

UT Austin | Portugal

INTERNATIONAL COLLABORATORY FOR EMERGING TECHNOLOGIES, COLAB

Year 4 ● ● ● ● ○

Report to the External Review Committee

*Funded by Fundação para a Ciência e a Tecnologia, Ministério da Ciência, Tecnologia e Ensino Superior
Prepared by the IC² Institute, The University of Texas at Austin, November 2010*

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



Report to the External Review Committee

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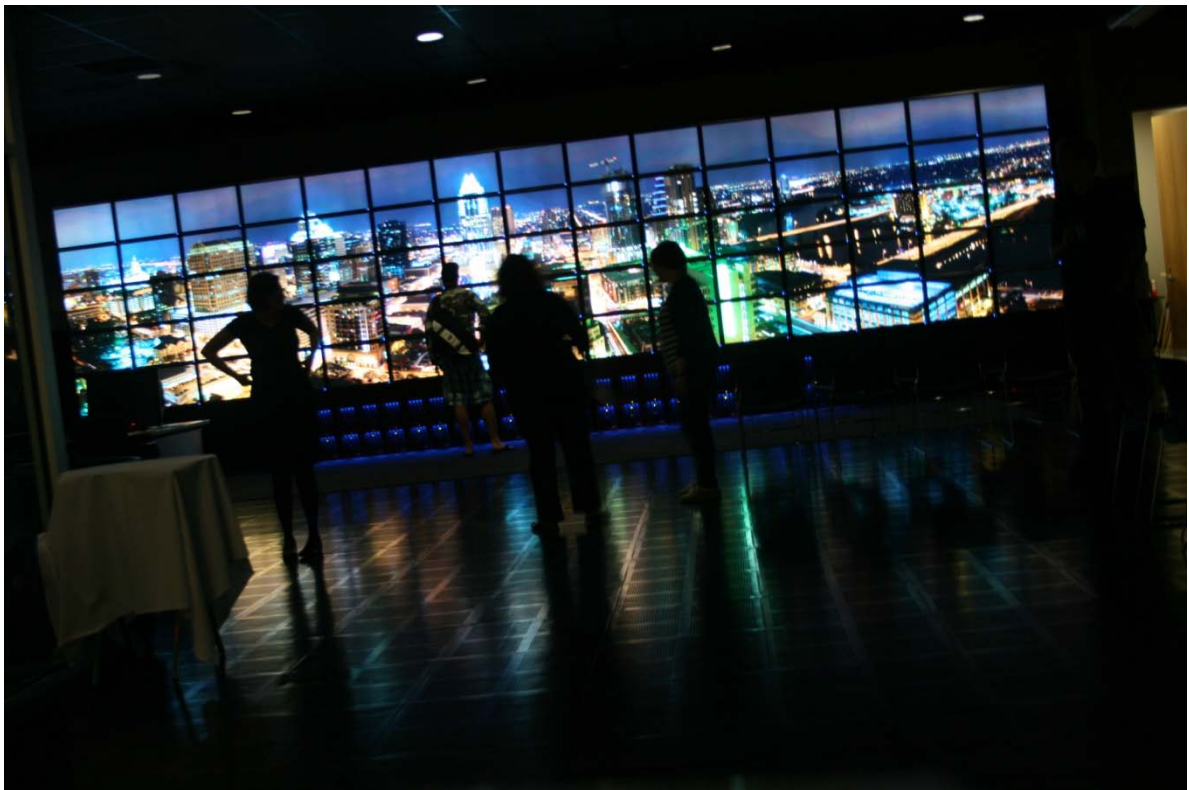
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1. ADVANCED DIGITAL MEDIA

As the UT Austin | Portugal CoLab completes its fourth program year, high importance is placed on results to date and taking the academic program toward sustainability. Advanced Digital Media occupies an academic space that intersects communications with advanced computing and mathematics. These three poles of the CoLab program are growing increasingly closer as faculty and graduate students interact in education and research programs and activities and as transdisciplinary work is performed. UT-Austin CoLab activities are conducted in cooperation across the academic components involved as follows:

- College of Communication
 - Radio, Television and Film (RTF)
 - School of Journalism
 - Communication Studies
 - Advertising & Public Relations
- College of Fine Arts
- Lyndon Baines Johnson School of Public Affairs
- School of Information
- Dept. of Computer Sciences (CS)
- Dept. of Electric and Computer Engineering (ECE)
- Texas Advanced Computing Center (TACC)
- Department of Mathematics
- Institute for Computational Engineering & Sciences (ICES)

Advanced computing activities, as a pivotal intersection point has traditionally been more academically connected with mathematics than the social sciences. Yet in the context of CoLab – since advanced computing applies mathematics to support the development of digital media – the projects and activities which were previously called Advanced Computing are now included in Advanced Digital Media with Mathematics as a sub-program. Advanced



Digital Media education and research activities are generated and overseen by more than one academic seat. The 2010 CoLab Report to the External Review Committee presents our combined effort to communicate with a single voice for the CoLab Academic Program.

Major milestones for Year 4 of the UT Austin | Portugal CoLab Advanced Digital Media program (Digital Media and Advanced Computing) include:

- Research in 13 projects currently funded by the FCT, involving at least 157 researchers;
- Hosting approximately 29 graduate students visited UT Austin to work on advanced research or professional internships, and to audit courses;
- Providing new educational and capacity-building events including:
 - ZON Intensive Script Development Laboratory
 - Digital Media Summer Institute 2010
 - Summer School in e-Science with many-core CPU/GPU processors;
 - International School on Digital Transformation
 - Future Places Festival
- Participation in external events including:
 - SXSW Interactive, Film, & Music Festivals (Austin)
 - Futurália
 - Second Int'l Conference on Games & Virtual Worlds for Serious Applications (VS-GAMES 2010)
 - Gear Up: Sound and Interactive Media 2010
 - CloudViews cloud computing conference
 - IBERGRID: 4th Iberian Grid Infrastructure Conference
 - U.Frame International Video Festival
 - International Online Journalism Congress
 - Nomadic 0910 in Porto

These accomplishments have effectively propelled the core purposes for which the UT Austin | Portugal CoLab was established. International educational opportunities have increased while research opportunities and international networks have been strengthened, including increased cooperation in shared grid computing between Portugal and Spain (the Iberian Grid).

ACCOMPLISHMENTS & STRATEGY FOR 2011

The fourth year of our collaboration in Portugal has brought both deeper and broader relationships. The breadth is evident in the growing web of businesses and organization involved with the program, catalyzed in part through nine new research projects funded by FCT but also through events such as the International School on Digital Transformation and Future Places. The depth is achieved through more routine faculty and graduate student visits both to Austin (Portuguese faculty and students) as well as to Portugal (Austin faculty, students and other visitors), in addition to concrete opportunities to work with each other on research projects. We highlight the role of the research projects in particular for galvanizing purposeful collaboration: six strategic and one exploratory project are bringing together UT Austin faculty from the School of Information, Engineering, and the College of Communication in order to work with Principal Investigators and collaborating faculty from several universities throughout Portugal. These projects have the added benefit of

partnering with several media industries as well, and we are optimistic that having their involvement in the actual practice of research will yield greater rapport and additional opportunities for joint work.

The new doctoral degree program is now one year old, and already the students exhibit a sense of “cohort community” and professional identity. The MediaGround facility at UNL is in place, and the curriculum appears to be generating the creative ideas and engagement that we expected. With the second year just starting, there are now over 50 students in the doctoral program, as well as more in U.Porto’s Multimedia M.A. program. Several doctoral students enrolled in the Summer Institute courses taught by UT Austin faculty, and we lengthened the term of two of the four Summer Institute courses (to three weeks) so that students would have greater opportunities to produce finished work. Also during the summer, UT Austin’s Computer Sciences faculty hosted numerous doctoral students working as research interns on projects. We observe that in general, many of the new doctoral students are involved in research projects, and participate in various conferences and meetings. At our Research Conference in Lisbon in September, 2010 several students showcased their recent work, and their exhibits easily were the equivalent of what one might encounter in professional conferences. Finally, we continue to support students – at the M.A. and doctoral levels - in applied and research internships in Austin.

We made a concerted effort to bring doctoral students from both Lisbon and Porto together in the International School for Digital Transformation 2010 (held during July), and believe some lasting relationships grew from that experience. We also used that occasion to inculcate research project ideas that, we hoped, would grow out of our discussions about using digital tools for civil society. Subsequent evaluations will enable us to learn if we were successful on that score, but anecdotally it appears that the project focus was welcome. (In later pages you will see a preliminary analysis undertaken of ISDT 2009 outcomes, in which we found that the residential school has indeed stimulated collaborative efforts and professional networks.)

More cross-pollination is occurring via faculty and student visits. We had many more UT faculty teaching or co-teaching long semester classes in Portugal during the past year, a practice continuing in the next year when we also plan to have more and longer faculty visits from Portugal. In 2010, UT Austin faculty taught one long semester class and co-taught three long semester courses. At this writing it appears that we will have between 10-15 doctoral students in Austin during the spring, 2011 semester, (and many more are interested), one UT faculty member spending the spring term in residence in Porto, another spending fall 2011 in residence in Lisbon, and a Portuguese faculty member scheduled to spend a term in Austin in fall, 2011. Two Portuguese faculty members have been in Austin on sabbaticals for the past year, while several others have come through for periods ranging from just a few days to two months. Our co-teaching model appears to be working well, judging from student response; we anticipate continuing this in 2011 as well specifically in research methods, sound design, and certain theoretical areas.



The Future Places media festival and ISDT have supported and enhanced the visibility of digital media creativity in Portugal while they also have provided additional training for students. One marker of success is the increasing interest and involvement of media companies. Future Places attracted support from Sapo, one of the country's major media companies. Our primary innovation during the past year, however, was the ZON Screenwriting Laboratory held in Austin. ZON agreed to sponsor the travel and housing for students selected competitively from 11 different schools around the country to receive intensive training for two months in writing and producing at the UT Austin facilities. We chose three of our very best instructors to work intensively with this group of students, their goal being to produce solid scripts that they would shoot and then edit from August-October in order to enter them into ZON's national contest by November 5. The Lab was a huge success from the perspectives of both students and instructors, and we may initiate something similar in 2011, depending on our assessment of the work submitted to ZON.

As we look towards 2011, we foresee improving some of our processes and activities and working with deliberation toward sustainable models for our exchanges and events. For example, the Future Places festival would benefit from having an Advisory Board composed of the arts leadership in Porto. With two major institutions situated locally, Casa da Música and Serralves, it would doubtless be to the benefit of the festival to form even stronger bonds with these entities. As well, the digital media program at the Universidade Católica Portuguesa in Porto, specifically its Sounds and Image program in the School of Arts, would be a logical partner for Future Places and it could be a comfortable extension of its work with some of our other programs. ISDT now has an international reputation, and Gary Chapman has committed to work with us on seeking grant funding for future incarnations of this unique accomplishment. Further, we have begun looking in earnest at various European Union programs that could grow the academic and research foundations we have established, and some partners in Portugal are enthusiastic collaborators.

In terms of the pedagogical component of the program, more Austin faculty will continue to be in Portugal on a routine basis, and we plan to create opportunities for doctoral students to share their research through targeted conferences. There is continued demand for Summer Institute courses, and we are working with doctoral programs to determine which courses we might offer. As students assemble their dissertation committees, we hope to play a key role in helping to identify the relevant UT Austin faculty who can help them. While the dual degree program as it stands may not be the optimal arrangement enabling students to complete their Ph.D. in four years, we believe that with proper planning, it can deliver the advice and opportunities that the students need.¹

Additionally, if the initial experiment with ZON appears worthwhile (i.e., if there are solid entries into the ZON competition this year), we may sponsor an animation-focused two month-long Laboratory in Austin in summer, 2011, functioning much along the same lines as in 2010 (competitive selection of attendees from around the country). ZON is interested in broadening the eligibility to early career, working professionals. The net effect of these intensive Labs will be to cultivate the talent pool in Portugal, in turn benefiting local media industries.

We also are working with Drs. Nuno Correia (UNL) and Rui Prada (IST) on a seminar series that would bring several well-known designers to Portugal (the individuals we are inviting include Bill Buxton, BJ Fogg, Ernest Adams, Adrian Cheok, Michael Mateas, Jesse Schell, Panos Markopoulos, and Tony Brook). Several design faculty from UT Austin also have proposed courses or workshops that appear to be in line with student interests, and we are planning to offer these at convenient times during the long semesters. The blending of design with computer science expertise represents a fruitful element of the collaboration, and is present in several of the newly funded research projects. We anticipate organizing a few small, targeted conferences on topics relevant to the research projects and to student interests that would be led by leaders in the field (presumably some of the individuals listed earlier).

Through the research, education, and academic community-building activities initiated by this collaboration, the advanced digital media community is strengthening in Portugal. We look forward to the next year as one of new research discovery, broadened scholarly opportunities, and increased industry interest. Our efforts are dedicated to growing a culture of creativity sustained by high levels of training and research, a culture that unites Portugal's diverse sources of expertise and talent.

¹ UT Austin does not establish joint degrees with other universities. A student who wishes a dual degree with UT Austin must complete all the normal degree requirements established by the University. This means that a student accepted into a doctoral program at UT Austin would be in residency two years and write a dissertation to be approved under the UT rules. The student's home university in Portugal has the discretion to approve the dissertation as satisfactory for their local requirements; two or more Portuguese professors may serve on the UT doctoral committee.

RESEARCH

Research Development

Proposal Writing Workshop

Drs. Sharon Strover (College of Communication) and Luis Francisco-Revilla (School of Information) from The University of Texas at Austin gave two proposal writing workshops in Portugal in November 2009. These workshops were intended to bridge the expectations gap between European and U.S. research and funding norms. The workshops covered the basic structure of a proposal, and addressed how to write research questions, the structure of a proposal, and covered issues of design, proof, and evidence in a proposal. Each of the workshops in Lisbon and Porto were attended by approximately 25 researchers and resulted in the submission of a record number of grant proposals, and acceptances, for the program.

At the end of each workshop, the presenters administered a workshop evaluation to each of the attendees. The average satisfaction rating from Porto was 4.7 on a scale of 1-5 and responses from Lisbon averaged 4.21. An attendee in Porto said, "It was very useful in terms of learning the best structure for a proposal. I feel now that I have to be more explicit, direct and practical in what I have to write to defend my investigation ideas." Most commented as well that they would like the workshop to be longer (two days) if it were to be offered again.

Research Projects

Table 1 provides an overview of all Advanced Digital Media funded projects. Four projects were funded by FCT in 2009. In these projects, as well as upcoming projects, there is extensive graduate student involvement as well as participation from various media industries. The near-term productivity of the initial projects is reported below and conforms to the accepted metrics for scientific accomplishment, namely professional papers and presentations; in the case of the kinetic controller research, parallel programming refinements, and SIMCARD cardiovascular modeling, there is also the opportunity to create commercial products and patents. The research projects are proving to be excellent vehicles for linking faculty interests to social and industry needs, for training new researchers, and for building collaborative frameworks.

The latest round of 2010 FCT-funded research grants funding to nine projects in Advanced Digital Media, including one high risk, exploratory research project that brings together new research ideas and experts working in various related areas, as well as six larger projects that are geared to yield results that can contribute strategically to media industries. The latter category includes grants focused on the future of television; the future of news, and interactive media environments/serious games. In addition, one project seeks to help understand the nature of combustion in order to help contain forest fires, while another pursues artificial intelligence and soft-computing to provide a modeling-based approach to evaluate the lifespan of asphalt pavements.

Overall, these 13 projects facilitated cooperative research for at least 155 researchers across 15 universities (12 Portuguese, three U.S., and one U.K.); working with 25 non-profit or industry organizations. Table 2 provides a breakout of these projects with their organizational involvement, and detailed descriptions of '09 and '10 projects follow.

Table 1. Advanced Digital Media Funded Research Projects

<i>Project Name</i>	<i>Principal Investigators/Univ.</i>	
Digital inclusion & participation	Cristina Ponte, UNL Joseph Straubhaar, UT Austin José Azevedo, U.Porto	
2009 Projects	Kinetic controller driven adaptive & dynamic music composition systems	Carlos Guedes, INESC Porto Bruce Pennycook, UT Austin
	PRIA: Parallel programming refinements	João Sobral, UMinho Keshav Pingali, UT Austin
	SIMCARD cardiovascular modeling	Adélia Sequeira, IST/UTL Thomas Hughes, UT Austin Chandrajit Bajaj, UT Austin
	Breadcrumbs	Álvaro Figueira, U.Porto Luis Francisco-Revilla, UT Austin
iDTV Health	Manuel Damásio, Univ. of Lusófona Laura Stein, UT Austin Michael Mackert, UT Austin	
2010 Projects	ImTV	João Magalhães, UNL Sharon Strover, UT Austin Luis Francisco-Revilla, UT Austin
	INTELLIPave	José Neves, UMinho Jorge Prozzi, UT Austin
	INVITE	Rui Prada, IST/UTL Jorge Peña, UT Austin
	LIFEisGAME	Verónica Orvalho, U.Porto J.K. Aggarwal, UT Austin Yan Zhang, UT Austin
	REACTION	Mário Silva, Univ. of Lisbon Luis Francisco-Revilla, UT Austin Matt Lease, UT Austin
	See-Through-Sound	Tomás Henriques, UNL
	TURBSCALAR	José Pereira, IST/UTL Venkat Raman, UT Austin

Table 2. Organizations Partnering in ADM Research Projects

	Digital inclusion	Kinetic controller	PRIA	SIMCARD	Breadcrumbs	iDTV Health	ImTV	INTELLIPave	INVITE	LIFEISGAME	REACTION	See-Through-Sound	TURBSCALAR
<i>Participating University Entities</i>													
Huston-Tillotson University (Austin)													
Instituto de Engenharia de Sistemas e Computadores do Porto (INESC Porto)													
Instituto Superior de Ciências do Trabalho e da Empresa (ISCTE)													
Open University (United Kingdom)													
Universidade de Aveiro													
Universidade Católica Portuguesa Lisboa													
Universidade Católica Portuguesa Porto													
Universidade de Coimbra (UCoimbra)													
Universidade de Lisboa (UL)													
Universidade do Minho (UMinho)													
Universidade do Porto (U.Porto)													
Universidade Lusófona de Humanidades e Tecnologias (ULHT)													
Universidade Nova de Lisboa (UNL)													
University of Texas at Austin (UT Austin)													
University of Texas at San Antonio (UTSA)													
Universidade Técnica de Lisboa (UTL)													
<i>Other Participating Organizations (*asterisk indicates for-profit organization)</i>													
Associação para o Desenvolvimento da Aerodinâmica Industrial (ADAI)													
Austin Free-Net													
Casa da Música													
Centro de Estudos das Tecnologias e Ciências da Comunicação													
Centro de Investigação em Sistemas Computacionais Avançados (CRACS)													
Centro de Investigação Media e Jornalismo (CIMJ)													
Centro de Tratamento de Doentes, Lda. (CTD)													
City of Austin Libraries													
Cooperativa de Formação e Anamiação Cultural, CRL (COFAC)													
Duideo - Cooperativa de Profissionais de Imagem CRL*													
Fundação para a Computação Científica Nacional (FCCN)													
Giscon Gabinete de Sistemas, Informatica de Consultadoria, LDA													
IBM Portugal *													
Instituto de Engenharia Mecânica (IDMEC)													
Hospital de Santa Maria													
Media, Objects & Gadgets - Soluções de Software e Hardware, SA *													
MSFT - Software para Microcomputadores, LDA (Microsoft) *													
PLUX, Engenharia de Biosensores LDA (PLUX) *													
Porto Editoro *													
PT Comunicações *													
Público - Comunicação Social, SA *													
Rádio e Televisão de Portugal, SA (RTP) *													
Sociedad Protugesa de Ressonância Magnética (SPRM)													
Ydreams *													
ZON Multimédia *													

'09 Project: Digital inclusion & participation

Comparing the Trajectories of Digital Media use by Majority and Disadvantaged Groups in Portugal and the USA

Principal Investigator

1. Cristina Ponte, UNL

Research Team

2. Ana Isabel Veloso, UAveiro
3. Anabela de Sousa Lopes, UNL
4. Armando Malheiro da Silva, U.Porto
5. Carla Ganito, Catholic University of Lisbon
6. Clara Almeida Santos, UCoimbra
7. Dean Graber, UT Austin
8. Fernanda Martins, U.Porto
9. Helena Santos, U.Porto
10. Isabel Dias, U.Porto
11. Isabel Ferin Cunha, UCoimbra
12. Jacqueline Vickery, UT Austin
13. Jeremiah Spence, UT Austin
14. José Alberto Simões, UNL
15. José Manuel Pereira Azevedo, U.Porto
16. Joseph Straubhaar, Faculty UT Austin
17. Laura Dixon, UT Austin
18. Lídia de Jesus Silva UAveiro
19. Luisa Aires, Open University
20. Óscar Mealha UAveiro
21. Ricardo Campos, Open University
22. Stuart Davis, UT Austin
23. Viviana Rojas, UT San Anonio
24. Wen Hong Chen, UT Austin

The Project

To date, this project has incorporated a total of 27 PhD students from the UNL, U Coimbra, U.Porto, and UT Austin plus 11 master's students and 28 undergraduate students from UT Austin. The digital inclusion project examines the digital divide, which is defined as gaps in technology access and use between generations and majority and minority social groups. This proposal is socially significant since Portugal has passed from being a country of emigrants to becoming a country of immigrants, from its colonies in Africa and Brazil in the last few decades, and more recently of immigrants from the countries of Eastern Europe. In the Lisbon area, eight percent of children that attend school were not born in Portugal, which raises the question of how to combine the initiatives of digital inclusion and cultural integration. Access and use of digital media also vary between children that have access to these media at home, and those who only get to use them at school and in public access where use is limited and conditioned by circumstances.

We examined the current research concerning: 1) Global conceptual frameworks, on generation and "life course" (Bertaux), and symbolic capital (Bourdieu); 2) Concepts focused

on digital practices, related to: access and use; digital literacy; gender issues; age issues (children and young people as well the elderly); migrations (inside and from other countries); level of socio-economic status; ethnicity; 'domestication' in the households. Each team collected data on the social contexts, in Texas and in Portugal, on the general access to the digital (such as the levels of broad band penetration); media history; and educational systems. Researchers from both countries exchanged short reports on each of these topics in their countries. Based on these state-of-art reviews, the main research questions and methodological orientations were adopted in July 2009.

As an associate partner to this project, IBM Portugal has been active in promoting research and contributing to the general field of the project. A case study is currently being developed on the impact evaluation of training programs for female adolescents that IBM has been promoting. Interviews with participants, IBM promoters and mentors are in process in order to evaluate the impacts to the participants on digital inclusion dimensions. On the Austin side, the main partners have been the City of Austin, both its telecommunication office and its library system, and a large digital inclusion NGO, Austin Free-Net. The Free-Net and Libraries were principal partners and sites of participant observation on digital inclusion programs this year. Interviews with users of these sites were also interviewed. Analysis of those data is taking place now.

A major task includes the qualitative analysis of families, identification of trajectories, similarities and differences between groups. In Portugal, the recruitment and training of students (mainly master's) to do the qualitative fieldwork research was done in three Universities. Similar training sessions took place at UNL, Porto, and Coimbra involving a total of 40 graduate students. The students participated in at least twelve theoretical and practical sessions where they were trained on conducting qualitative surveys and non-observer participation. In Austin, a total of 22 graduate students and 25 undergraduate students were trained in the three seminars at UT mentioned above. They were trained intensively in the first half of the semester and conducted interviews in the second half.

At UT, the interview guide is primarily defined and based on previous research in the area. Portuguese researchers adapted the same topics to the Portuguese population. Therefore, the new questions were pre-tested and improved. The other tool for this qualitative research among families was the family genogram, enabling researchers to look at the generational trajectories within the families interviewed. This tool was consolidated among the UT researchers, but was new to Portuguese researchers.

In Texas, the choice of the families to be interviewed was based on criteria that the researchers agreed on in the July 2009 Mexico meeting: diversity of social class background, education, ethnic, and migration status were considered. The Austin team wanted to provide some comparability to families that were interviewed ten years ago, therefore providing longitudinal comparative data. In Portugal, where no similar work had been done, the selection was mainly based on the agreed criteria above.

The field work was conducted in both countries in 2009. Austin researchers are now consolidating both quantitative and qualitative treatment of the genograms, to compare Austin and Portugal. The Portuguese interviews conducted in November-December 2009 by the 40 graduate students included the questionnaire and the genogram. As the field work involved a total of 65 families, 130 individuals were interviewed on their life story and their

relation with the media, particularly the digital ones. In Texas, the 47 students trained in the seminars did similar interviews, with an emphasis on finding three generation families where possible. In Austin, 18 individuals were interviewed in April 2009 and 47 in November 2009.

All the interviews are transcribed and are being analyzed using qualitative data analysis programs. According to their different research interests, senior and junior researchers are now starting to explore this qualitative information. The diversity and the interest of the collected data are so impressive that their exploitation by the team researchers will be an ongoing work.

Ethnographic studies in cybercafés and other public spaces in Austin are being conducted; this research concentrated on public library access centers, NGO access and training centers, senior centers and immigrant service centers that provide digital inclusion. A provisional paper was presented at the ICA conference in June 2010, and a more advanced paper for publication is being prepared now.

Papers and Presentations

Aires, L. *La inserción Digital desde la Orientación: Las dos caras de Janus*. Workshop—Mesa de Trabalho. Facultad de Ciencias de la Educación. Universidade de Granada. 20/05/2010.

Azevedo, J., Straubhaar, J., Dixon, L., Jorge, A., Francisco, K., *Comparing the life histories of digital media use in Portugal and the USA: What can we learn about digital inclusion processes*. Painel aceite para apresentação na conferência ECREA, Hamburgo 2010.

Brites, M. J. *Young people and their particular perspectives on the 2009 elections—I International Graduate conference on Media and Communication—Selling Politics and War, C2COM—Universidade do Porto, YCREA and Media XXI*. 14/05/2010.

Costa, C., Ponte, C. *How brand literate are we? The voices of 9 years old Children about brands, ads and their online community practices*. ESA Consumption Research Network Interim Meeting, Tartu 2010.

Ponte, C. (2010). "Jovens e internet: Discutindo divisões digitais." XXXIII Congresso da INTERCOM. M. Barbosa and O. Morais. Caxias do Sul, Brasil, *INTERCOM*: 42-71.

Ponte, C., Azevedo, J. & Straubhaar, J. (2009). Digital inclusion and participation: how disadvantaged families deal with the digital in Portugal and the US. Comunicação apresentada na conferência Transforming Audiences 2, Universidade de Westminster, Londres, 4 de Setembro.

Straubhaar, J, Ponte, C., Azevedo, J., Ferin Cunha, I., Simões, J., Malheiro, A., Pinto, MM. *Digital inclusion, migration, generation and social context: Comparing the life histories of digital media use by majority and disadvantaged groups in Portugal and the USA*. Painel aceite for apresentação no IAMCR, Braga, Portugal, Julho 2010.

Straubhaar, J. et al. (2010). *Structuring Access: A Ten-Year Review of the Role of Austin Public Libraries and Community Technology Centers in Digital Inclusion*. Comunicação na International Communication Association, Junho 2010, Singapura.

Straubhaar, J., Ponte, C., Azevedo, J. and Spence, J. (July, 2009). Painel de apresentacoes do Projecto *Digital Inclusion and Participation no Digital Divide Working Group*, IAMCR, Mexico City.

'09 Project: Kinetic Controller Driven Adaptive & Dynamic Music Composition Systems

Principal Investigator

1. Carlos Guedes, INESC Porto

Research Team

2. André Baltazar
3. Bruce Pennycook, Faculty UT Austin
4. George Sioros
5. Gilberto Bernardes
6. Hugh Lobel
7. Rui Dias
8. Russell Pinkston
9. Tanvi Joshi
10. Tomás Henriques

The Project

This joint research project is developing new techniques and strategies for computer-assisted composition in the context of real-time user control with non-standard human interface devices for applications in electronic art and digital entertainment systems. The research team will design and implement real-time software, hardware and specialized human-interfaces that will provide tools and resources for music, dance, theatre, installation artists, interactive kiosks, computer games, internet/web information systems.

The outcome of the project will be the creation of a modular toolbox for real-time dynamic music generation that will allow for easy creation of software applications for the purposes described above. The toolbox will be highly flexible allowing its use both by trained musicians and the general public. Simply by patching together the desired modules for music generation, musical parameters can be seamlessly operated and controlled by gesture driven interface/kinetic controllers, thereby granting the user of the system a very intuitive way of music control and interaction.

Casa da Música and YDreams are pivotal partners, in which they help keeping the overall focus of the project – the creation of a software toolbox for real time control and generation of music able to be utilized by a broad range of users, into applications meant to be engaging, entertaining and stimulating. The applications to be developed will be aimed both at (1) highly specialized users aiming at a standard professional quality for use in products such as inline/offline interactive marketing, computer assisted performance and accompaniment, interactive installations, computer games, etc.; (2) non-specialized users, including people with disabilities, children and the elderly for use in sound based games, interactive music creation and cognitive sound stimulation.

Phase 1 research consisted of complementing the literature review initiated by the UT Austin team, developing a framework for implementation of a procedural music system, and developing some computer vision algorithms for gesture analysis. Work focused on reviewing published algorithms for generative music, including a thorough review of applications that involve automatic music generation. Researchers started implementing their computer vision as Max/MSP external objects, such as:

- An algorithm for real-time human body skeletization by developing a previous algorithm by Fujiyoshi et al (2004);
- Measurement of averages on the quantity of movement from a video stream, algorithms for automatic tempo detection from bodily movement that elaborate on Guedes's previous work (2005), and temporal filters to de-noise real-time analysis information from video cameras.

Research has focused on a general framework for the implementation of a procedural music system that encompasses the automatic generation of syntactically correct musical structures and their transformation and adaptation over time according to the user's gestural input. This framework utilizes a software "critic" (Rowe, 1993) which analyzes the output from the algorithms and prevents non-musical output. In addition, two doctoral students from the UT Austin-Portugal Program in Digital Media (Gilberto Bernardes and Rui Dias) are working on the project since November 1, as part of an independent study supervised by Guedes. These students intend to relate their doctoral dissertations to the project. Bernardes has reviewed applications of genetic algorithms (GAs) for automatic music generation elaborating on ideas initiated by Biles (1994) and Eigenfeld (2006, 2009). Dias was working on the Graphical User Interface (GUI) of the Toolbox, expanding on the work he did in his master's dissertation (2009).

Phase II research (January-June 2010) was dedicated to the development of several algorithms for automatic rhythm generation and to the development of software applications involving generative algorithms. Bernardes is developing a software application using a GA that enables users to generate multilayered rhythms in known styles from gestural input, in which the input to the algorithm consists of a data set of drumming patterns (e.g. MIDI loops from Apple's GarageBand and Logic Pro) that are logically recombined in order to produce novel output. The recombination process (Cope, 1996) is supervised by Clarence Barlow's metric indispensability algorithm (Barlow, 1987) that functions as a critic to the output generated by the GA. Probabilistic models of rhythm generation that draw upon Barlow's metric indispensability algorithm (1987) are in development, and Temperley's recent work on automatic generation of rhythm using a Bayesian approach (2007).

Dias is developing a "Blues machine" that enables users to generate and control several instruments (piano, bass drums, saxophone/guitar) within a Blues structure using a Wii remote control. During this phase, we had a meeting with researchers from Portuguese multimedia company YDreams in order to start thinking about the integration of the research outcomes into YVision, a platform for the development of interactive installations. During this phase we also put another call to hire a full-time researcher for the project who started working in the project in May. By the end of Phase II the INESC Porto team expects to have a set of Max/MSP externals that enable multi-layered rhythm generation in highly refined ways, by combining and modifying existing approaches for automatic rhythm generation such as those mentioned above. We also expect to have a MaxMSP prototype of a procedural musical software application to be implemented as an iPhone/iPod/iPad (iOS) application.

The project continued to complete background research and literature searches and, most importantly, defined the work for the January-May 2010 work period when two new hires

came on board. In January 2010 we hired Hugh Lobel, Master of Music candidate in Composition and Tanvi Joshi, M Sc. candidate in Electrical Engineering, to start realizing the work plan. Their focus is on building music and audio analysis tools that will provide a framework for the acoustical and musical feedback component of the overall plan (presented by Guedes and Pennycook in December 2009 at UT). Also during this session, Professor Russell Pinkston, Director of the UT Electronic Music Studios and a well-known computer music expert, became a part of the UT team and has been providing valuable insights for both Lobel and Joshi. The work is predicated on past research by Pennycook (see refs below) and by Dale Stammen who completed his Ph.D. with Pennycook at McGill University.

The impact of the scientific work to date includes the following products, papers and presentations:

1) *A set of Max/MSP programs* have been written that extract pitch, timing, amplitude and articulation details from monophonic audio. This information is then parsed into musical phrases according to a revised version of the Lerdahl and Jackendoff Grouping Preference Rules (1983). Simultaneously, the data provides a set of temporal indexes into the original audio file for further analysis.

2) *Time Warp*, has been developed as a Max/MSP external. This function is particularly useful for pattern detection with information that has variable lengths such as speech detection. It will be used to dynamically create a database of salient musical phrases which will ultimately become input to the generative processes in the large model.

Papers and Presentations

Baltazar, André, C. Guedes, B. Pennycook, F. Gouyon. (2010). *A Real-time Human Body Skeletonization Algorithm for Max/MSP/Jitter*. Proc. of the 2010 Intl. Computer Music Conference. ICMA. (pp 96-99).

Bernardes, Gilberto, C. Guedes, B. Pennycook (2010). *Style Emulation of Drum Patterns by Means of Evolutionary Methods and Statistical Analysis*. 7th Sound Music and Computing Conference. Barcelona, Spain.

Guedes, Carlos (2010) *Movement and Musical Control*. Oral Presentation at the Motion Capture Methodologies Workshop, University of Sussex, June 26, 2010.

Guedes, Carlos (2010) *Overview of Sound and Music Computing Research at INESC-Porto*, Oral Presentation at GEAR- 1st Workshop for Practice-Based Research in Art and Design, University of Beira Interior, Covilhã, Portugal, April 5, 2010.

Guedes, Carlos and Heitor Alvelos. (2010). *Future Places and Sites: An R&D Project at INESC-Porto and a Digital Media Festival*, Oral presentation at Ciência 2010, Lisbon, July 7, 2010 .

Pennycook, Bruce and Carlos Guedes, *Kinetic Controllers and Generative Music*. UT Austin, December 11, 2009.

Pennycook, Bruce, Eugenia Costa-Giomi, Tanvi Joshi. (2010). *Audio Signal Analysis of instrumental and vocal excerpts*. 2010 Intl. Conf. on Music Perception and Cognition. Univ. of Washington.

Prototypes and Products

kin.skel & kin.draw – Max/MSP/Jitter external objects for real-time human body skeleton extraction and drawing

Wii Drums – software application developed to illustrate the proposed framework for procedural music toolbox development. Wii remote controller controls the automatic generation of rhythm as output by a genetic algorithm. (Involvement of Carlos Guedes's class in Automatic Music Generation [Masters in Multimedia, U.Porto] in converting MIDI Drum loops and testing software developed by the research team.)

kin.rhythmicator – Max/MSP object that implements a modified version of Clarence Barlow's metric indispensability algorithm for automatic rhythm generation

kin.genalgorithm – generation of drum patterns by evolutionary methods using statistical analysis of data sets.

Blues Machine – automatic generation of blues-style music using a Wii remote controller.

'09 Project: PRIA: Parallel Programming Refinements for Irregular Applications

Principal Investigator

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The Project

Given current trends, it can be expected that general-purpose processors will be many-core processors in which the number of cores is likely to double every 1.5 years. Currently, four and eight core processors are on the market, and ten years' time could see development of "kilocore" processors. This move towards many-core architectures has shifted the burden of improving program execution speed from chip manufactures to software developers, requiring a fundamental change in the way software is developed and maintained.

The high-performance computing (HPC) community uses communication libraries, like MPI, to code parallel applications for distributed-memory computers. Their approach to software development is performance-driven, and high software development costs have been hidden behind the high cost of large-scale distributed-memory parallel systems. This approach is too expensive for the mass market.

Most of what we know about parallel programming is confined to "regular programs," which are programs that manipulate dense matrices. Stencil codes and matrix factorizations are examples of regular programs. We know very little about the patterns of parallelism and locality in irregular programs, so there are few languages, constructs, and tools to help programmers to write such programs. Recently, the Galois project, led by Keshav Pingali, performed a number of case studies of irregular programs that show that many of these programs have a generalized form of data-parallelism called "amorphous data-parallelism."

In addition to parallelism, programming models must also permit expression of locality of reference, which is important even on sequential platforms. Programming paradigms promoting strong separation of concerns can play a crucial role to address the development complexity of parallel applications. The decomposition of parallelization concerns into high level features (fine-grained refinements that add implementation detail, such as parallelism or the use of particular data structures) will make it possible to synthesize/tune applications for each class of target platforms and/or problems by selecting the set of features to attain the best performance.

The research team aims to identify and modularize refinements (a.k.a. patterns, skeletons) that parallelize computations in programs, and to compose such refinements to map base programs to efficient, platform-specific, parallel applications. Researchers start with a base program, specified in a platform independent manner, and progressively increment its functionality towards a more platform specific version. Thus, in the proposed approach, parallel programming abstractions are application refinements that will be validated by making Galois an extensible run-time platform, by allowing the addition of new program refinements and identifying the conditions under which such refinements can be effectively used. Researchers use existing case studies of Galois, as well as new case studies, where parallelism and locality of references will be expressed as program refinements.

Research Metrics

In early research planning meetings, it was decided to initially focus on two key research areas:

- Classification of parallelization patterns for irregular application;
- Parallelization refinements.

These two areas were the main focus of the first year of the project. Currently a catalogue of parallelization patterns is concluded and an initial assessment of techniques to implement parallelization refinements is also concluded . The results obtained so far are at an early stage. Future research falls in three areas:

- Searching for new parallelization patterns in irregular applications;
- Working on the concept of refinement;
- Applying refinement-based programming approach to concrete case studies.

There are several project member publications directly related to the themes under investigation, including two new joint papers describing the most important results from the first year, that are being prepared for publication.

There are three ongoing PhD theses, jointly advised. These three Portuguese researchers spent 6 months at Austin (from February to July 2010). Moreover, one MSc was concluded and another will be concluded this year.

'09 Project: SIMCARD, Patient-specific cardiovascular modeling & analysis

Principal Investigator

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21. Jo3o Gonçalo Silva Marques, MSc, UTL
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23. Rita Fernandes Sousa, PhD, Hospital Santa Maria
24. Zhen Ma, PhD, UPorto

The project

The aim of SIMCARD is to develop computational tools for the simulation of mathematical models describing the anatomical structure and the physiological response of the human cardiovascular system in healthy or pathological states.

Emphasis is directed to setup patient-specific models built around virtual realistic geometries reconstructed from in vivo medical images, and on the use of highly integrated and efficient numerical algorithms for their simulation at acceptable computational costs. The models will constitute steps towards a research and development platform for the process of “predictive-medicine” in which interventions and therapies are planned, analyzed and optimized, based upon predictions and outcomes through accurate and efficient numerical simulations. Research is focused on three main topics:

A. Morphology and flow in the cerebral vasculature based on patient-specific data. *In vivo data is used to perform numerical simulations of FSI problems. This involves development of*

mathematical models, geometry reconstruction and characterization, uncertainty estimation, validation of simulations.

B. Mechanical properties of heart tissue from medical image sequences. *The aim is to develop new computational methodologies and models to analyze the mechanical behavior of structures from images, specifically the heart, by adopting biomechanical principles.*

C. Optimal design for balloon expandable stent. *FEM based mathematical models are used to characterize the micromechanical properties and optimization of cardiovascular stents.*

Research Metrics

The following set tasks have seen advancement in the past year's research:

- Medical imaging in vivo (MRI, MRA, CT)
- Medical image interpretation
- Numerical simulations of cerebral vasculature
- Uncertainty quantification of vessel geometry variability
- Software development

Preliminary work has been carried out, and a variety of image interpretation techniques have been studied and their application tests toward the two tasks of Analysis of the behavior of structures and estimation of their mechanical properties from images, and Experimental properties and reflexive activity of the tissues. Results remain to be consolidated toward the task micromechanical modeling and optimization of cardiovascular stents. Research publications and presentations related to the project were accomplished by team members through April 2010 include:

- Books or special issue journals edited: 5
- Papers in international journals or book chapters: 20
- Papers in conference proceedings: 20
- Relevant presentation at international conferences and seminars: at least 24
- One PhD Thesis

In addition to these publications and presentations, project members organized ten special scientific events; and there are five related additional research projects related to the SIMCARD project.

'10 Project: Breadcrumbs

Principal Investigator

1. Álvaro Reis Figueira, CRACS-FCUP & INESC Porto

Research Team

2. José Paulo Leal, CRACS-FCUP & INESC Porto
3. Luis-Francisco Revilla, UT Austin

The Project

The goal of the “Breadcrumbs” project is to capitalize on the participation of the general public in the production of news by creating bridges between online news and the “Social Web.” The project builds on the use of Social Web tools, gathering the opinions of readers, and creating a semantically organized model of the readers’ opinions. In particular, Breadcrumbs focuses on:

- Collecting news fragments
- Organizing those fragments
- Aggregating fragments across readers
- Inferring relationships between readers
- Inferring relationships between news

In order to accomplish these tasks, the team is researching various inference and interaction approaches. The team hypothesizes that combining automatic and user-mediated approaches will yield better results than either approach in isolation: automatic mechanisms can handle extremely large amounts of data, and people can provide insights difficult to identify with automatic mechanisms. In particular, the team will explore the following research questions:

- What is the best way to combine user-based methods (interaction analysis) with automatic methods (textual analysis, social classification) to infer:
 - Implicit links between different articles, events, and stories
 - Implicit links between readers
 - Interests of readers
 - Value of reader/contributor participations

In order to answer these questions the team will design, implement, and evaluate Breadcrumbs, a system to take advantage of the readers’ ability to select relevant information and the power and scalability of text mining and clustering algorithms. As evidenced by the success of social bookmarking systems (i.e. delicious.com) people like to track, store, and collect digital information items, so that they can be accessed, reviewed, or used later. Breadcrumbs will allow readers to select news stories fragments from any news site, blog, etc., collect them in a *personal digital library* (PDL) and annotate them with tags and comments. While each PDL represents the individual perspective of a reader, we believe that it is possible to aggregate them by integrating the PDLs of all readers. The team will test the hypothesis that it is possible to identify previously unavailable patterns and relationships by organizing the user-selected fragments at the PDL level and aggregating PDLs at the system-wide level using text mining and social filtering techniques.

In order to organize each PDL, the team will research automatic mechanisms that classify fragments based on their content and semantic proximity. PDL aggregation will be focused on text mining and social classification methods to identify implicit links or relationships between fragments based on similarity of text, tags, and comments assigned by the users. As a result the team expects to create a social network based on these implicit links. It is hypothesized that this network, or graph, will allow journalists and news agencies to:

- Learn which stories and workdings resonate the the readers
- Identify previously undetectable connections between apparently disconnected information sources
- Track the path of news between readers and information sources
- Identify user communities
- Provide users with reading suggestions

The design and implementation will follow an iterative, participatory approach that includes journalists and end-users. The team will evaluate the project by assessing system functions such as fragments collection, PDL classification, and general aggregation; and evaluate the effectiveness of the inferred social network to enhance tasks and experiences for both journalists and readers.

'10 Project: iDTV Health

Principal Investigator

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4. Hugo Filipe Silveira Gambôa, PIS
5. Inês Isabel Pimentel de Oliveira, ULHT
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9. Maria da Conceição Gonçalves Costa, ULHT
10. Michael Mackert, UT Austin
11. Nuno Manuel Garcia dos Santos, ULHT
12. Nuno Pedro da Costa Marques Martins
13. Paulo Renato da Silva Gil Viveiros, ULHT
14. Rita Maria Espanha Pires Chaves Torrado da Silva, ISCTE

The Project

The iDTV Health project will evaluate the potential of digital interactive television (iDTV) to promote health care and wellness services and information to Portuguese age 55 and older, and/or low levels of income and literacy. The results will give researchers a better understanding of how to present and distribute health information. In the current technological context (i.e. analog switchover), digital TV adoption is significantly conditioned by factors of performance expectancy, effort expectancy, social influence, with a strong probability of rejection among population segments such as the elderly, people with less experience in technology use, and people with specific needs. The impact future television will have on existing social relations or its ability to prompt new forms of sociability when the exchange of information is at stake (Damásio & Poupá, 2008), is still not clear, but its emergence happens against a backdrop of an apparent fraying of the social fabric brought on by the adoption and use of technologies such as the mobile phone and the internet. The effects of social capital depend greatly on the culture and habits of the community and the type of individual relations it supports. Very few studies exist that relate this problem with changes in media environment and associated social practices.

Two changes in particular in the television environment will be more closely scrutinized under iDTV-health: 1) changes in access forms (such as mobility or IP based devices) and services provided and their consequences upon social relations and social capital; and 2) changes in media content (i.e. addition of metadata or the use of television as an input device) and its consequences upon media production, sharing and distribution, not only as means of social interaction but also of new forms of professional exercise. This second issue will be approached both by the side of information producers (medical doctors) but also on the side of media professionals (content producers using new formats like MXF) and final users (use of metadata to search specific related content). Our research will focus on the following areas of interest:

- Attitudes, perceptions, patterns of use, and access to digital television for specific tailored health and wellness related content among target groups;

- The role of iDTV in promoting original forms of access and social interaction that increase social capital and transform the proprieties of the existing social context when discussing health and wellness related areas
- Future applications and content forms when discussing the provision of health and wellness related content via iDTV;
- Nature of interfaces and media content when discussing the provision of health and wellness related content via iDTV.

The central hypothesis of the project states that the digital interactive television services in the area of health and wellness contribute to social cohesion and increase social capital, though resulting in a covariance relation between digital television use in different settings and social interaction and users' satisfaction, if such a use occurs in relation with specific subject areas (i.e. health and wellness.) The perspective guiding the construction of this hypothesis is based on the concept of complementary, suggesting that changes in access and type/levels of media content complements social outcomes. The secondary research hypotheses are:

- Individuals with tailored digital television access perform a different set of activities when compared with those who only accessed non-segmented content. Individuals that access and use segmented content and services display higher levels of social capital and are more satisfied with the use of the medium.
- Digital television services, more than other technologies, can prompt professionals in certain areas (i.e. health and wellness) to produce professionally related information if an acquisition method is provided (i.e. sensors)
- Digital television services, more than other technologies, are positively appreciated by professionals in specific areas (i.e. health and wellness) to distribute and share professionally related information
- Digital television services, more than other technologies, are appreciated by target groups as a means to access health and wellness related information and services
- Digital television provides a viable platform to archive and distribute tailored content only if this process is supported by end user's access and interface technologies.

This research adopts a mix of quantitative and observational methods and techniques in order to grasp the variables at social and individual levels involved. Specific project objectives to test these hypotheses include:

- The descriptive and qualitative study of the attitudes and perceptions among target groups in Portugal toward the use of digital television for the provision of health and wellness related services and content in Portugal in the period 2010 to 2012.
- The identification of the factors that contribute to the growth of social interactions in that context
- The identification of the content areas relevant for target groups
- The production of five different sets of content to be used during the project for testing procedures
- To test production and distribution workflows in the same context and the ways these are driven by the nature of content and services being provided (Damasio & Quico, 2004).

'10 Project: ImTV

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16. Vitor Manuel Marques Martins

The Project

The closing decade has revealed a great change in TV and video consumption trends. Many new services and companies have flourished: Web viewers can now watch their favorite series and films online made available by TV Broadcasters and media aggregator companies (e.g., Hulu.com, LoveFilm.com, Netflix.com), and cable TV operators offer rich interactive services in their latest set-top-boxes such as TiVo and ZON BOX. However, the landmark event of this last decade was the massive proliferation of user generated media fostered by the advent of YouTube. Millions of users now look for video entertainment not only on their favorite TV channels or cinemas, but also online, i.e. the YouTube live transmission of a U2 band concert. High-quality entertainment video shows are now created by professionals, independent producers and amateurs that publish their media online and free of charge. While this new media workflow creates added value services for end-users (e.g. personalized TV viewing), it also breaks the traditional TV concepts and affects key economic functions such as program scheduling, audience measurement, and targeted advertisement.

The long-term vision of this proposal is to exploit the full potential of new trends in media production and consumption by devising an on-demand immersive-TV framework combining TV industry, Internet distribution models and end-user's needs/interests. To accomplish this vision, this project has four objectives.

Objective One is to study and quantify the team's knowledge regarding key aspects of the new media workflow driving the entertainment industry: the way the new generation of media producers work (professionals, independent, and amateurs); how they use new distribution mechanisms to accommodate user interests; how viewing communities are constructed and how producers conceptualize users' engagement in this model. Existing

social and market models (e.g., audience interests, publicity impact) are being updated constantly by new players.

Objective two addresses the production side of the new media workflow, specifically the role of intelligent metadata and new digital formats in the production of video programs. The fast pace at which media is created puts an unprecedented pressure on the media producers who want their content to reach the target market as quickly as possible. An example is the TV series, "Sanctuary," which was filmed entirely in a digital set, which reduces the production time and costs; it was first sold directly to the viewer on the Internet. In this new distribution environment, reaching the target market can be a difficult task. Thus, linking media production with new digital video formats to rich metadata is critical to reach the right community of viewers.

Objective three is to develop richer immersive environments and novel feedback mechanism inferred from richer interaction with media and among viewers. Traditional feedback models capture viewing audiences and their points of access from which user profiles can be computed. These models provide an incomplete picture of the full spectrum of media consumption: richer feedback mechanism using alternative channels such as SMS, Internet forums, and live chats between viewers and actors (i.e. popular TV shows such as Big Brother) are not yet systematically incorporated into the equation that enables programmers to serve audiences. This illustrates the exciting opportunities to exploit the advantages offered by the community and personalized aspects of Internet services, and to strengthen TV producers and broadcasters' most valuable asset: the viewers' long-term loyalty.

Objective four links the outcomes of the previous two objectives: it aims to improve the viewers' experience by offering them a personalized combination of the mainstream TV content together with online user generated content. More specifically we will research algorithms that process the content metadata, the user and the community feedback to aggregate TV content and user generated content, thus, enabling users to access TV channels they are most likely to favor on demand. This will result in a win-win situation: viewers get personalized recommendations of popular content and TV broadcasters achieve more effective publicity.

The research will help define new marketplace for legal distribution and consumption of TV and media programs. The two major outcomes of this project are the solid statistics concerning the population of media consumers in the Portuguese media market, and the technology that will permit ubiquitous interaction between viewers, media, and producers. The main results of this project will be:

- A media impact assessment and a user study to support the technological activities of the project;
- Software technologies for recognizing human behavior and gestures while watching TV.
- Automated software algorithms to discover groups of interests among TV viewers.
- Software algorithms to compute media recommendations specialized to the TV environment;
- The evaluation of the proposed framework as well as the individual evaluation of the researched techniques.

'10 Project: INTELLIPave

Principal Investigator

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11. Reus Salini, PhD candidate
12. Ricardo Gomes de Faria
13. Victor Manuel Rodrigues Alves

The Project

The INTELLIPave project applies advanced techniques in artificial intelligence and soft-computing to provide a more scientifically accurate, modelling-based approach to evaluate the potential behavior and durability of asphalt pavements. This approach, being holistic and systemic, is expected to provide much more accurate results than the methods currently employed, which were developed half a century ago (or more) and which are based on empiric and empiric-mechanistic methods.

To meet this objective, researchers are referencing data collected in the Mn/Road Project (Minnesota, USA), which provides a detailed history of the service life for instrumented test sections of asphalt pavements that provides details sufficient for the needs of this approach. The relative data includes records taken by electronic sensors over the service life cycle of the relative asphalt pavements, taken over ten years, with the transit of about 100 million vehicle axles, with the capture of over two billion data terms. This detailed data includes vehicular information (date, time, axle configuration, weight by axle, speed, tire type and pressure, stresses in the tire-pavement contact area), environmental information (air temperature, pavement temperature, precipitation, wind speed, solar and UV radiation, humidity in the granular pavement layer), and structural information (strains and stresses in key points of the asphalt concrete and granular layers).

This wide database allows for the creation of a new modelling method that considers all these variables in an explicit way, without simplification or concession. The modelling method under development will also allow the addition of other variables that are not yet known as significant. Database information will be filtered, qualified, and organized to create a numerical matrix that will be optimized through the use of advanced soft computing techniques (e.g. particle swarm optimization; SOMA, evolutionary genetic algorithms, logic-mathematic functions) and equation systems to determine the contribution of each variable and each vehicle toward the ruin of the pavement. This optimization will populate a “matrix of performance” that will be used as a source of “experiences, knowledge, and intelligence” to program a neural network set that will be

able to predict the behavior of asphalt pavements. These predictive qualities will be valuable for projecting design, life expectancy, and maintenance of both new and existing pavements, with the input of information including proposed vehicular traffic, climate, and structural data. Therefore, this research will allow simulation of the life cycle of proposed pavement designs to be modeled against projected use, to secure the maximum design efficiency against projected traffic flow for its climate.

The innovation and flexibility of this modelling approach is based in its potential application against multiple parameters, objective and subjective, to evaluate pavement quality against different future scenarios, including need vs. cost. The following criteria will be included:

- Percentage of cracked pavement area;
- Structural capacity;
- Depth of wheel track;
- Roughness of the road as related to driver comfort;
- Macro texture as related to tire adherence and driver security;
- The value of the property for the highway.

Further, the approach will provide for the addition of new data parameters that are not yet described. Another benefit of this approach is the potential for the accumulation and cross-referencing of knowledge in a scientific way to provide a basis for the development of a matrix of pavement performance: and a foundation by which this body of knowledge can increase continuously over time.

The scope of this work is believed to be sufficient to coalesce a new field of interdisciplinary research in which the fundamentals and practices of Extended Logic Programming Languages, Evolutionary Intelligence, and Soft Computing might help to effectively solve engineering and other problematic aspects of asphaltic pavements. This project coordinates international researchers from Brazil, Italy, Argentina, Portugal, and the U.S.A., to help develop a productive network of expertise in this field, with high potential for expansion. This is also interested in establishing a Society of Pavement Researchers based on the results of this work, and this project has been entered into the Project on the Society of Collaborative Networks (SOCOLNET).

'10 Project: INVITE

Principal Investigator

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Research Team

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5. Pedro Alexandre Simoes dos Santos

The Project

Serious Games are increasingly situated in virtual environments (de Freitas, 2008). Users generally control an avatar which helps them engage in the environment and enables them to craft an identity and interact with computer controlled entities (virtual agents) that perform a series of roles in these environments. A particular case of interest, explored in this project, is when players form partnerships and perform collaborative tasks with virtual agents. In such cases, successful collaborative experiences with virtual agents depend not only on the ability of the agents to perform the task but also on the socio-emotional skills of the agent (Prada & Paiva, 2009).

The focus of the project will be around the notion of partnership of a human with another human or a virtual agent in a virtual environment: the project will study how partnership is created, maintained, or broken during an interaction supporting the realization of a particular task in a virtual environment. The hypothesis proposed is that inclusion of AI models that incorporate social intelligence, inspired by human behavior, in a virtual environment will foster believability in virtual agents within the context of partnership.

In this multidisciplinary project, we will incorporate state-of-the-art knowledge from social sciences on how users perceive other entities in a virtual environment and what factors are important in forming partnerships in order to create and implement an AI model for social intelligent virtual agents, which will be integrated in an existent 3D engine. A test scenario will be created and the hypothesis tested through a study involving 150 participants. Participants will be invited to get to know human-controlled and computer-operated partners using collaborative tasks in the virtual environment. The participants will partake in a 2 (avatar partner: real or virtual agent) by 2 (identity: ingroup or outgroup) factorial design experiment. The experimental outcomes to be examined include participants' perceptions of their real or computer-operated partner (e.g., recognition as a computer-operated or human-controlled avatar partner, social/task/physical attractiveness, believability, perceptions of prototypicality, group identification, and trust.

The results of the project will advance the state-of-the-art, suggesting answers to the following questions:

- What characteristics of partnership are the most important when modeling partnership in virtual environment? What are the roles of anticipation, type of social relations, social identity, how are the users first impressions formed and how they evolve in a virtual environment?
- What would be a good computational model for implementing partnership in virtual environments?

- What AI models are more efficient in achieving believability of virtual agents in partnership scenarios?

The hypothesis this team proposes is that inclusion of AI models that incorporate social intelligence in a virtual environment will create virtual agents indistinguishable from human avatars from the point of view of the user, for a limited interaction time, within the framework of a partnership. It is the objective of this project to tackle the problems above by developing AI models of socially intelligent agents, implementing them within a virtual environment, and then performing the adequate tests involving the creation of partnerships and the execution of tasks. The information gained from the tests will, besides solving the research problems connected with the human perception, allow the AI models to be improved, and a new cycle of implementation and testing to be performed.

The outcomes of this study proposal can potentially inform the literature on the design and evaluation of avatars (e.g., Isbister, 2006; Nowak, 2004). Additionally, the findings can potentially contribute to the study of social identity dynamics in computer-mediated contexts (Postmes et al., 1998), with a new emphasis on how ingroup/outgroup perceptions affect collaborating with and then evaluating real and AI avatars. A version of the final prototype will be adapted to a showcase prototype to demonstrate the commercial potential of the developed technologies.

'10 Project: LIFEisGAME

Principal Investigator

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The Project

The ability of socially and emotionally impaired individuals to recognize and respond to emotions conveyed by the face is critical to improve their communication skills. The LIFEisGAME project shows how it is possible to apply a pioneer serious game approach to teach people with Autism Spectrum Disorders (ASD) to recognize facial emotions, using real time synthesis and automatic facial expression analysis. Some studies estimate that around 10,000 Portuguese suffer from ASD, and most still use non-interactive methods to learn facial emotions. Our interactive digital media solution has an explicit and carefully thought-out educational purpose within the health care industry: the games will help individuals learn to recognize emotions in a fun way and without inducing stress. New applications in graphics, animation, virtual reality and digital media are enabling the development of different learning-based strategies. Companies like Sony and Microsoft [NATL] are investing vast resources in the research of new interactive methods for next-generation game consoles, including identification of facial expressions, which will expand the access and the impact of serious games. This joint project between UT Austin and Portugal is a natural fit for current research interest of the team members and aims to extend them: automatic recognition of human motion, user needs assessment (UT Austin) and facial character animation (Portugal).

The LIFEisGAME project is part of a broader research effort that focuses on an open question of scientific and clinical importance; whether the use of virtual characters in interactive training programs can provide a basis for ASD rehabilitation. Technology development will be the initial phase of research. LIFEisGAME's overall objective is to deploy a low cost real time facial animation system embedded in an experimental game, allowing further study of symptomatic problems of facial emotion recognition. This will have relevant impact in the entertainment industry, academia, and psychology. The team seeks the following advances:

- To provide research that leads to a system capable of facial synthesis in real time with cinematographic quality
- To provide research that leads to a markerless facial motion capture system using low cost hardware, such as webcams. Such a system does not currently exist.
- To provide a general methodology to create a facial expression analyzer and classifier system that provides detailed information that cannot be captured using current motion capture systems

- To explore different models to define the most adequate tangible user interface to allow an immersive behavior when interacting with people that suffer of ASD
- To study, validate, and propose novel game concepts that improve social and communication skills by training interpersonal awareness through facial emotion recognition.
- To realize and evaluate a prototype game that enhances the ability to recognize emotions through an interactive experience and becomes a key reference in the field. Tests of several game modes will be performed with two groups: individuals with and without ASD
- To disseminate result to the public and to the scientific community.

To carry out this project and achieve its goals, the team consists of interdisciplinary members and external consultants.

Many efforts have been done to teach people to recognize facial expressions with varying results, but none focused on using real time facial synthesis. The team argues that current technological advances in character animation can substantially improve the way people with Autism Spectrum Disorder (ASD) are taught to recognize facial expressions. Most methodologies use photographs of facial expressions. Besides having severely limited interactivity, they fail to reproduce the dynamics of a facial expression: far from being a still image, it is the voluntary and involuntary contraction of muscles that produce different facial movements. These movements convey emotions from one individual to another, enabling non-verbal communication. Thus, the need exists to weigh in an additional technology and new game approach to allow real time facial motion study. The main technological innovative aspects of LIFEisGAME are to:

- Streamline the process of creating realistic virtual characters (humans, cartoons, creatures), by advancing the general fields of real time animation, including the development of a markerless capture system, a transferable auto-rigging system and real time dynamic skin shaders; second, it is the first time that a serious game approach using virtual characters goes hand in hand with a very important topic in psychology, which is the study of facial emotion recognition. The influence of realistic virtual characters had never been fully explored before due to their high cost, only affordable by big movie projects. Thus, both areas, computer graphics and human computer interaction plus psychology, will benefit from this project.
- The main research challenges arise from the synchronization and realism problems, the support for the reusability of components, and the need for an avatar-user interaction model with real time response. Traditional techniques to achieve high quality human animation are very time consuming, expensive, and laborious, and usually include key frame animation and motion capture based on facial markers. This is not only cumbersome, but also unpleasant and unnatural. Thus, creating realistic virtual humans is nowadays performed off-line (for example, in movies, where no real time interaction is required) following expensive, per-character procedures. Other contexts, such as games or virtual reality, adopt cheaper approaches, at the expense of overall visual quality and credibility of the models.

The most important issue to highlight is the close collaboration between the medical and the computer science teams in this project, to ensure the algorithms and technology

developed are based on a solid learning methodology provided by experts on ASD. Otherwise the project result could be high-end technology without useful clinical application. To guarantee the success of the project, it has been divided into 2 stages. Stage one is to develop a prototype that builds on a facial synthesis method developed by team members, which eases the real time animation process. This method serves as proof-of-concept and guarantees that the team can receive early user feedback, despite the research challenges to be faced in stage 2. The pilot game implements the key concepts of emotion recognition. It uses a videogame based approach, where avatars can adopt different appearances, i.e. human, cartoon, or fantastic creature. It contains a set of exercises embedded in the game play to reinforce the learning process and generate a real time avatar response based on direct therapist input or on a set of predefined rules. It also includes a facial expression editor capable of displaying 3D characters in real time. This allows the therapist to adjust or create new exercises on the fly, without the need of artistic or technical skills. This is mostly a development stage that allows validation and testing of the approach with clinical data. These initial tests will help define the requirement of Stage Two which consists of research and development to create:

- the markerless motion capture system;
- the avatar-user interaction model;
- the facial analyzer and classifier;
- the facial synthesis;
- technology and the deployment of the pilot game in hospitals.

'10 Project: REACTION

Principal Investigator

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The Project

Retrieval, Extraction and Aggregation Computing Technology for Integrating and Organizing News. This research project aims to help journalists and researchers make better sense of what is news and what is not among the massive amounts of data produced every day. While traditional articles in print offer limited, slice-of-time snapshots of the world, with today's technology provides the opportunity to tell the "real story that never ends" which is tightly integrated with the overarching context of ongoing world events. This enlarging deluge of 21st century worldwide information production demands new journalistic practices to effectively monitor, interpret, and summarize news—in addition to development of new models to present dynamic, interactive, integrated content to readers. News now evolves over time as a cooperative dialog between news outlets and the public at large.

News presentations should fundamentally reflect this through "anytime" organization of the latest events, expressing story elements as they develop over time, and integrating the story in the larger world context. Journalistic excellence today requires advanced data-mining and search technologies, together with novel web services and integrative mash-ups. The goal of this project is to take news delivery and development to the next level. CoLab researchers identify the challenges of the industry in analyzing multiple information inputs (formal and informal, explicit and non-explicit), as well as in designing rich interactive interfaces for effective news delivery, and case study evaluation of computational journalism methodologies. In order to help address these challenges within practical constraints, REACTION has organized seven complementary research tasks: mining resources, entity and event tracking, web community sensing, tracking information flow, interaction and personalization, query and visualization, computational newsroom.

Collected and annotated datasets will be shared with the research community along with dissemination of new methods and their evaluation. This will broadly stimulate greater work on computational journalism in the research community at large. The project will produce robust, open-source tools for wide use by journalists and end-users, and document a critical case study evaluation of computational journalism methods in the newsroom.

In content analysis, the research team will use automatic and semi-automatic methods to create linguistic resources for mining texts relevant to journalists (with a focus in politics), relationships, and opinion mining for annotation of large document collections. Methods will specifically address:

- entity ranking, i.e. finding the relevant personalities for a given topic
- entity distillation, finding relevant resources for a given entity
- attribute selection, finding a list of key aspects to compare and differentiate a given set of entities

Therefore besides identifying the relevant entities in a document collection, the project will provide insights about the entities based on context retrieval.

In social networks analysis, research will examine how to track information flow patterns, infer authority and credibility of sources; and finding experts on the topic of a news story after identifying influential community members. Detected information flows will enable novel interactive visualizations to be automatically generated for rapid, cost-effective, and integrative interpretation of news.

Detected information flows will be monitored in conjunction with explicit social networks to aid in community discovery. Individuals or organizations who exhibit regular patterns in producing, redistributing, modifying, and/or consuming news are reflective of communities.

Work on sentiment analysis and opinion mining techniques of individual stories will be informed by situating such stories in the context of their larger flow. In the other direction, knowledge of such sentiment in tandem with flow networks will aid in community discovery by monitoring flow of sentiment among individuals and organizations. Interaction work studying how individual users organize news will further inform detection of implicit relationships, both between stories (information flow) and between users (community discovery).

In user interface design and analysis research will examine new methods for ranking and finding implicit associations between news from user navigation patterns. The project will also develop and evaluate tools to present news automatically and semi-automatically produced with the knowledge obtained from the above research, leveraging resources and software already developed or under creation by the participating research groups and development teams.

All the above ideas will be scientifically tested, either through participation in joint evaluations, such as TREC (Text Retrieval Conference) or by observation of the use by journalists of the proposed algorithms, methods, and tools in an experimental computational newsroom and measuring the impact of these technologies in their activity.

'10 Project: See-Through-Sound

Principal Investigator

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The Project

The See-Through-Sound exploratory research project focuses on the creation of an innovative solution for the cognition and sensing of space. Its novelty lies in mapping visual information into the auditory realm to enable a spatial environment's unique features to be described as an organized sonic event. The goal is to develop a portable, wearable interface that can be used in a wide range of applications, by a large pool of different users. In addition to being worn by a user, this interface might be mounted on a small mobile robotic in order to transmit the data to a remote location for analysis. The sonic events that are output by the interface are the "image" of the space being surveyed with complexity that spans from simple discrete timbres of varying spectral richness to intricate music-like sound structures making use of a plethora of rhythmic and melodic patterns. New spaces and new spatial environments will exhibit and provoke deviations on the known/stored sound patterns.

This project has the potential of creating a new and reliable "language" based on the correspondence of the proposed sound-image paradigm, with a user learning curve similar to that of acquiring a new language. The most immediate benefits of this technology are far reaching, including medical and scientific use, as well as a tool for people with vision disabilities enabling them to "see" space through sound. A further dimension of this research is the possible development of a universal auditory language with which to map visual data into auditory data. The project will step through five strategic components/goals that will provide milestones to measure progress.

1) Information gathering and literature review on the projects three essential components: techniques of image analysis and recognition; mapping visual information into sound data; auditory scene analysis.

2) The pursuit of individual experimentation in the three areas listed above, with the goal to gather data from both real time video capture and ambient sound into a single hardware and software application that will feed a software synthesizer.

3) Bring together the research in image and auditory scene analysis. A portable HCI interface will be devised to bring together the data fed by the sensors that will capture both the image and the ambient sound of a given space. That information will be coded and prepared to be analyzed and processed by the sound synthesizer and sound pattern generator.

4) Experimenting with sound pattern generation using as raw data the image and ambient sound analysis. This is the core of the research, and where the potential for innovative solutions can be accomplished: a solution that effectively maps a sensorial domain into another. Given its relevance, the work with sound pattern generation will begin after the literature review and will cover the entire span of the project. The research with sound

synthesis and pattern generation will integrate both *timbre* and *sound* structures. *Timbre* will provide subtle or sudden changes over time as a result of changes in light, forms and shapes of individual objects present in the space. *Sound* patterns will convey the potential complexity of the features of a given space.

5) Designing the final interface prototype and refining the software applications that will be integrated into the interface. Effort will continue to focus on implementing unique and effective solutions for mapping images into sound and reach the means to reliably and consistently convey spatial information in an immediate way with a high degree of detail.

'10 Project: TURBSCALAR

Modeling the sub-filter scalar dissipation near the Turbulent/Non Turbulent interface in jets

Principal Investigator

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The Project

Many industrial and transportation devices involve combustion in jet diffusion flames where the combustion reaction takes place at edge of the jet where fuel and oxidizer interface. Improving the understanding and the accuracy of the simulations of turbulent reactive jets is therefore crucial to improve the fuel economy and to decrease the emissions in numerous combustion systems. The study of scalar transport is hugely important in these flows since ultimately it is the evolution of scalar fields governed by transport equations that determines the rates of turbulent mixing, combustion and pollutant dispersion. An important physical quantity in this context is the scalar dissipation which represents the rate at which the scalar fluctuations are dissipated by molecular effects. It acts mainly at the small scales of motion and its dynamics is closely associated with the final stages of the energy cascade mechanism for the scalar field. Regions of intense scalar dissipation tend to form very thin sheet like structures in isotropic turbulence. Due to its high relevance to both theory and applications much work has been done in the characterization of the statistics, topology, and geometry of this quantity (Overholt and Pope 1996, Vedula et al. 2001, Schumaker et al. 2005, Schumaker and Sreenivasan 2005).

On the other hand, it has been recognized for some time that from the existing numerical techniques only large-eddy simulations (LES) can accurately describe the complexities of the flow in turbulent jet diffusion flames. In LES the large, energetic scales of motion are explicitly computed while the effect of the small scales of motion is modeled. A quantity of much interest for large-eddy simulation (LES) of turbulent combustion is the sub-filter scalar dissipation which is needed as a parameter in flamelet models of non-premixed combustion (Cook 1997). It appears also in the transport equation of the sub-filter scalar variance. Thus, in large-eddy simulations (LES) involving scalar transport such as in turbulent mixing or combustion, the sub-filter scalar dissipation has to be modeled (e.g. Pierce and Moin 1998, Cook and Bushe 1999, Grimaji and Zhou 1996).

Since the most important contribution to the sub-filter scalar variance comes from the small scales, its modeling is particularly challenging. Despite its importance many aspects of the sub-filter scalar dissipation are not well understood. In particular, the detailed

characterization of the topology of the sub-filter scalar dissipation is still incomplete even in isotropic turbulence. The regions of intense sub-filter dissipation also exhibit a sheet like structure that can be quantified using the surface area, the thickness of the surfaces, and its curvature. Moreover the fractal dimension of these structures can also be computed.

Another important aspect of turbulent jets that is receiving much attention recently is the mechanism of “turbulent entrainment.” Turbulent entrainment that takes place in all free shear flows such as mixing layers, wakes and jets and largely governs the transfers of mass, momentum, heat, and other active or passive scalars across the sharp edge of the jet, which in jet diffusion flames separates the fuel from the oxidizer. It has been shown recently that the physical mechanisms occurring at this region are considerably different from previously thought. In particular, recent works show that turbulent entrainment is mainly caused by small scale motions (“nibbling”) and not by large-scale eddy motions (“engulfment”).

Moreover, the classical turbulent variables display sharp gradients and very particular dynamics to this region. Moreover, it has been shown that scalar gradient, its production, dissipation and convective transport are particularly intense near the fuel/oxidizer interface. A detailed study of the sub-filter dissipation in this context is both useful and urgent for the scientific community and the industry. One related application of this knowledge of high interest to the research team is in understanding the action of embers produced during a forest fire which can be transported by thermal plume to create secondary fires, thus complicating fire suppression and very often endangering lives. This process of fire propagation is not well understood, and one of the objects of this research is to apply the knowledge gained against this need.

The goal of this research is to (i) analyze the dynamics of the scalar field across the fuel/oxidizer interface, (ii) study the Lagrangian statistics of the particle trajectories across the fuel/oxidizer interface, (iii) characterize the detailed geometry e.g. the surface, thickness, curvature, and fractal dimension of the structures of intense sub-filter scalar dissipation in turbulent plane jets in the context of the turbulent entrainment and, (iv) develop and assess a new model for the sub-filter scalar dissipation to use in LES based on this information, (v) apply this modeling to predict ember production and transport during forest fires.

EDUCATION

New degree programs have been established as a result of the collaboration. They include a Ph.D. degree in digital media at U.Porto with UNL, which began in fall, 2009, as well as a master's program in multimedia at U.Porto. In addition, the program supports students who wish to pursue an additional complementary Ph.D. at UT Austin.

We have embarked upon a program of teaching and co-teaching courses in Portugal both in the summer and in the long semesters. Our most recent venture was to develop an intensive screenwriting laboratory for select students during the summer of 2010. Sponsored by industry partner ZON, this laboratory is dedicated to cultivating the next generation of talented media makers in Portugal. Complementing these academic programs, the UT Austin |Portugal program has hosted visits in Austin with several graduate students and faculty from Portugal. The program facilitates internships for additional professional training in the Austin region and on campus, and supports exploratory visits from doctoral students interested in studying in Austin and in cultivating relationships with UT Austin faculty and students.

In addition to the degree programs, the collaboration has spawned lectures, summer courses, full-semester courses and co-taught classes in Portugal, as well as workshops. The graduate level classes include core courses in the program as well as special programs to develop talent among Portuguese creative students.

PhD, Digital Media

The four-year Digital Media degree program at U.Porto and UNL, which began officially in fall 2009, was designed with a multidisciplinary structure supporting four specializations:

- Creation of Audiovisual and Interactive Content
- Technology
- Journalism
- Industry, Publics, and Markets

Students are co-supervised by professors in Portugal and Austin, and the program includes a research fellowship in Texas. Students are eligible to apply to UT Austin doctoral programs for a dual degree.

The program entails a full year of organized courses, including theoretical, methodological and laboratory-based work. Roughly in the middle of the second year, students present their dissertation research ideas, with the intention of spending their remaining two years working on their original research. Students seek co-



supervisors from among the UT Austin faculty, and they may spend a fellowship year in Austin. (The first joint Ph.D. student attended Austin in fall, 2010, taking advantage of the university's deep resources in production and live theater technology.) Currently there are 32 doctoral students in the program in Porto, and 22 students in the program in Lisbon. UT faculty has contributed several courses both by co-teaching and by offering stand-alone classes, as detailed below.

MA, Digital Media

U.Porto's Multimedia Master of Arts program entails one year of coursework complemented by a second year dedicated to thesis or project work. This new two-year multidisciplinary program offers the following emphases:

- Arts and culture
- Education
- Interactive music and sound design
- Technologies

A number of new courses have been created to support the new area of interactive music, such as the Sound Design for Digital Media, most recently co-taught with UT Austin Professor Andrew Garrison. In the second year, students pursue either a research-oriented thesis or a project developed with industry. The multimedia program enrolled 54 students in its first year and 42 students in its second year.

ZON Intensive Script Development Laboratory

(June-July 2010) A major new addition to the program was a two-month-long laboratory in Austin sponsored by ZON and attended by students selected from among several Portuguese universities. Our educational programs reached numerous students from several Portuguese universities as well as working, early career professionals. Enrollments included: 66 students in intensive summer classes in Portugal; eleven students from different universities in the summer 2010 ZON Laboratory; 33 students in long semester or co-taught classes during the '09-'10 academic year. In the fall 2010 term there will be 62 students involved in the courses co-taught by Dr. Pennycook, and another ten in an *Economics of Information* course taught by Dr. Strover. As well, numerous students and early career professionals were reached through our various sponsored lectures and events.

In the summer of 2010, leading Portuguese communications company ZON Multimédia partnered with the UT Austin-Portugal program to cultivate a new generation of creative talent in Portugal, sending several promising student filmmakers to UT Austin, home to one of the top media production programs in the United States. Observing that one of the weakest elements in contemporary media is a strong sense of story, ZON and UT devised a laboratory that would focus on the principles of story. Selected on the basis of story synopses submitted last spring, the students spent two months in the ZON Intensive Script Development Lab, a rigorous program designed to hone their production and writing skills and develop the brief synopses into scripts for ten-minute films. Upon return to their home institutions, the students spent August and September in production and postproduction, so that they can submit their completed works to the ZON Criatividade em Multimédia prize 2010 competition in November.



During their stay in Austin, the students studied many aspects of film including production management, budgeting, and character development, as well as applied technical skills such as cinematography and non-linear editing. The program was divided into three concentrated courses. These included *Writing the Short Script*, taught by Stuart Kelban, a professional screenwriter who serves as Head of Screenwriting in the Radio-TV-Film department; *Producing Film and Television*, taught by Richard Lewis, a highly experienced producer, director, and writer; and *From Script to Screen*, led by award-winning filmmaker Steve Mims.

The three classes created a demanding schedule, which required class attendance Monday through Thursday in addition to many hours of study, writing, and practice outside of class. Kelban's screenwriting course led students through each step of script creation, with continuous writing exercises throughout the session. The students honed their story and character development skills, so that their original film treatments evolved into fully-fledged scripts. While doing so, they learned about the business and management aspects of filmmaking in Lewis's producing class, including the supervision of film crews and the construction of a realistic budget.

While each student was selected on the basis of his or her outstanding story treatment, the students possessed varying degrees of expertise regarding actual film production. Mims' From Script to Screen class began with the basics of 16mm and digital camerawork, and went on to address digital cinematography, film grammar and design, editing theory, and other elements of post-production. Additionally, students attended special labs on advanced audio and lighting. At the conclusion of Mims' Script to Screen course, the students separated into small groups and created their own short films. These were screened on July 28, just before their departure, with a farewell dinner following the final screening.

Students reported great satisfaction with their class experiences. In a survey conducted at the conclusion of the program, all students who responded strongly agreed that the classes improved their understanding of the subject matter and all respondents rated the instructors highly in terms of teaching effectiveness.

The ZON Intensive Script Development Lab at UT Austin fostered the development of professional ties and friendships among members of different institutions and allowed several aspiring filmmakers to further develop their abilities and realize their potential. By supporting these emerging filmmakers, the Lab nurtures the students' individual careers and also contributes to the development of a technologically and artistically innovative new generation of media makers. ZON Intensive Script Development Workshop attendees included:

- José Azevedo from Universidade do Porto
- Raquel Martins from Escola Superior de Comunicação Social
- Pierre Jézéquel from Escola Superior de Música e Artes do Espectáculo
- Ricardo Feio from Escola Superior de Teatro e Cinema
- Ana Martins from Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa
- Patrícia Brásia from Universidade da Beira Interior
- Fábio Veríssimo from Universidade da Beira Interior
- Luís Brás from Universidade Lusófona
- Susana Neves from Universidade do Minho
- Nuno Castilho from Universidade Católica do Porto
- Danilo Nascimento from Universidade de Aveiro.

Digital Media Summer Institute 2010

The Summer Institute provides several intensive graduate level courses that cover different aspects of the Digital Media Program including cinema studies, music and sound, animation, and journalism. The 2010 Summer Institute classes were taught by award-winning UT Austin production and studies faculty members and took place at UNL. The courses focused on advancing students' conceptual knowledge and applied skills. These courses saw a total enrollment of 66 students and expanded their knowledge in the areas of journalism, film studies, documentary production, and animation. Descriptions of the classes are below.

Digital Journalism for a Network Society

(June 21 to July 2) Rosental Alves, a professor at the UT Austin School of Journalism, taught a two-week course that explored the current business environment for news outlets, examining how technology is playing a role in reshaping both journalism and the broader society. In addition to exploring macro-social trends around the news industry, the course also examined how technology is changing the practice of journalism, both in terms of new, computer-aided methods of newsgathering and new relationships between journalists and news organizations. The course ended with a discussion of how initiatives in Portugal could take advantage of opportunities offered by the evolving network society. Twenty students attended this course, producing a business plan for an on-line news outlet and a proof-of-concept.

Documentary Mash-Up

(June 14 to July 2) Karen Kocher of the Department of Radio-TV-Film (RTF) led a three-week course that combined documentary film production with the use of geospatial visualization tools like Google Maps and Google Earth. Sixteen students produced short documentaries about topics in Lisbon, keeping an emphasis on a sense of place. As the documentaries were produced, students also learned how to integrate these shorts into interactive mapping systems, which give the viewer the ability to access video by clicking on locations on the map related to the video. The 2010 class video and video from prior classes was integrated into an interactive map of Lisbon, available at: <http://utaustinportugal.org/docmashup/>.

Intermediate Animation

(July 12 to July 30) Geoff Marslett from the Department of RTF taught a three-week course targeted toward experienced animators. The course, which employed both the vector-based Flash and raster-based After Effects software packages, required students to produce a three-minute animation at the end of the course. In addition to the technical skills involved in animation, the course also taught students to think through the project management aspects of animation, from pre-production to production scheduling to asset management. This course enabled 13 students to extend their existing animation skills and learn more about the industry.

Digital Cinema

(June 21 to July 2) Tom Schatz, a professor in the Department of RTF, offered a two-week course examining the role of digital production technology in contemporary film and video. The course emphasized Hollywood feature films, but also explored the technical changes in other national cinemas, independent films, and ephemera such as commercials and music videos. In addition to changes in production, the course studied how digital technologies have affected the distribution of films and how the adoption of digital technologies has influenced globalization, media convergence, and ownership concentration. Each of the 17 participated in this course and delivered presentations on the course readings.

Full Semester Courses

Documentary and Sound, Spring 2010

(Spring 2010) RTF Professor Andrew Garrison co-taught two long semester courses at U.Porto. In the first, co-taught with Soraia Ferreira, Dr. Jose Azevedo and Dr. Artur Alves of U.Porto, students came from the master's and doctoral programs in digital media. Garrison lent his expertise in documentary production to class, which produced six three minute documentaries of events that occur around Porto (making traditional shoes, traditional sweets, scenes in a bakery, etc.) and two 10 minute documentaries (one addressing the *uberman schedule* – polyphasic sleep – and one about privacy issues in Facebook)...

A second course, Sound Design for Digital Media, was organized in three parts: in the first part, students analyzed films from second year MFA students at UT and worked under Garrison's and Guedes's supervision to design sound; in the second part, students worked with Guedes on the aesthetics of sound for film and developed a critical approach towards sound design. In the third section, students worked with Garrison and Tom Hammond from Soundcrafter (an Austin-based company) in mixing and post-production of surround sound for 5.1 environments.

Digital Communication Theory, Spring 2010

(Spring 2010) Dr. Derek Lackaff led this full semester investigation into the theoretical foundations of communication theory at U.Porto. Sixteen PhD students at U.Porto attended this course, which included on-site and distance-learning elements. The course followed the trajectory of communication theory from early investigations into mass communication to contemporary studies of online interactive media.

Digital Interactive Systems, Automatic Music Generation

(Fall 2010) Dr. Bruce Pennycook is co-teaching a fall 2010 graduate seminar at U.Porto with Dr. Carlos Guedes. This course will explore advanced techniques in computer music synthesis and production. He also will spend a full semester at the U.Porto in the spring of 2011 and will co-teach Automatic Music Generation in the second semester.

Lectures

Kathleen Tyner Gives Keynote at Games Conference

Associate Professor Kathleen Tyner from the RTF department gave the keynote at the VS Games 2010 conference at the University of Minho in Braga. Her talk, titled "An Array of Play: Games for Living and Learning" explored instrumental uses of games. Some games Tyner discussed, called "serious games" use game play to teach a particular set of knowledge or outcomes. Tyner also discussed virtual worlds such as *Second Life* or *World of Warcraft*, which offer new platforms for users to communicate and socialize. The conference looked at these games from a variety of disciplinary standpoints in order to advance understanding of how games can achieve social goals.

Motivation and Mobilization: Social Network Sites and Social Research

(March 2010) Dr. Derek Lackaff presented lectures in both Porto and Lisbon on the subject of network analysis, an important tool in understanding how social media unfold. Titled Motivation and Mobilization: Social Network Sites and Social Research, his presentation pointed out that social network sites (SNSs) such as Facebook and MySpace have emerged as important platforms for online social interaction. These sites have exhibited astonishing convergence as they assimilate functions from other more specialized media platforms such as media sharing, blogging, and gaming. At the macrosocial level, SNSs have played a significant role in many recent collective actions, ranging from mainstream political campaigns to pro-democracy protests within repressive regimes. At the microsocial or personal level, a range of factors impact behavior. His lecture presented research that examines the antecedents and consequences of SNS behavior, with a particular focus on social scientific explanations of individual motivation and the mobilization of network resources.

Interactive Advertising

Dr. Linden Dalecki, a professor of marketing at Pittsburg State University and an alumnus of UT Austin, presented a seminar in interactive advertising on June 2, 2010 at the University of Porto and met with several students and faculty and some advertising companies. His talk, titled "What's Playing on WalMart Tonight? Trends in Digital Marketing" addressed contemporary challenges in advertising with respect to using new media.

Google and Surveillance

Dr. Siva Vaidhyanathan, University of Virginia, spoke at UNL on October 14, 2010. Titled “The Googlization of the Global Street,” his talk examined the method, process and effects of Google Street View and other surveillance systems that Google has installed around the world. It focused especially on European reactions to new forms of corporate visual surveillance. Skeptical of Google’s potential, Vaidhyanathan specifically identifies Google as a barrier to global intercultural communication and exchange. Although some tools like Google Translate provide some basic communication tools, other initiatives, such as Google’s efforts to tailor search results to individual users may make it less convenient to encounter information from other cultures and nations since it privileges results by the user’s locality and language.

Seminar Series, 2010-2011 in Lisbon

Drs. Nuno Correia, Sharon Stover (UT Austin) and Rui Prada (IST) are planning a seminar series for doctoral students and faculty that will focus on the intersection of the design and the computer environment. The talks will be streamed to Porto.

Visiting Scholars and Researchers in Austin

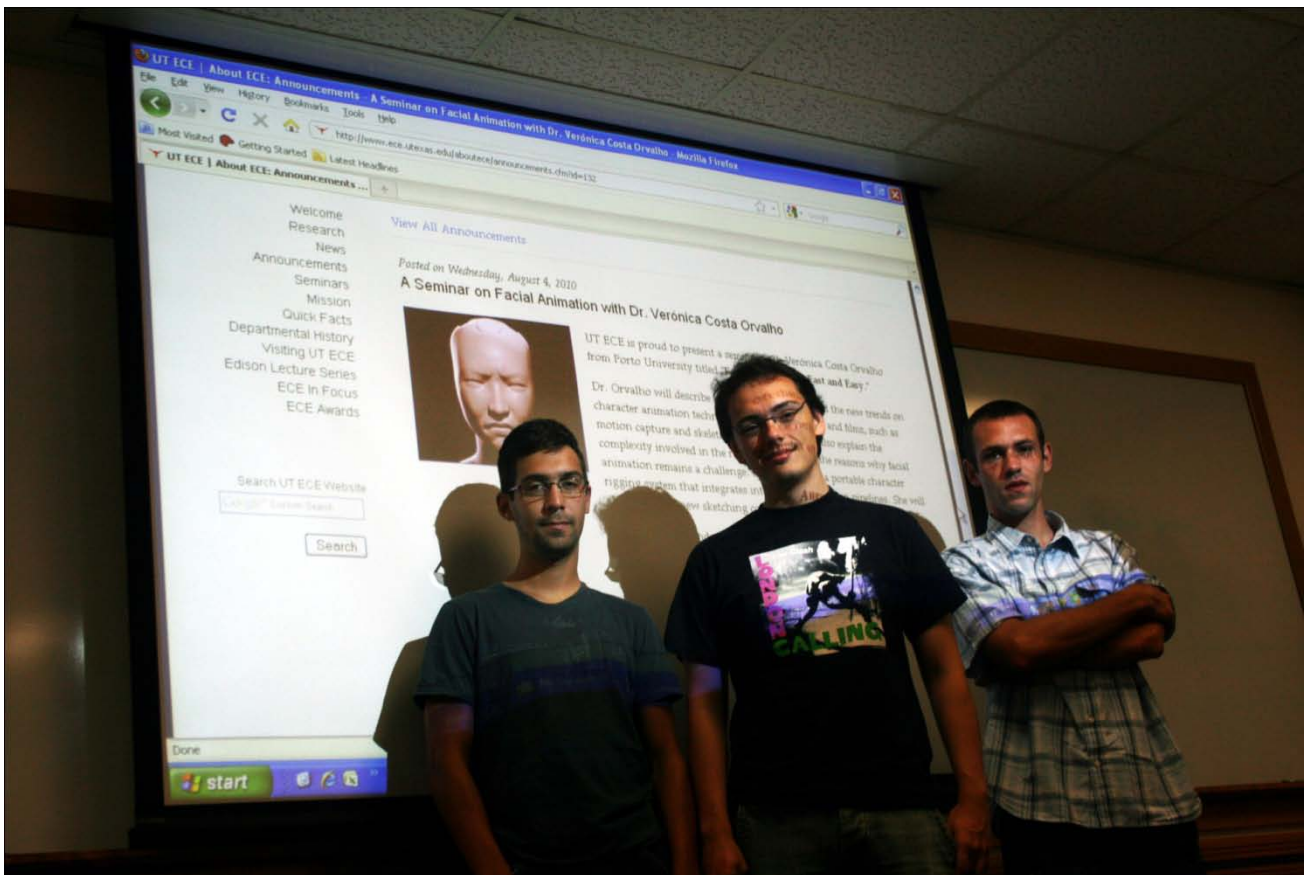
Visiting researchers and interns at ICES

This spring, the Institute for Computational Engineering and Sciences (ICES) welcomed *Rui Gonçalves, Reus Salini, Edgar Sousa, João Barbosa, and Diogo Neves* as Visiting Scholars to study at UT Austin and to collaborate with the departments of Computer Science, Electrical and Computer Engineering, the Texas Advanced Computing Center (TACC) and the Center for Transportation Research (CTR). João Barbosa examined high-performance computer graphics; Reus Salini contributed to the INTELLIPave research project; Rui Gonçalves worked on parallel programming methodologies that improve modularity and promote the incremental development of parallel applications; Diogo Neves’ focus was to raise the abstraction level of parallel programming by developing a new set of constructs that promote a stronger separation of concerns in parallel computing; Edgar Sousa pursued aspect-oriented programming to develop tools for (semi-)automatic parallelization of legacy scientific codes, as he worked closely with Professor Keshav Pingali and his research team to take part in the development of the Galois framework.

Nine Portuguese PhD candidates attended a shorter ICES summer intern session in August. Some students worked alone with their faculty mentors and others joined research project teams. Topics varied from software development to computer reproductions of bio-molecular motion. The students and their mentors included:

- *Nuno Miguel Monteiro Barbosa, University of Porto* (Supervising Professors, Porto: Verónica Orvalho, Álvaro Reis Figueira; Supervising Professor, Austin: Paul Navratil)
- *Filipe Brunido, University of Coimbra* (Supervising Professors, Coimbra: Luís Moura e Silva; Supervising Professor, Austin: Paul Navratil,
- *Luís Filipe Pinho Correia, University of Porto* (Supervising Professor, Porto: Miguel Dias Costa; Supervising Professor, Austin: Ron Elber)
- *Rui Sérgio Magalhães da Costa, University of Minho* (Supervising Professor in Minho: Alberto Proença, Supervising Professor in Austin: Ivo Babuska)

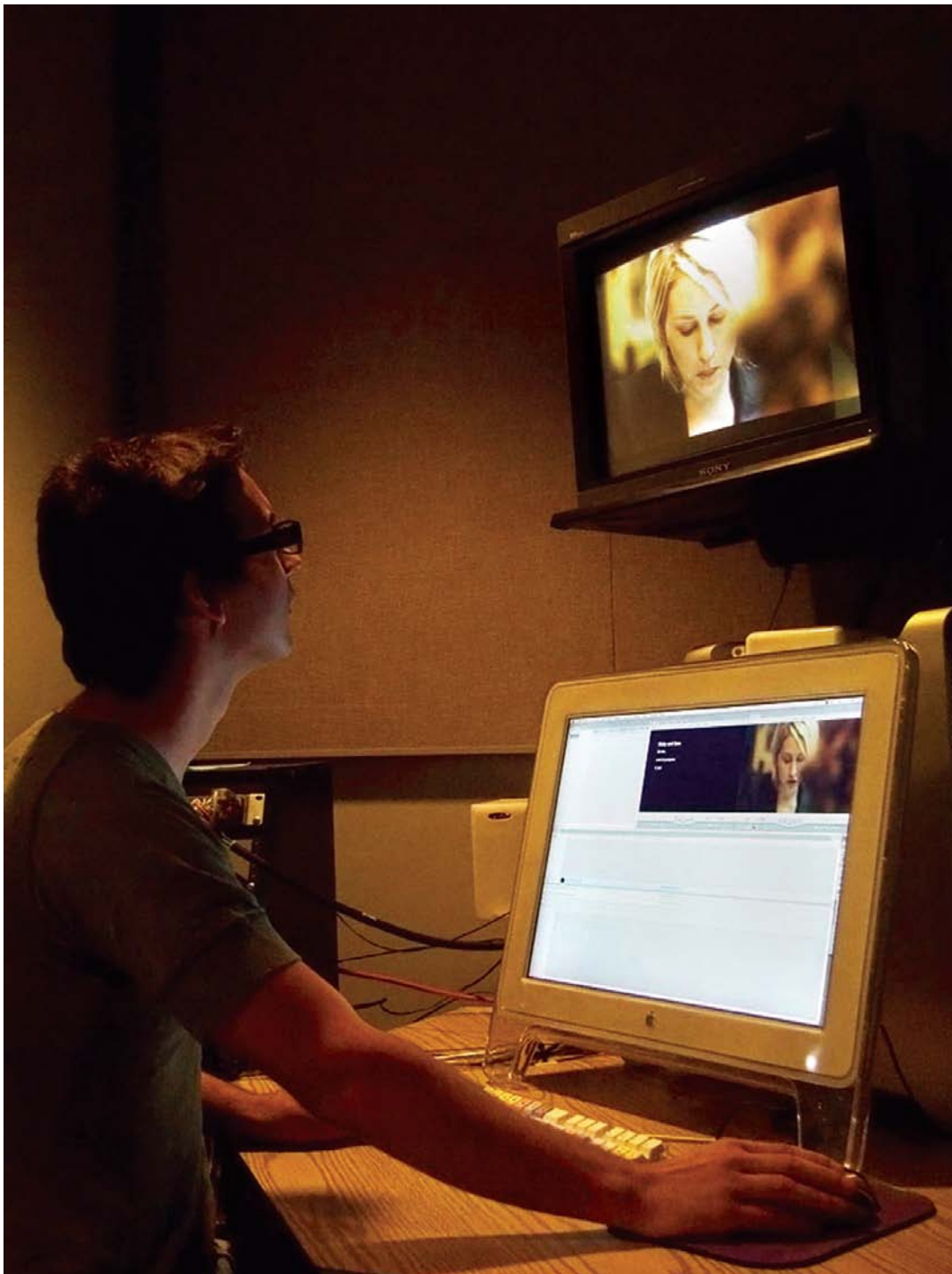
- *Nuno Filipe Monteiro Faria, University of Minho* (Supervising Professors, Minho: João Luís Sobral, Rui Ralha, Alberto Proença, António Pina; Supervising Professor, Austin: Chandrajit Bajaj)
- *André Pereira dos Santos Lourenço, University of Coimbra* (Supervising Professor, Coimbra: Luís Moura e Silva; Supervising Professor, Austin: Ron Elber)
- *Luís Filipe Teixeira Miranda, University of Minho* (Supervising Professor, Minho: Alberto Proença, Supervising Professors , Austin: Donald Nguyen, Mario Méndez)
- *Roberto Carlos Sá Ribeiro, University of Minho* (Supervising Professors, Minho: João Luís Sobral, Rui Ralha, Alberto Proença, António Pina, Supervising Professors, in Austin: Ivo Babuska, Karl Schulz)
- *André Silva Rocha, University of Minho* (Supervising Professor, Minho: Alberto Proença, Supervising Professors in Austin: Chandrajit Bajaj)



Visiting Scholars, Interns, and Faculty Visits at the College of Communication

Pedro Resende (UNL) interned in Fall 2009 at 501 Post studios. He returned to Austin in summer 2010 to pursue further work in the film industry, working with the Austin School of Film.

*Nuno Rocha of Polytechnic of Porto (ESMAE) and ZON Prize Winner studied in the Department of RTF from September to December 2009 and shot his second short film, *Vicky and Sam* (now on the festival circuit), while there.*



Hugo Almeida Rodrigues, U.Porto interned with RTF alumnus and instructor Kyle Henry in Austin from December 2009-January 2010.

Dr. Isabel Maria Ribeiro Ferin Cunha of the University of Coimbra spent a sabbatical at UT from February to June 2010, collaborating with RTF Professor Joe Straubhaar on the digital inclusion research project. *Dr. Domingos Ferreira (UNL)* is spending a yearlong sabbatical in Austin collaborating with advertising professor Matt Eastin. *Dr. Maria Fernanda Fernandes (U Minho)* came to Austin to work with College of Communications Dean Rod Hart at the Strauss Institute.

Joana Mirando (U.Porto) attended the School of Journalism's International Online Journalism Symposium April 2010. *João Grilo (UNL)* screened his documentary "O Tapete Voador" in the RTF Department in April, 2010 and also met with faculty on various program planning matters. Members of the FCT-funded digital inclusion research team came to Austin in May, 2010 to work with Professor Joe Straubhaar. The researchers included *Cristina Ponte (U.Porto)*, *José Acevedo (U.Porto)* and *José Alberto Simões (UNL)*. *Artur Alves (U.Porto)*, *Nuno Correia (UNL)*, *Fátima São Simão (U.Porto)*, visited the Austin campus in July 2010 to discuss ISDT10 and other administrative issues.

Gilberto Bernardes de Almeida (U.Porto) is spending the fall semester at UT Austin, 2010, working with Dr. Bruce Pennycook. Student *Edgar Texeira (UNL)* is spending most of the fall semester 2010 in Austin working on the Digital Inclusion research project with Dr. Joe Straubhaar. *Ana Bareto (doctoral student, UNL)* is spending fall 2010 in Austin studying digital media in several UT departments.



Exploratory Visits to Austin

UNL doctoral student *Mónica Mendes (UNL)* came to Austin on an exploratory visit in March, 2010, where she attended South By Southwest Interactive Festival and also met with numerous faculty and students. *Frederico Gustavo Pereira (U.Porto)* came to Austin in August, 2010 on an exploratory visit.

Nine digital media PhD students from UNL visited Austin September, 2010 to explore opportunities to study there in Spring 2011. Students met with faculty from a broad swath of programs at UT including the Department of Radio-TV-Film, the Department of Art and Art History, the Department of Advertising, the School of Information, the School of Education and the School of Journalism. Students also inquired into day-to-day facets of life in Austin, ranging from housing to Austin's iconic Barton Springs pool. Students have identified several UT faculty as potential advisors, including Luis Francisco Revilla, Bruce Pennycook, Joe Straubhaar, Paul Resta, Dan Olsen, Riley Triggs, and Tom Schatz, among others. Their research projects include subjects such as interactive and spatial narratives, mobile journalism, educational technologies, and generative music.



BUILDING CAPACITY

While all of our educational and research endeavors contribute to accelerating creativity and encouraging entrepreneurship in new media in Portugal, creating a climate that is receptive to and nurturing of these efforts requires something that stretches beyond the walls of the academy. We observe that a flourishing digital media culture and industry represents fast and easy exchanges between universities, businesses, artists, developers and public institutions. Sharing ideas, meeting other creative people, coming up with research ideas, and exploring new ventures are best accomplished in an environment with permeable membranes – places and circumstances that are receptive, experimental, playful, and unafraid to challenge conventional ideas. To this end, we endeavor to build Portugal's capacity for new media innovation through some novel and experimental venues.

Two major contributions to building a climate for creativity are our International School on Digital Transformation (ISDT) and the Future Places digital media festival. Both aim to create environments where people from around the world can share ideas, test their theories, and engage other like-minded individuals. Creating networks of collaborators, friends, mentors, and students serves to cement the country's role in the digital media world and to bring more social capital into the mix. Our goal has been to try to attract talented and motivated people from around the world to participate in both of these for a, and to put them together with some of the most talented students and faculty in Portugal. The most vibrant cybercultures around the world thrive on a blend of virtual and face-to-face meetings and contexts for exploring similar interests, and Portugal is becoming a site for precisely these sorts of encounters, with the help of ISDT and Future Places.

Summer School 2010: e-Science with Many-Core CPU/GPU—with NVIDIA and more

June 14-19, Braga. UMinho and UT Austin organized this year's CoLab Summer School. In addition to knowledge-sharing, the program provided hands-on experience in developing applications software for many-core processors with massively parallel computing resources, to provide participants the ability to:

- Understand algorithm styles that are suitable for accelerators.
- Understand the most important architectural performance considerations to developing applications.
- Be exposed to computational thinking skills for accelerating applications in science and engineering.
- Engage computing accelerators on science and engineering breakthroughs.

Participants developed applications software for many-core processors with massively-parallel computing resources. By the end of the event, participants gained an understanding of algorithm styles that are suitable for accelerators and the most important architectural performance considerations for developing applications. Instructors shared computational thinking skills for accelerating science and engineering applications. Participants learned how to engage computing accelerators on science and engineering breakthroughs. This event presented the first course in Europe provided by NVIDIA senior members, which in addition to David Kirk, included Michael Garland and Wen-mei W. Hwu of the University of Illinois at Urbana-Champaign.



David Kirk is an NVIDIA Fellow and served from 1997 to 2009 as NVIDIA's chief scientist, a role in which he led the development of graphics technology for today's most popular consumer entertainment platforms. Wen-mei W. Hwu is the Walter J. ("Jerry") Sanders III-Advanced Micro Devices Endowed Chair in Electrical and Computer Engineering in the Coordinated Science Laboratory of the University of Illinois at Urbana-Champaign. Michael Garland is currently a research scientist with NVIDIA Research and an adjunct professor in the Department of Computer Science at the University of Illinois, Urbana-Champaign.

The Summer School also had other experts in Graphics Computing as well as from other Scientific Computing areas, to present their views and experiences in using CUDA in the development of their libraries or scientific applications. As a follow-on of the Summer School, researchers from 14 Higher Education institutions in Portugal took an active role in creating the GPU Computing Portugal community, using as a communication forum the GPU computing.net website. A test bed facility with 4 Fermi devices and 40 CPU-cores was deployed at UMinho for the Portuguese community that came out of the Summer School.

Agenda: Summer School 2010, e-Science with Many-Core CPU/GPU Processors

Monday, June 14:

Beginner's Tutorial on Many-Core Processors, Multi-Core Processors, and C Programming, Michael Garland, NVIDIA

Introduction to Many-Core Processors, David Kirk, NVIDIA

Introduction to CUDA, Wen-mei Hwu, University of Illinois U-C

Tuesday, June 15:

CUDA Threading Model & CUDA Memory Model, David Kirk, NVIDIA

Algorithm Design for Many-Core GPUs, Michael Garland, NVIDIA

Hands-on lab classes (Problems, Qsub script, Makefile.mac)

Multiple GPU's in a MPI cluster, Wen-mei Hwu, University of Illinois U-C

Wednesday, June 16:

CUDA Performance Considerations, Wen-mei Hwu, University of Illinois U-C

CUDA and Higher-level Tools, Libraries and Software Resources, Michael Garland, NVIDIA

Teacher track (discussion on how to best use the textbook, resource sites, and labs)

Thursday, June 17:

Case Study 1: Dense Linear Algebra for Hybrid GPU-Multicore Systems, Marc Baboulin, Universidade de Coimbra

Case Study 2: The Power of Heterogeneous Computing in Future Generations of Computer Graphics Systems, David Kirk, NVIDIA

Case Study 3, Part I: Calculation of Electrostatic Potential Using Direct Summation - Steps of Performance Optimization, Wen-mei Hwu, University

Case Study 3, Part II: From Direct Summation to Cut-off Binning - Achieving Data Scalability in a Massively Parallel Computation, Wen-mei Hwu, University of Illinois U-C

Hands-on lab classes

New Fermi and CUDA 3.0 features, David Kirk, NVIDIA

Friday, June 18:

Case Study 4: Molecular Simulation Strategies for Next-Generation Streaming Architectures, Erik Lindahl, University of Stockholm

Project proposals: Short presentations about how attendees would CUDA-ize their applications, followed by discussion and suggestions)



International School on Digital Transformation (ISDT)

The International School on Digital Transformation was launched as part of the UT Austin-Portugal Program in July 2009 at U.Porto. The first ISDT session hosted 22 faculty presenters and 51 students, who applied from all over the world and represented 14 countries, including 17 students from Portugal. The second ISDT session took place in Porto in July 2010, drawing about 40 students and speakers from a variety of countries, including 16 from Portugal, to discuss social and political changes related to digital communication systems. It is an immersive, residential school that brings together students with academic and practitioner faculty to explore ideas on cutting edge technologies useful for civil society.

The purpose of ISDT has been two-fold. First, the program introduces students from Portugal and abroad to interesting ideas and projects that illustrate how digital technologies are transforming societies. Secondly, the School creates and fosters an international network of scholars, researchers, practitioners and innovators who are working with citizens all over the world to employ digital technologies in positive social change.

“For me, ISDT was about building community, envisioning possible bridges between fields and projects, and facilitating possibilities for opening global conversation about shared areas of interest.”

— ISDT Student

There were two inspirations for ISDT: the 43-year-old International School on Disarmament and Resolution of Conflicts, or ISODARCO, which is held every year in Italy; and the world’s largest digital media conference, held in Austin, South-By-Southwest Interactive. ISDT is an attempt to combine the residential experience of ISODARCO with some of the subject matter of SXSW Interactive, and to bring together advanced students in digital media with experienced scholars and practitioners for a week of interaction. Porto has turned out to be an ideal location for the school, because it is attractive to people to visit, it is walkable and safe, and there are researchers and practitioners in Porto who are doing valuable work that can be shared with others at the school.

ISDT builds on a common model of collaboration between researchers, scholars and social entrepreneurs in the nonprofit sector. It is the “permeability” of these different roles that leads to innovation and creativity in digital media, as well as some important social phenomena. ISDT is a place to explore this process with its best practitioners and with young leaders.

ISDT is also a method, so to speak. Everyone who attends is regarded as a peer, to encourage productive conversations, instead of as speakers and audience. Free time is built into the schedule to encourage informal and spontaneous conversations, workshops, discussion groups, etc. Everyone shares breakfasts and dinners, again, in order to promote conversations and idea-sharing. And ISDT is meant to be fun, too—a memorable experience—one that will make it stand out from conventional academic meetings. The combination of innovation, inspiration, interactivity and fun is what makes ISDT unique. A survey of 2010 student participants confirms this: Over 90% of respondents agreed that the program expanded their professional networks and 80% agreed that ISDT provided them with an experience they would be unable to find elsewhere. Sixty percent reported that as a result of ISDT, they are working with new collaborators.



ISDT's value to Portugal is to help create a core group of young leaders who are part of an international network of innovation and inspiration. Experience shows that these are the elements of creativity and progress in digital technologies. ISDT helps "put Portugal on the map" in the minds of international leaders in digital transformation. It is a way for Portuguese innovators to share their own work with people from around the world. The core constituencies of ISDT are changing the world with new ideas such as Open Source, free culture, transparency, crowd-sourcing, civic engagement, community informatics, and a host of other, related concepts in digital media. It is to Portugal's benefit that these ideas become embedded in the way young Portuguese leaders think and how they create new things. These ideas are the "drivers" in creative centers like Austin, Texas, Brazil, Barcelona, Silicon Valley and elsewhere.

The School's topics include:

- Democratic transformations of society through digital media
- Innovations in transparency and political participation using new online tools
- Grassroots civic activities using digital technologies
- Prospects for digital communication in developing regions
- Economically and politically galvanizing historically underserved areas
- Developing "open cities" and municipal participation through technological interventions

ISDT is a place to explore these emerging issues with top practitioners and young, upcoming leaders; the program emphasizes concrete, real-world examples and stimulating, productive discussions. At the 2009 ISDT session, presentations about copyright, open licenses, and digital media helped catalyze conversations among students about "free culture" in Portugal. In 2010, participants learned about Ushahidi, an Open Source mapping and crowd-sourcing tool that has been invaluable in the effort to rebuild Haiti after its tragic

earthquake. Another example described in the 2010 ISDT session was Cape Town's R Labs, or Reconstructed Living Labs, which has developed software to help very low-income residents of Cape Town, especially those with mental health and substance abuse problems. The personal exchange allowed by a weeklong residential program of a relatively small group of people allows extensive interaction and has led to the development of friendships and collaborations. ISDT has been a solid success with its participants, and it's a program that is a valuable and vital element of the UT Austin-Portugal Project.

ISDT 2010 Faculty

- Ademar Aguiar (INESC Porto)
- Fiorella de Cindio (University of Milan Department of Informatics and Communication, Italy)
- Eric Gundersen (Development Seed, US)
- Michael Gurstein (Centre for Community Informatics Research, Development and Training, Canada)
- Ming-Chun Lee (UT Austin School of Architecture)
- Pedro Markun (Jornal de Debates, Brazil)
- Tanya Notley (Tactical Technology Collective, UK)
- Marlon Parker (Cape Peninsula University of Technology, South Africa)
- Leslie Regan Shade (Concordia University, Canada)
- Daniela Silva (Esfera, Brazil)
- Laura Stein (UT Austin, College of Communications)
- Karin Wilkins (UT Austin, College of Communications)
- Gary Chapman (UT Austin, LBJ School of Public Affairs)



Future Places Festival

October 12–16, 2010. In its third year, the 2010 Future Places in Porto festival hosted speakers from around the world, local community activist groups, researchers, and several outstanding artists. Through presentations, performances, screenings, and exhibitions, the festival celebrated digital media's potential to strengthen local cultures.

The festival offered four workshops on October 12 and 13. These included a seminar in programming for Android phones, sponsored and conducted by Portuguese telecommunications company SAPO; a two-day workshop on community building and digital technologies, led by cultural and technological activist group MediaLab Prado of Spain, in collaboration with musicians Blaine Reininger and Anselmo Canha; a course on community and digital radio led by RadioFutura, which also provided 24 hour coverage of the festival; and a course on creating video narratives with mobile devices, conducted by Professors Valentina Nisi and Ian Oakley of the University of Madeira.

The festival officially opened with a party at the popular Porto club Passos Manuel, and featured a concert by recording artists Jana Winderen of Norway and Mike Harding, head of UK-based media label Touch. Bruce Pennycook of the University of Texas' Butler School of Music and the Department of Radio-TV-Film gave the first keynote speech the following day at the festival's primary venue, prominent Porto cultural space Maus Hábitos. Pennycook's address described how the diffusion of digital technologies has affected the processes of music composition and performance, in some ways changing what it means to be a musician. This opening keynote talk was followed by presentations on different aspects of digital media and community, and a formal opening of the invited artists exhibits.



Over 100 digital media artists from 23 countries submitted proposals to Future Places. This is a considerable rise from previous years and provides evidence of the festival's increasing visibility in the global arts community. A review committee of 18 established artists and scholars examined the proposals in 3 person panels, ultimately selecting 8 top projects. The creators of these projects were invited to exhibit at Future Places and were awarded up to \$2000 USD in travel expenses. The outstanding pieces chosen in this highly competitive review process included projects produced by artists from around the world. They included exhibits of:

- *Voicings*, by UK artist Laura Malacart, a project that explores the experience of working class immigrants, language, and self-presentation.
- *Sounds Like Graffiti*, represented by UK artist Shabina Aslam and Finnish artist Matti Pohjonen, an international project that facilitates the creation of digital media narratives by underserved youth in the economically depressed UK community of Bradford.
- *HiperBarrio-Colombia*, represented by Diego Gomez of Colombia and Finnish scholar Alvaro Ospina Ramirez, a library-based outreach program in Medellín which encourages community building through digital media creation.
- *Molecular City*, by Roberto Bottazzi, Tobias Klein, and Tasos Varoudis of London, an interactive installation that projected augmented reality upon representations of existing Porto architecture, allowing users to contribute to a new, hybrid version of the city.
- *Serendipicity*, by Paris-based artist Pedro Fernandes, a mobile application designed for travelers that draws upon publicly available geolocalized photos and enables users to experience places through others' eyes.
- *Feedback Fred* by Benoît Maubry of Berlin, a performance of a tortured man unable to form relationships due to his constant, inadvertent generation of deafeningly loud feedback.



Two of the eight selected artists were members of the UT Austin-Portugal program:

- *Steven Parker*, a trombonist and experimental musician at UT Austin, performed selections from “The Language and Sound Project,” an innovative exploration of global identity and self-expression through recorded vocalizations and video representations, accompanied by Parker’s live trombone performance.
- *Yago de Quay* of U. Porto, who produced “Espanta Espíritos,” an audio sculpture that greeted attendees at the entrance of Maus Hábitos, producing melodic echoes through giant wind chimes. Many festival participants also took advantage of the installation’s interactive capacity, using a microphone to capture and create a unique soundscape.

The following days of the festival featured two additional keynote speeches, a gala dinner held at the Coliseu do Porto, presentations of workshop outcomes, and a variety of interactive activities and performances. Siva Vaidhyanathan of the University of Virginia, a renowned scholar of intellectual property issues, spoke on communication technologies and expressions of local culture. Closing keynote speaker Blaine Reininger, founding member of notable experimental music group Tuxedomoon, spoke on the use of random systems and digital technologies in musical composition.

The festival was widely covered, appearing, often multiple times, in these publications and media outlets:

- Rádio e Televisão de Portugal (RTP1 and RTPN)
- Portugal Canal
- SICN
- Público
- Jornal de Notícias
- Diário de Notícias
- Grande Porto
- TimeOut Porto
- Antena 1
- Rádio Nova

“I am already collaborating with Radio Zero on independent productions that will air on KUT (the Austin Public Broadcasting radio station). I am also excited about collaborating with other researchers I met at the festival on projects both professionally and academically.”

-- Rebecca McInroy, KUT programmer

This coverage strengthened awareness of Porto as a center of digital media creativity. The festival also facilitated connections among media professionals and artists from around the world, laying the groundwork for sustained creative relationships. For example, members of Lisbon-based station Rádio Zero made plans for future collaborations with Austin’s public station, KUT, which is based at the University of Texas at Austin and is an affiliate of US National Public Radio. In these ways, Future Places contributed to the mission of capacity building on a local, national, and international level.

Festival Attendance

All festival attendees were asked to register, although this was voluntary. Of 178 registered attendees, 14 countries were represented, including Brazil, Spain, Mexico, Greece and Finland, as well as Portugal, demonstrating the festival’s international scope. Chart 1 shows the composition of the registrants by nation, consolidating the attendees from other European and non-European countries.

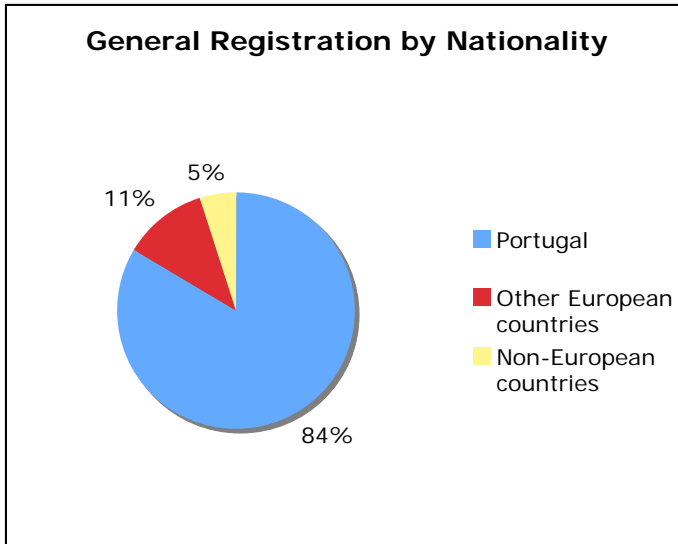


Chart 1: Attendance by nationality

Chart 2 shows the division of registered attendees by institutional category. While the majority of festival attendees came from different faculties within the University of Porto, members of private companies, non-profit organizations, and other institutions of higher education within Portugal and beyond joined them.

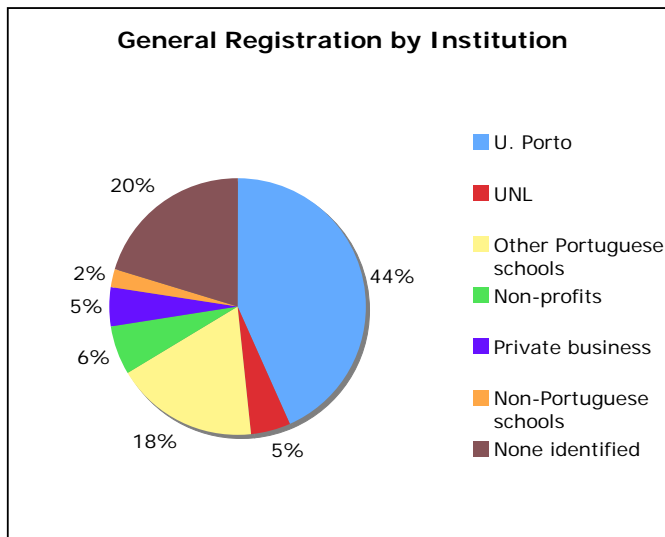


Chart 2: Attendance by institution

These numbers and charts do not include festival speakers, performers, and invited artists, who came from a variety of countries such as the United Kingdom, the United States, Norway, and Colombia, among others.

2010 Future Places Workshops

Uncovering Urban Stories: the Story in the Mirror

The Urban Stories workshop targeted filmmakers: professionals, semi-professionals and students. It explored the structure and the interactions afforded by the emerging medium of location-aware mobile devices. These are systems capable of selectively presenting media to an audience who is out and about, engaged and interacting with a dynamic urban environment. The distinguishing quality of this media format is its powerful ability to deliver narrative experiences that merge with an audience's physical context – the environment immediately surrounding them. However, it is also experienced on small screens and viewed in conditions with varying light and sound pollution. Furthermore, structuring narratives into fragmented segments distributed spatially and temporally presents new challenges to conventional storytelling practices. This workshop explored the balance among these constraints. Its participants were guided through the process of producing as well designing interactions for mobile, spatially distributed narratives. Working in pairs they were given a loose fictional narrative plotted around the barber shops of the city of Porto. The processes of producing the story in multimedia format and design the interactions around the specific story experience, were tailored to suit presentation on mobile devices. The workshop culminated with a walking tour and public exhibition showing the stories in context.

“The Stories in the Mirror workshop at Future Places 2010 covered the design of interactive, location-aware mobile video narratives. We had informative discussion, generated compelling concepts, and learnt at least as much as we taught.”

--- Ian Oakley, Future Places workshop instructor, U Madeira

Mobile, Digital, Cooperative: Radiate Yourself

This workshop provided instruction on how to stream through the web from mobile locations and learn to use this new knowledge to engage in the practice of collaborative, disperse radio. Bertoldt Brecht asked for a Radio that could work as a listening and sending device but things worked out differently. Regulatory needs under political and military motivations rendered Radio a broadcast medium where passive listening is the rule and access restricted. Enter the digital platforms, with open rules of access/content and Brecht ideas can come to fruition. Listening and broadcasting can be done in the same apparatus, the computer. And the computer is the gateway and tool to re-think radio and expand its possibilities. This workshop addressed the two questions that remain: “How to do it in practice” and then, “What to do with it.” *Tutors: Radio Zero – Ricardo Reis, Paulo Raposo, Udo Noll, Filipe Roque, Gil Brandão.*

Collaboratory: Neighborhood Science

Recently, entire communities have been springing up for distributed experiments, production of knowledge, and exchanging ideas and information amongst amateurs, professionals, and academics in many disciplines. In recent years, CCSTOP, a bankrupt shopping mall in Porto, has largely become a network of musicians who have rented the former shops and turned them into rehearsal rooms. But in reality, CCSTOP is also the space of other activities: a handful of shop owners remain, technicians, a few bars, a danceteria, video makers, a seamstress, a beautician. This workshop employed two days of experimentation in cross-breeding expertise among the inhabitants of CCSTOP, and

provided opportunity to cross heavy metal and jazz, electronica and dub, and to also consider the rhythmic work patterns of the seamstress as music, the beautician as a provider of innovative styles for musicians, the antique shop as a space for music memorabilia, far beyond the dead end of a Hard Rock Café. *Tutors: MediaLab Prado, Blaine L. Reininger, Anselmo Canha.*

Android Symphony: Development of Android application, introducing basic Android concepts.

This hands-on workshop enabled participants to develop a musical application with the help of trainers. Instead of percussion or stringed instruments, each Android device participated, in line with the others, as an element of an orchestra. Android's libraries were used to communicate between the devices and a remote server; user interface employed the native Android layouts and also WebViews to demonstrate the possibility of mixing native code with Web technologies (HTML / CSS / Javascript). *Tutors: Sapo Labs.*

Other Events, Talks, Workshops

Imaging, Modeling & Visualization in Multiscale Biology, 2010

This workshop presented topics from both mathematical and engineering perspectives on interdisciplinary topics, to address research problems related to medical imaging, biomechanics, biology, and bioengineering.

Explore Creativity in Digital Space

April 29, 2010, Austin. The Texas Advanced Computing Center (TACC) Visualization Laboratory boasts the world's highest resolution tiled display wall, as well as high-definition video and multiple large-scale graphics displays. In conjunction with the UT Department of Art & Art History and the Austin Museum of Digital Art (AMODA) the TACC VisLab presented an evening of photography and video works by Austin artists including: Lawrence McFarland, Trey Ratcliff, Robert Melton, Ricardo Meleschi, and Morgan Gaither. Participants were able to meet and interact with the artists as their work was viewed.

Verónica Costa Orvalho Speaks on Advances in Facial Animation

August 2010, Austin. Dr. Verónica Costa Orvalho, Assistant Professor of computer science at the University of Porto, as well as founder of the Porto Interactive Center (PINC) and Face in Motion, presented "Facial Animation, Fast and Easy" at UT Austin's Department of Electrical and Computer Engineering on August 10. Dr. Orvalho's software, Fimmie, makes the process of animating facial expressions up to 99 percent faster than animation by traditional methods. Through a series of mathematical algorithms, she "created a program that bridges the gap between modeling and animation," she said. Fimmie allows artists to create several characters from one rig. Animation for one character can be automatically applied to animation for other characters that use the same rig.



Network of Creative Cities

At the CoLab Research Conference in Lisbon, September 2010, the program offered a parallel track that emphasized the importance of place in developing creative cultures and industries. As a city known for its cultivation of the film, music, and video-game industries, Austin provides a useful model for how cities around the world can nurture creative businesses and professionals. Representatives from Austin discussed how local policy has led to global leadership in a range of fields. CoLab director David Gibson presented sociological analysis of how Austin became a leader in computer hardware and software, while director Sharon Strover provided insight into entertainment fields including film, electronic gaming, and music. The representatives from Austin were joined by local digital-media director Antonia Camara to provide a view from the Portuguese academy. Finally representatives from the city governments of Lisbon, Cascais, Óbidos, Pardedes, Montemor-o-Velho, and Guimarães came to discuss how their cities foster a creative climate.

Involvement in external events

SXSW Interactive, Film, & Music Festivals

- Heitor Alvelos, João Cruz, and Anselmo Canha (U.Porto) performed at the Austin Museum of Digital Art music showcase.
- Mónica Mendes, a PhD student at UNL attended SXSWi where she explored the opportunities in digital media Austin has to offer. She also met with faculty for potential research advising.

Futurália

CoLab has been represented by an information booth at this high profile student event since 2008.

2nd Int'l Conference on Games & Virtual Worlds for Serious Applications (VS-GAMES 2010)

March 25, 26, 2010, Braga. The International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2010) is the primary conference dedicated to serious games and virtual worlds presenting state of the art methods and technologies in the multidisciplinary fields outlined above. The use of virtual worlds and games for serious applications has emerged as a dominating force in training, education and simulation due to the focus on creating compelling interactive environments at reduced costs by adopting commodity technologies commonly associated



with the entertainment Industries. This field is informed by theories, methods, applications and the state-of-the-art in a number of areas based on technological principles and innovation, advances in games design, pedagogic methodologies and the convergence of these fields. While the serious games community has made it possible to bring together such diverse fields, further academic and industrial collaboration is needed in further defining, formalizing and applying the standards and methodologies for the future. Keynote speakers included:

- Prof. Sara de Freitas, Serious Games Institute, Coventry, UK (<http://www.seriousgamesinstitute.co.uk/>)
- Prof. Kathleen Tyner, Assistant Professor, Department of Radio-Television-Film, The University of Texas at Austin, (<http://rtf.utexas.edu/faculty/kytyner.html>)

Gear Up: Sound and Interactive Media 2010

Bruce Pennycook and Jade Walker (UT Austin Digital Media), Heitor Alvelos (Univ. Porto), and Carlos Guedes (Polytechnic Institute of Porto) presented talks at this conference on practice-based research in art and design at the University of Beira Interior from April 7 to 12, 2010.

CloudViews cloud computing conference

April 20-21, 2010, Porto. CoLab joined in support of the CloudViews 2010 conference as it convened IT professionals, researchers, and service providers in the cloud computing field. Organized by EuroCloud Portugal, CloudViews 2010 was the second annual edition of the conference purposed to help cloud computing achieve its main goal—to transform IT platforms in elastic, highly available, fault tolerant, secure, and multi-tenant platforms, and to increase Portugal’s capacity to build a true Computing ecosystem in the Cloud: encryption mechanisms, predictability and provision platforms, SLAs monitoring and agreements contracts, AAI, elastic networks, interoperability frameworks, schedule mechanisms, etc.

IBERGRID: 4th Iberian Grid Infrastructure Conference

May 24-28, 2010, Braga. “Bridging the gap between European e-Science and Iberian America.” CoLab also provided support to IBERGRID’2010, the fourth Iberian Grid



Infrastructure Conferences, initiated within the framework of the bilateral agreement for science and technology signed between Portugal and Spain. The aim of IBERGRID’2010 was to leverage the construction of a common Iberian Grid Infrastructure and to foster cooperation in the fields of grid computing and supercomputing. Alberto Proença, served as Conference Chair; and a hands-on session was presented by Paul Navrátil, on the world’s largest GPU cluster for data analysis and

scientific visualization, the Longhorn cluster.

The Portuguese Minister of Science, Technology and Higher Education, José Mariano Gago, opened the event, together with the representative of the Spanish Ministry of Science and Innovation (José Manuel de Labastida), the Scientific Coordinators of the e-Science programs in Portugal (Luís Magalhães) and Spain (Vicente Hernandez), the Director of the Emerging Technologies and Infrastructures, DG-INFSO/F, at the European Commission (Mário Campolargo), and the Rector of University of Minho (António Cunha). The Conference Chair during his intervention challenged this political panel to be more active at IBERGRID by funding concrete actions in a fashion similar to the ones already running on CoLab: on researcher mobility and on joint projects.

U.Frame International Video Festival

UT Austin has joined U.Porto and the Universidade da Coruña to produce this film festival during the last three years. This juried festival includes Master Class lectures from UT Austin faculty (Professor Andrew Shea in 2008 and Professor Stuart Kelban in 2010). To date, two of the main prizes have been awarded to UT Austin students participating through the Digital Media Program.



In 2010, UT Austin sent two RTF students to the festival to present their work. Angela Chen was a finalist in the fiction competition with her film “By Jude,” a domestic drama that includes the perspective of a boy with a camera. An RTF MFA student Angela Torres, also attended the festival and screened her pre-thesis film, “Frente Noreste (Northeast Front),” which portrays a true story about drug violence in Mexico. Students from U.Porto also presented work at the festival, including Guilherme dos Santos Junior and João José da Costa Batista Pereira.

Professor Stuart Kelban served as a judge for the festival in 2010 and conducted a master class in Writing for the Short Film to 50 students. Kelban commented that this class addressed some of the weaknesses in the movies he screened: “They need more focus on storytelling and characters. It all begins with the script, and the sooner you recognize that the better off you are.”

International Online Journalism Congress

Rosental Alves (UT Austin Digital Media) addressed the ways the digital revolution is removing barriers in journalism, especially in the way the role of the journalist has become

an open public forum. A special day is allocated to the Ibero-American forum for Spanish- and Portuguese-speaking journalists from around the world.

Nomadic 0910 in Porto

September 2009, Porto. Stories of Art and Science is an international conference exploring the relationships between art and science, their intersections, and contrasts. Focused on the comprehensive understanding of these questions and on the narrative of specific collaboration episodes, the conference aims to bring people from the visual and performing arts, the natural sciences and the humanities together around the proposed event aims of exploring the dynamics of knowledge production and, more specifically, to sort out the ways art and science foster each other's development, their open and hidden connections.

The UT Austin | Portugal Program was represented by Maria Esteva, a Research Associate/Data Archivist in the Visualization and Data Analysis group, of the Texas Advanced Computing Center (TACC), University of Texas at Austin, USA, who provided a lecture on "Endless possibilities: digital collections as crossroads between the Humanities and the Sciences." This theme is related to her professional activity, since her research interests focus on digital archives and preservation, being involved in developing scientific data collections, implementing digital archiving and preservation strategies for scientific datasets, and the use of information visualization as a tool for archival processing.

MEASURING IMPACT

One of the primary goals of the International School on Digital Transformation is catalyzing international networks of researchers and practitioners. It is the hope of the organizers that participants will form lasting relationships that can lead to collaborations and professional support. With this in mind, a research team that included Professors Sharon Strover and Artur Alves, research associate Derek Lackaff, and research assistant Chris McConnell undertook a study to see what kinds of social ties emerged from ISDT 2009.

This research, which was presented at the International Association for Media and Communication Research conference in Braga, used a survey to analyze the social connections that were created and maintained at the 2009 school. Nine months after the school, the team administered a survey to each of the participants, asking them to identify which of their fellow participants they met and maintained contact. The survey also asked them to identify which ways they maintained their relationship, whether it was through internet media such as email and social-networking services or conventional means such as the telephone and face-to-face contact. The results of the research suggested ISDT 2009 succeeded in fostering lasting connections between participants. Out of 77 total participants, 51 responded to the survey, and each of them indicated they had developed some kind of connection as a result of the program.

We present in summary form below three sociograms that capture the contrast between the networks that existed before the residential school and those afterward. The first sociogram illustrates the social connections among participants before ISDT 2009, and the other two illustrate connections post-ISDT. Students are represented as circles, presenters are represented as squares, and organizers are shown as diamonds. Each line represents a social connection and the arrow indicates a participant that was identified by another participant.

The pre-ISDT figure illustrates that some participants did indeed know each other, but there were few “strong” connections, as represented by the edge width and opacity in the diagram. (Respondents are represented in black and nonrespondents in grey.)

The two post-ISDT figures show many more connections among the attendees, the accomplishment of the School. In the first, we separate out only the incidence of “active” communication (as opposed to connections maintained by more passive means such as Facebook and twitter updates – which also illustrate intensive connections). By phoning, directly emailing, talking, and so forth, the ISDT participants had grown their networks in what are probably meaningful ways since they are taking the time to actively reach out to each other. The third sociogram focuses only on research collaborations, since this is one core goal of ISDT. There we can see clearly that many research collaborations were initiated, more planned, and that there are other non-research activities also in progress (such as working with non-profits, etc.). A total of 112 research relationships were identified among 49 ISDT participants, with 35 of these relationships supporting current and active research projects. A further 74 relationships supported other types of active projects. The research activities span all of the participants in ISDT, suggesting that the experience successfully cultivated research agendas among students as well as enhanced research ideas among faculty.

Figure 1. Pre-ISDT relationships, with relationship quantity outlier edges hidden.

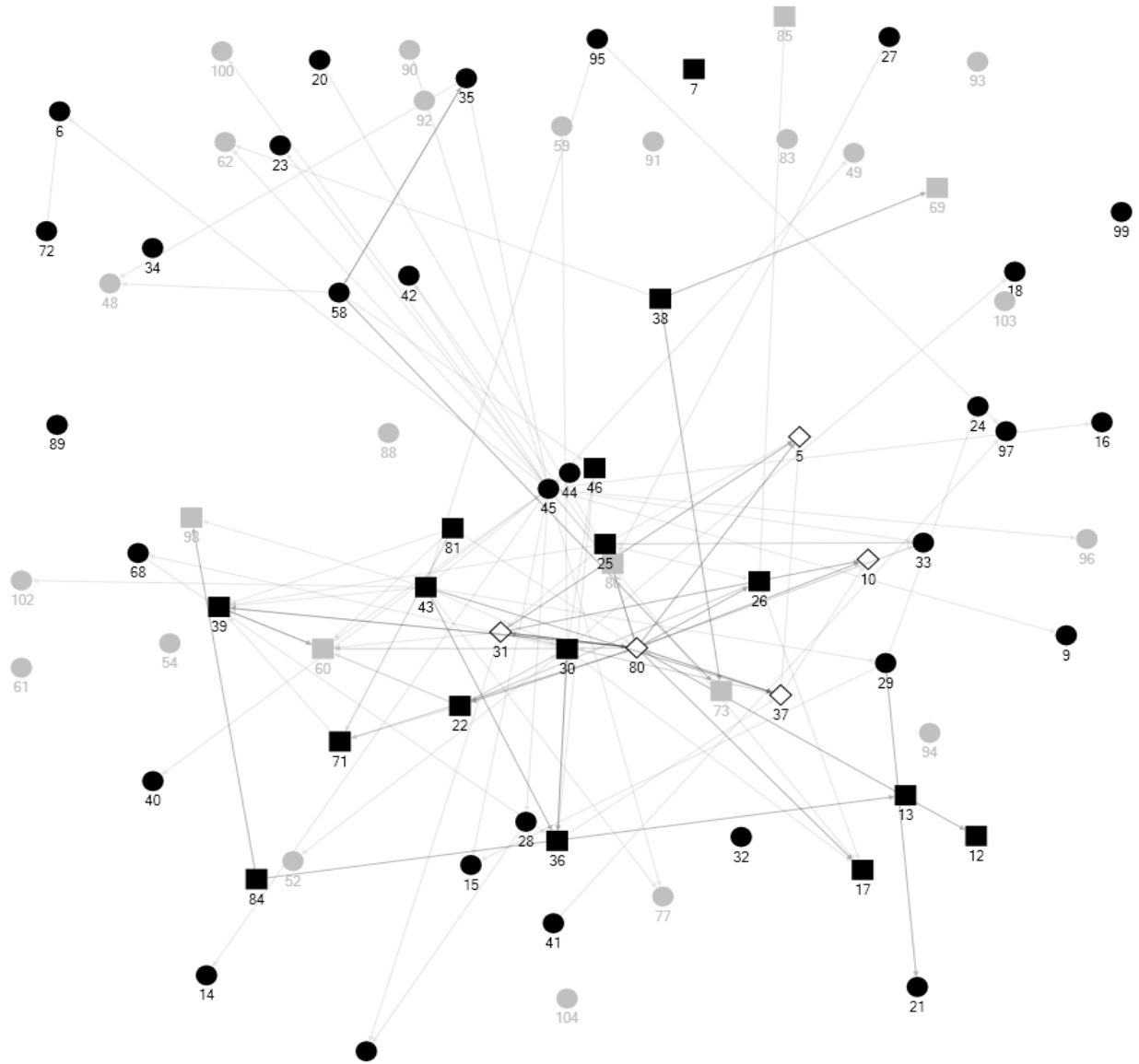


Figure 2. Post-ISDT relationships, active awareness (phoning, talking, etc.)

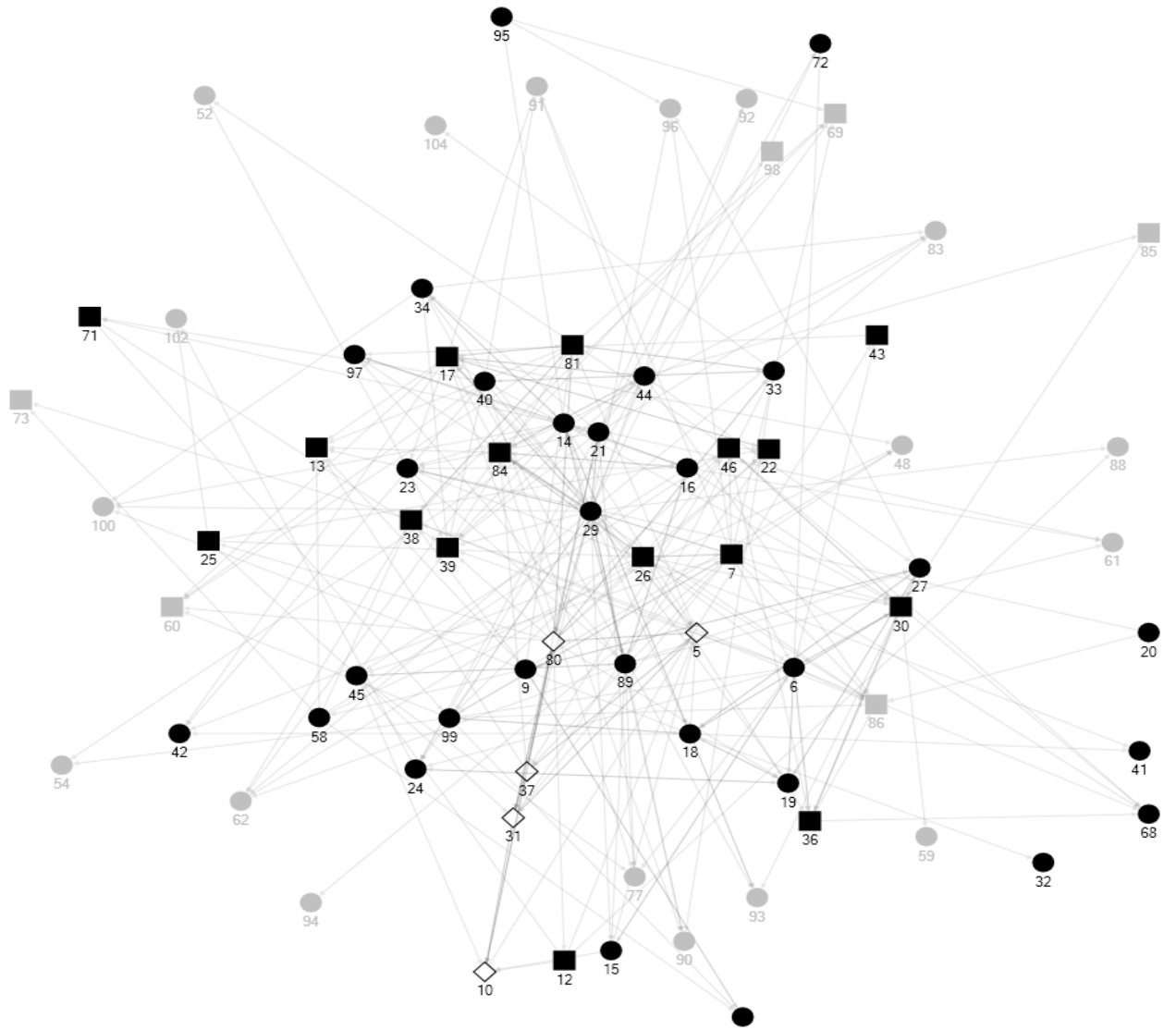
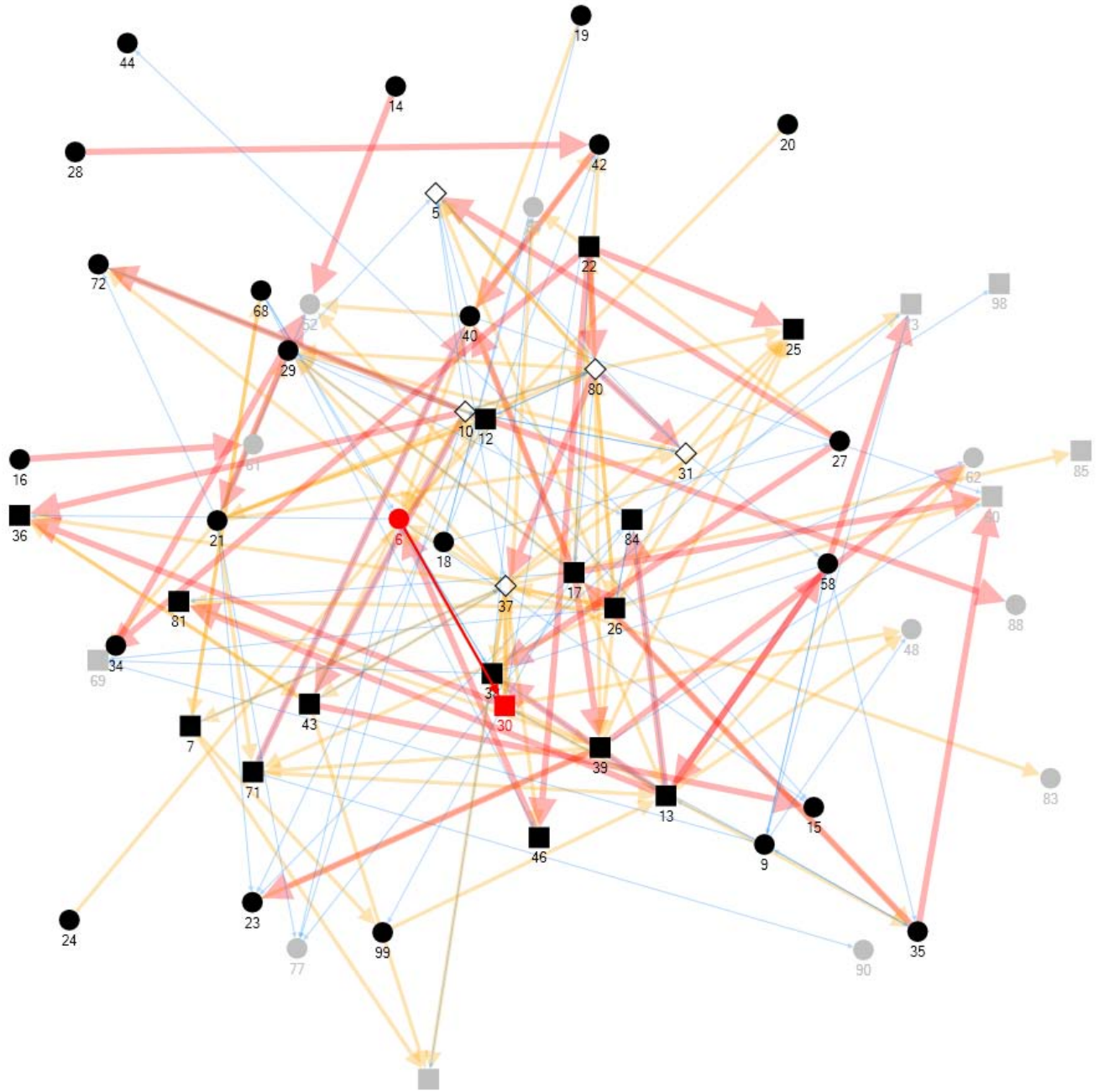


Figure 3. Research contacts (active projects in pink, planned projects in yellow, "other" in blue)



CoLab Personnel

Artur Pimenta Alves, Co-Director, Digital Media Portugal

Professor Catedrático, Faculty of Engineering, Department of Electrical and Computer Engineering, Telecommunications Section, U.Porto; researcher, Institute for Systems and Computer Engineering of Porto (INESC Porto)

Jay Boisseau, Co-Director, Advanced Computing Austin

UT Austin Director, Texas Advanced Computing Center (TACC)

António Câmara, Director, Digital Media Portugal

Professor of Environmental Systems Analysis at Faculdade de Ciências e Tecnologia; Founder of Ydreams

Conceição Capelo

Administrative and Academic Management, Portugal

Nuno Correia, Co-Director, Digital Media Portugal

Professor, Dept. of Computer Science and coordinator of the Interactive Multimedia Group at FCT/UTL

João Mário Grilo, Co-Director, Digital Media Portugal

Professor, Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, FCSH/UNL

Karen Gustafson, Program Manager, Digital Media, Austin

Research Associate, Telecommunications and Information Policy Institute

Pedro Medeiros, Co-Director, Advanced Computing Portugal

FCT/UNL Associate Professor of Informatics

Keshav Pingali, Director, Advanced Computing Austin

UT Austin, Professor of Computer Sciences

Alberto José Proença, Director, Advanced Computing Portugal

U. Minho, Professor of Computer Science

Luís Silva, Co-Director, Advanced Computing

U.Coimbra, Associate Professor of Informatics Engineering

Sharon Stover, Director, Digital Media Austin

Professor Department of Radio-Television-Film; director, Telecommunications and Information Policy Institute (TIPI)

Staff: Chris McConnell, Jonathan Daniels, UT Austin; Pedro Madeira, Carolina Enes, Lisbon

University & Laboratory Partners

New University of Lisbon

Faculty of Science and Technology (FCT/UNL)
Faculty of Social Sciences and Humanities (FCSH/UNL)
School of Economics

University of Porto

Faculty of Engineering (FEUP)
Faculty of Fine Arts (FBAUP)
Faculty of Humanities (FLUP)
Faculty of Economics (FEP)
INESC Porto

New University of Lisbon (UNL)

Dept. of Informatics, Faculdade de Ciências e Tecnologia (DI-FCT-UNL)

University of Coimbra (UCoimbra)

Dept. of Informatics Engineering (DEI)
Software and Systems Engineering (SSE)
Centre for Computational Physics (CFC-UC)

University of Minho (UMinho)

Dept. of Informatics (DIUM)

Laboratory for Particle Physics Lisbon (LIP)

The University of Texas at Austin

College of Communication

- Radio, Television and Film (RTF)
- School of Journalism
- Communication Studies
- Advertising & Public Relations

College of Fine Arts

Lyndon Baines Johnson School of Public Affairs

School of Information

Dept. of Computer Sciences (CS)

Dept. of Electric and Computer Engineering (ECE)

Institute for Computational Engineering & Sciences (ICES)

Texas Advanced Computing Center (TACC)

Industrial Affiliates

Nearly every facet of the UT Austin|Portugal program interfaces with industry in some way. From the internship program to the research calls, the program collaborates with industrial partners. In addition, the Advanced Digital Media Program has sponsored activities that interface with industry in more direct ways. Some, like the seminars on search and retrieval, engage industry professionals by sharing best practices, while others bring Portuguese professionals to Austin to interact and network with peers on the other side of the Atlantic. These direct-engagement activities complement the overall raft of digital media programs by

solidifying the academic-industrial connection. Below are some of the partners in the Industrial Affiliates Program, which invites businesses to partner with the CoLab initiative to ensure that future education meets the needs of industry.

- Brandia Central, www.centraldecomunicacao.pt
- Bycom, www.bycom.com.pt
- Casa da Música, www.casadamusica.com
- Critical Software, www.criticalsoftware.com
- Duvideo, www.duvideo.pt
- Fundação de Serralves, www.serralves.pt
- Innovagency, www.innovagency.com
- Inteli, www.inteli.pt
- Media Capital Editora Multimédia, www.mediacapital.pt
- Porto Editora, www.portoeditora.pt
- Público, www.publico.pt
- YDreams, www.ydreams.com

2. MATHEMATICS

STRATEGY

As the UT Austin | Portugal CoLab program completes its fourth year, the Mathematics group has a strong sense of achievement and confidence for the final phases of the program. Education and research initiatives such as the yearly workshops in Austin, summer schools and workshops in Portugal, research training groups for undergraduates, the PhD and post-doctoral programs, as well as the exchange faculty program have been extremely successful. The four funded research projects are highly collaborative, involving over 80 researchers.

This academic year, several Portuguese faculty spent extended periods at The University of Texas at Austin. In September 2009, *Agnieszka Malinowska* and *Delfim Torres*, U.Aveiro, visited Austin and laid the groundwork for a research project with UT's *Cristina Caputo*. *Daniel Abreu*, UCoimbra, worked closely with *John Gilbert* at the Mathematics Department of UT; and *Professor Isabel Figueiredo*, UCoimbra, spent several months in residence at UT. *Antonio Salgueiro*, U.Coimbra, visited Professor John Luecke from August 13 to 24, 2010 to begin collaboration in the area of geometric topology. Some of the post-docs, *Stefania Patrizi* and *Maria Teresa Perez*, are now at UT Department of Mathematics where they are in residence for the fall semester. Maria Teresa Perez was in Portugal last semester and Stefania Patrizi will be in Lisbon during the spring semester. Further, the final research call will bring funding to new projects to that we believe are critical to establishing long term research collaborations with UT.

A third annual workshop, *Classical and Random Dynamics in Mathematical Physics*, was held which brought together several Portuguese researchers with UT Austin faculty. Also in Coimbra, the third Summer School and Workshop focused on *Imaging Sciences and Medical Applications*, expanding on interdisciplinary topics handled from both a mathematical and an engineering applications point of view. In addition to mathematicians and engineers, the target audience included graduate and PhD students with a research interest in problems related to Mathematics, Medical Imaging, Biomechanics, Biology, and Bioengineering. In addition, in collaboration with the Carnegie Mellon | Portugal program, the second Postdoctoral Academy in Mathematics was held September 23-24, 2010 at the Universidade Nova de Lisboa. Events scheduled, but still pending include *Optimization in Machine Learning* to be held at the University of Texas at Austin, May 31 to June 7, 2011, the *Aubry Mather Theory and Optimal Transport Summer School*, June 13-17, 2011, and the *Nonlinear PDEs* conference, June 20-24, 2011.

Diogo Gomes, Luís Caffarelli



RESEARCH

'09 Project: Applied mathematics from dynamical systems to cryptography

Principal Investigator

1. Diogo Gomes, IST/UTL

Research Team

2. A. Malinowska
3. Amílcar dos Santos Costa Sernadas
4. Carlos Alberto Varelas da Rocha
5. Carlos Manuel Costa Lourenço Caleiro
6. Cláudia Rita Ribeiro Coelho Nunes Philippart
7. Delfim Fernando Marado Torres
8. Diego Marcon Farias, Graduate researcher, PhD candidate
9. Farid Borzognia, Post-doctoral researcher
10. Filippo Cagnetti, Post-doctoral researcher
11. Gabriele Terrone Bolseiro, Graduate researcher, PhD candidate
12. Irene Gamba, Faculty Researcher
13. João Carlos Martinho Lopes Dias
14. Jose Felipe Voloch, Faculty Researcher
15. Levon Nurbekian, Graduate researcher, PhD candidate
16. Luis Caffarelli, The University of Texas at Austin
17. Maria Teresa Perez Perez, Post-doctoral researcher
18. Milena Chermisi, Post-doctoral researcher
19. Paulo Alexandre Carreira Mateus
20. Rafael de la Llave, Faculty Researcher
21. Raquel Maria Medeiros Gaspar
22. Sérgio Pequito, Graduate Researcher, PhD candidate
23. Stefania Patrizi, Post-doctoral researcher
24. Thaleia Zariphopoulou, Faculty Researcher
25. Verónica Rita Bolseiro, Graduate researcher, PhD candidate
26. William Beckner, Faculty Researcher

The Project

Researchers from several disciplines are joining efforts in applied mathematics including dynamical systems, financial mathematics, game theory, optimal control, viscosity solutions, number theory, and cryptography. In dynamical systems the main focus research areas are Aubry-Mather theory, renormalization and attractors of semilinear parabolic equations. In financial mathematics focus is being placed on developing forward price models, interest rate models and stochastic volatility models, and first passage times in diffusion processes. Game theory oligopoly models are being considered to investigate the following issues: uncertainty, signaling, dynamic price discrimination (linear prices and non linear pricing), research and development programs, location decisions, advertising strategies and their effects, trade policy models and competitive strategies in spatial networks, as well as mean-field games and its applications. Optimal control theory and viscosity solutions of Hamilton-Jacobi equations are essential to understand important problems in dynamical systems

(Aubry-Mather theory) and in mathematical finance. These directions are being pursued, as well as certain problems in multiple criteria decision-making. Finally, in the emerging applied area of cryptography, the group is examining post-quantum cryptography in order to propose cryptosystems based on rational points on curves over function fields and show that they are robust to quantum adversaries.

Research Metrics

To help initiate this joint research, D. Gomes, D. Torres and A. Malinowska visited The University of Texas at Austin. During these visits, research on Partial Differential Equations and in Optimal Control Theory was actively pursued. Gordan Zitkovic visited Lisbon this September to pursue research activities under this project on Stochastic Processes and Stochastic Optimal Control. D. Gomes and G. Terrone have submitted a paper on Bernstein estimates for weakly coupled elliptic equations. D. Torres, A. Malinowska, and C. Caputo initiated collaboration during the stay of D. Torres and A. Malinowska, September 2009. A paper has been submitted. V. Quítalo has been pursuing research under L. Caffarelli and D. Gomes on fully nonlinear elliptic equations.

'09 Project: Endoscopic image processing through mathematic modeling

Principal Investigator

1. Isabel Maria Narra de Figueiredo, U Coimbra

Research Team

2. Bjorn Engquist, Faculty researcher
3. Carlos Manuel Franco Leal, UCoimbra FCT researcher
4. Chandrajit Bajaj, Faculty researcher
5. Elisha Rabinovitz, Chief Scientist, Consultant Given Imaging
6. Georg Stadler, Faculty researcher
7. Giuseppe Romanazzi, UCoimbra FCT researcher
8. Ilda Marisa de Sá Reis, UPorto Graduate researcher
9. João Manuel Ribeiro da Silva Tavares, UPorto Faculty researcher
10. José Manuel Bioucas Dias, UTL Faculty researcher
11. Juan C. Moreno Briceño, UCoimbra FCT doctoral researcher
12. Maria Manuel Rodes de Sousa Romão Donato, UCoimbra FM researcher
13. Mário Alexandre Teles de Figueiredo, UTL Faculty researcher
14. Nuno Miguel Peres de Almeida, UCoimbra FM researcher
15. Omar Ghattas, The University of Texas at Austin
16. Pedro Manuel Narra de Figueiredo, UCoimbra FM researcher
17. Sandra Maria Fernandes Lopes, UCoimbra FM researcher
18. Surya Prasath, UCoimbraFCT postdoctoral researcher
19. Yen-Hsi Richard Tsai, Faculty researcher
20. Zhen Ma, UPorto Graduate researcher

The Project

This project focuses on the mathematical modeling and endoscopic imaging processing of aberrant polyps and aberrant crypt foci (ACF, which statistically precede polyp formation). Multiscale methods are used in a modeling process that involves partial differential equations and level set methods, to simulate the dynamics and shape of ACF and polyps populations. The project's aim in image processing is to develop computerized and fast algorithms to identify and assess ACF and polyps patterns, captured in vivo by endoscopy in order to facilitate and speed up screening methods towards CRC prevention. The DM-FCTUC and FM-UC teams at U Coimbra have focused their research so far on the image segmentation of endoscopic aberrant crypt foci. Their ongoing research includes:

Image detection of colorectal polyps obtained with the PillCam colon capsule (produced by the company Given Imaging), either static or video images (the techniques employed involve variational methods, partial differential equations and optimization).

Mathematical analysis for simulating the dynamics and shape of aberrant crypt foci and colorectal polyps' populations, by means of time dependent equations for cell populations (the techniques include convection-diffusion equations and level set methods).

The teams of FEUP and IT have developed research in imaging sciences that is not yet directly related to the main topics of this project. However, their work is extremely important in itself, not only because it fits the framework of the project, but also because

the techniques developed might be applicable and meaningful to the particular medical problem of the project.

In the period July 01, 2009 to March 31, 2010, the U Coimbra team developed some effective research collaboration with the following project members of UT Austin: Georg Stadler, Omar Ghattas, Bjorn Engquist and Richard Tsai. In particular, Isabel Figueiredo visited ICES, UT Austin, from August 30 to October 2, 2009, and also from March 1 to May 7, 2010. She returned this fall, having arrived August 27, plans to continue her collaborations in residence at the Institute for Computational Engineering & Science (ICES), until October 2, 2010. Bjorn Engquist of UT Austin visited the Department of Mathematics, University of Coimbra, from November 2 to 4, 2009.

Research Metrics

The following research advancements related to the project have been accomplished by team members:

- Publications in progress: 4
- Papers published or in press: 9
- Communications in Congresses/Scientific Meetings (PT members): 7
- Seminars in PT: 1

'09 Project: Nonlinear partial differential equations

Principal Investigator

1. José Miguel Urbano, U Coimbra

Research Team

2. Alexis F. Vasseur, UT Austin Faculty Researcher
3. Ana Jacinta Pereira da Costa Soares, UMinho
4. Bruno Miguel Almeida Martins Pereira, UTL PhD candidate
5. Celestino António Maduro Coelho, UTL PhD candidate
6. Clint Dawson, UT Austin Faculty Researcher
7. Domingos José Ramos Lopes, U Coimbra PhD Student
8. Euclides Augusto Luís, UTL PhD candidate
9. Eugénio Alexandre Miguel Rocha
10. Eurica Manuela Novo Lopes Henriques
11. Fabio Augusto da Costa Carvalho Chalub, UNL
12. Fernando Augusto Pinto Miranda, UMinho
13. Filipe Serra de Oliveira, UNL
14. Hugo Ricardo Nabais Tavares, UL PhD candidate
15. Irene Gamba, UT Austin Faculty Resarcher
16. João Pedro Silva Brito Boto, FC/UL
17. Juha Hans Videman
18. Lisa Maria de Freitas Santos
19. Luís Caffarelli, UT Austin Faculty Researcher
20. Miguel de Paula Nogueira Ramos FC/UL
21. Pedro Alves Martins da Silva Girão
22. Rojbin Ozlem Laleoglu
23. Susana Margarida Pereira da Silva Domingues de Moura

The Project

Nonlinear partial differential equations (PDEs) are central in modern applied mathematics, both in view of the significance of the concrete problems they model and the novel techniques that their analysis generates. This project explores some of the new applications of these equations in biomathematics, against eight tasks:

- Regularity for singular/degenerate PDEs
- Numerical ocean and climate modeling
- Nonlinear elliptic systems
- Kinetic equations and BGK-type models
- Problems driven by subelliptic operators
- Drift-diffusion equations
- Free boundary problems
- PDEs involving variable exponents.

Advancement in understanding of these equations can be related to many applications such as the motion of multiphase fluids in porous media, the melting of crushed ice (and phase transitions in general), the behavior of composite materials, the pricing of assets in financial markets, or the quantum drift diffusion in semiconductors.

To date, in joint work with Vorotnikov, Urbano proved a series of results concerning the emptiness and non-emptiness of a certain set of Sobolev functions related to the well-posedness of a two-phase minimization problem, involving both the $p(x)$ -norm and the infinity norm. The results, although interesting in their own right, hold the promise of a wider applicability since they can be relevant in the context of other problems where minimization of the p-energy in a part of the domain is coupled with the more local minimization of the infinity norm on another region.

In relation with Bose-Einstein type systems for binary mixtures, the existence of positive solutions for such systems was obtained (B. Noris and M. Ramos) and the properties of the limit configurations was undertaken (H. Tavares, S. Terracini, et al.). The trend to equilibrium of a chemically reactive mixture modeled by means of the spatially homogenous Boltzmann equation has been investigated by A. J. Soares and F. Oliveira. Under the assumption of uniformly boundedness and equicontinuity of the distribution functions, the solution of the Boltzmann equation is shown to converge in strong L^1 -sense toward Maxwellian equilibrium as time becomes large. This research work has been developed in collaboration with G. M. Kremer (Univ. Federal do Paraná, Brazil).

Pending research includes the study of the regularity question for infinity harmonic functions by means of intrinsic scaling; and to approach the evolutionary infinity Laplace equation using its discrete version, in which the objective is to obtain a new proof of the existence of solutions and, most importantly, to derive more direct Lipschitz estimates and an obvious way of constructing a numerical scheme, similar to the Oberman scheme for the stationary equation. This could provide insight on how to deal with the non-homogenous stationary problem when the non-homogeneous term changes sign, a major difficulty in the theory. Researchers intend to obtain a rather complete study of the ground state solutions of strongly nonlinear elliptic systems, including: their sign, uniqueness, and radial symmetry, which is being performed jointly with D. Bonheure (ULB, Brussels) and E. dos Santos (Univ. Sao Carlos, Brazil).

The global existence and stability of solutions for space homogeneous chemically reactive gases will be investigated for models of simple reactive spheres. This work will be developed in collaboration with Jacek Polewczak (California State Univ.). Also, free boundary problems will be examined, in regards to the existence of a solution and the asymptotic behavior in time will be analyzed for the evolutionary system coupling the electromagnetic and thermal fields associated with power type laws both in the electromagnetic induction and Joule heat. Some progress has been made against the antennas problem, but the study of this topic is not completed yet. For problems arising in superconductivity and the dynamics of sand piles, progress has also been made, although some clarifications are needed in order to bring this work to publication.

Research Metrics

The following research publications and presentations related to the project were accomplished by team members during the funded period:

- Papers in international journals or book chapters: 17
- Papers submitted or pending publication: 9
- Relevant presentation at international conferences and seminars: 25
- One PhD Thesis

In addition to these publications and presentations, project members organized two special scientific events, the BCAM-CIM Workshop on Applied Mathematics in Bilbao, Spain (July 2-4, 2009), and the Minisymposium on Computational Atmospheric and Ocean Dynamics, ECCOMAS, Lisbon, 2010.

'09 Project: Reaction-diffusion in porous media

Principal Investigator

1. José Ferreira, U Coimbra

Research Team

2. Adérito Luís Martins Araújo, UCoimbra Faculty Researcher
3. Cidália Alves das Neves, UCoimbra Faculty Researcher
4. Ercília Cristina da Costa e Sousa, UCoimbra Faculty Researcher
5. Fernando Manuel Lucas Carapau, University of Evora Researcher
6. Gergina Pencheva, UT Austin Faculty Researcher
7. Giuseppe Romanazzi, UCoimbra Faculty Researcher
8. Gonçalo Nuno Travassos Borges Alves da Pena, UCoimbra Faculty Researcher
9. Luís Miguel Dias Pinto, UCoimbra Faculty Researcher
10. Marc Baboulin, UCoimbra Faculty Researcher
11. Mary Fanett Wheeler, UT Austin Faculty Researcher
12. Mojdeh Delshad, UT Austin Faculty Researcher
13. Sílvia Alexandra Alves Barbeiro, UCoimbra Faculty Researcher
14. Vivette Girault, Université Pierre et Marie Curie, Paris VI Faculty Researcher

The Project

In recent decades, diffusion in porous media has attracted researchers from several disciplines, such as geosciences, environmental sciences, mechanics, biology, chemistry, petroleum engineering, biomedical engineering, physics and mathematics. Diffusion in porous media has applications to problems such as groundwater contamination, diffusion in polymers, and flow in oil reservoirs. The fundamental equation governing diffusion in porous media is the equation of mass conservation, which is of parabolic type. It is established assuming that the dispersive mass flux is given by Fick's law where the dispersion tensor is assumed to be independent of the concentration and its gradient. It is well-known that this equation gives rise to an infinite speed of propagation. Small- and large-scale heterogeneities in porous matrix and/or fluid properties are the main sources of deviations of the so-called Fickian dispersion behavior. In order to overcome this deviation, a certain memory effect should be included in the flux modeling. The aim of this project is to introduce memory effects in the models for fluid flows in porous media characterized by small-scale and large-scale heterogeneities in several contexts.

The first stage of this research seeks to propose new mathematical models for non-Fickian flow in porous media. Researchers started by studying linear integro-differential equations that can be obtained combining the mass conservation law with the Maxwell Voight law for the mechanical behavior of the medium. In this way, memory effects were introduced in the models for fluid flows in porous media characterized by small-scale and large scale heterogeneities in several contexts. For the new models we gained some insight on the mathematical analysis of the mathematical problems and we developed discretization schemes and established stability and convergence.

To advance this research, the team organized the 2010 workshop "Diffusion in porous media," that took place in the University of Coimbra, in February; and a symposium with the theme, "New trends in diffusion phenomena," in the "European Conference on Computational Fluid Dynamics, ECCOMAS CFD 2010" June 14th-17th in Lisbon.

In 2009, Silvia Barbeiro and José Ferreira visited ICES at UT Austin November 15 to 26, to develop research work with the UT partners of the project. Mary Wheeler, with UT, visited the University of Coimbra in June 2010 to continue the research work with the members of the research team at U Coimbra.

The next step is to couple the diffusion equation studied in the first step with a reactive transport equation. After investigating this single phase flow and reactive transport, researchers propose to extend our results to the two phase immiscible reactive transport problem. The final goal is to consider multiphysics coupling systems and to perform numerical experiments for verifying theory and model some realistic engineering applications.

Research Metrics

The following projects outputs have resulted from this research:

- Organized meetings: 2
- Presentations: 12
- Seminars taught: 2
- Papers published or submitted for publishing: 10

Research Papers

The following research papers were direct result of collaborations between Portuguese researchers and UT researchers, as well post-doctoral students:

Barbeiro, S., & M. F. Wheeler, *Coupling methods for poro-elasticity* (work in progress).

Barbeiro, S., & M. F. Wheeler: *A-priori error estimates for the numerical solution of a coupled geomechanics and reservoir flow model with stress-dependent permeability*.

Caputo, C., "Time Scales: from Nabla Calculus to Delta Calculus and vice versa via Duality," to appear on *IJDE*.

Dawson, C. (UT Austin), & J. Videman (IST), *Streamline Diffusion Methods for Shallow-Water Equations* (work in progress).

Figueiredo, I. N., G. Stadler, & medical doctors of the research project UTAustin/MAT/0009/2008, *A multiscale segmentation model for aberrant crypt foci*.

Figueiredo, I. N., Ghattas, O, G. Stadler, & medical doctors of the research project UTAustin/MAT/0009/2008, *A PDE-constrained optimization problem for image segmentation of endoscopic aberrant crypt foci*.

Figueiredo, I. N., P. N. Figueiredo, G. Stadler, O. Ghattas & A. Araújo, *Variational image segmentation for endoscopic human colonic aberrant crypt foci*, *IEEE Transactions on Medical Imaging*.

Figueiredo, I. N., P. N. Figueiredo, N. Almeida, M.C. Leitão, O. Ghattas, G. Stadler, "Endoscopic Detection of Human Colonic Aberrant Crypt Foci using Mathematical Methods", *Endoscopy 2008*; 40 (Suppl 1) A 189.

Figueiredo, I., B. Engquist, R. Tsai, C. Leal, G. Romanazzi and Medical Doctors of the research project UTAustin/MAT/0009/2008, *A micro-macro model for tracking the shape of colonic crypts*.

Girão P., & M. Perez-Llanos, "Bifurcation curves for a logistic equation with harvesting orthogonal to the first eigenvalue," submitted to appear on *IJDE*.

Gomes, D. & F. Cagnetti, "Aubry Mather theory for non-convex Hamiltonians," submitted to appear on *IJDE*.

Gomes, D., & G. Terrone, "On the Bernstein estimate for systems of weakly coupled fully non-linear elliptic equations and integral operators", to appear in *CFAA*.

Other Collaborations

In order to build a successful UT Austin Portugal Cooperative Program in Mathematics there needs to be a strong component of joint research at junior and senior levels. Accordingly, the CoLab program has provided a regular exchange of post-doc and junior faculty as well senior faculty to organize workshops to foster the development of common research interests and projects.

Rocha, Caffarelli

Eugénio Rocha is collaborating with Luis Caffarelli (CoLab@Austin Mathematics Director) in the study of the theoretical issues concerning subelliptic operators and (fractional) Laplacians evolving in Carnot groups (a subclass of nilpotent Lie groups).

Barbeira, Wheeler

Sílvia Barbeira is working with Mary F. Wheeler, from ICES, and her interests are in the field of numerical solution of partial differential systems applied to coupled geomechanics and reservoir flow models.

Videman, Figueirido, Dawson, Arbic

Juha Videman and Isabel Figueirido from Portugal are pursuing research in collaboration with Clint Dawson, from ICES, and Brian Arbic, from UT Institute for Geographics, in partial differential equations in geophysical fluid dynamics.

Abreu, Gilbert

Professors Luís Daniel Abreu (U Coimbra) and John Gilbert (UT Austin) have initiated a collaboration in the area of mathematical signal analysis. Their focus is “Harmonic analysis on contractions of the phase plane,” in the mathematics section of the UT Austin | Portugal program. For this purpose, Professor Abreu visited Austin in July 2009 and January 2010. The two researchers apply the representation theory of the contractions of the Heisenberg group to the construction of frames. They use methods from complex and harmonic analysis. Their theoretical results may lead to new implementable algorithms for the analysis and synthesis of signals supported on compact sets. The outcome of this research is expected to promote a transference of knowledge between the mathematics and communications engineering communities involved in the UT Austin | Portugal program.

Salgueiro, Luecke

Assistant Professor António Salgueiro (U Coimbra) visited Professor John Luecke (UT Austin) from August 13 to 24, 2010 to start a collaboration in the area of geometric topology. They studied the cyclic coverings of knots and links using the JSJ decomposition of 3-manifolds and methods from hyperbolic geometry, Seifert fibred space theory and graph theory. In particular they expect to understand if all coverings of different degrees of a given nontrivial link are nonhomeomorphic.

Figueiredo, Stadler, Ghattas, Engquist, Tsai

July 1, 2009 to March 31, 2010, the U Coimbra research team for the endoscopy project developed some effective research collaboration with the following project members of UT Austin: Georg Stadler, Omar Ghattas, Bjorn Engquist and Richard Tsai. In particular, Isabel Figueiredo visited ICES, UT Austin, from August 30 to October 2, 2009, and also from March 1 to May 7, 2010. She returned this fall, and plans to continue her collaborations in residence at the Institute for Computational Engineering & Science (ICES), August 27 until October 2, 2010.

Post Doctoral Opportunities: Doctoral Fellows

In order to pursue the internationalization of Portuguese universities it has been considered essential to develop a post-doc and junior faculty exchange program. Such a program would attract talented recent graduates and junior faculty from UT Austin to Portugal as well as send to Austin recent Portuguese graduates and junior faculty. In Portugal and at UT Austin post-doctoral and junior faculty positions would be funded by the UT Austin Portugal Program and post-docs would be expected to have a reduced teaching load. Furthermore, in order to foster joint research enterprise at the senior level yearly workshops will be

organized alternating between Austin, Coimbra and Lisbon. Current Doctoral Fellows of the program include:

- Maria Teresa Perez
- Farid Bozorgnia
- Stephania Patrizi
- Gabriele Terrone
- Filippo Cagnetti

EDUCATION

PhD Program

The Lisbon-University of Texas at Austin PhD Program in Mathematics (LUTAMath) is a dual PhD program between the Mathematics Departments of the three Lisbon public universities (Instituto Superior Técnico, Universidade de Lisboa and Universidade Nova de Lisboa) partnered with the University of Texas at Austin.

This internationally attractive graduate program is organized along the following guidelines: Students enrolled must satisfy the requirements of all of the participating universities. On completion of these academic requirements, the student will be allowed to submit a thesis statement at both the participating Portuguese university and UT Austin, and the student will be able to obtain a degree in mathematics from both participating institutions.

There is a long history of scientific interaction between the Department of Mathematics at UT Austin and Portuguese universities namely in the areas of applied mathematics and partial differential equations. Furthermore, both UT Austin and the involved Portuguese universities have strong and complimentary groups in geometry and topology providing the framework for strong intellectual cooperation to promote high quality scientific collaborations and research. In the near-term, collaborations will also include other areas such as mathematical finance and algebra.

Portuguese and UT Austin students should be involved in these cooperative research activities as soon as possible so that they can obtain the most benefit from these bi-national collaborations. Research activity resulting from this cooperative program should be monitored by established research centers at the participating universities and which employ the involved researchers including the following key Portuguese faculty and institutions: Rui Loja Fernandes and Diogo Gomes (IST); Luisa Mascarenhas and Luís Trabucho (FCT-UNL); José Francisco Rodrigues and Jean-Claude Zambrini (FC-UL).

2010 Call for Doctoral Scholarships

In the context of the UT Austin | Portugal Program, the FCT (Foundation for Science and Technology) opened a call for: Mathematics PhD Scholarships, taking place in Portugal and at The University of Texas at Austin in the following areas:

- Algebra and Number Theory
- Applied and Numerical Analysis
- Analysis and Partial Differential Equations
- Geometry and Topology
- Optimization
- Stochastic Processes and Mathematical Finance
- Dynamical Systems

The scholarship is only given to those candidates that are able to demonstrate that they were accepted in one of the PhD Programs by a Portuguese University involved with the UT Austin | Portugal Program for the different areas. Scholarships were granted under the conditions stated by the FCT on the Scientific Fellow's Regulation (Law n. 40/2004, August 18) and Regulations for Advanced Training and Qualification of Human Resources of the FCT

(<http://alfa.fct.mctes.pt/apoios/bolsas/regulamento.phtml.en>). The scholarships are funded by the QREN Portugal 2007-2013 Operational Program Human Potential and by funds from the Ministry of Science, Technology and Higher Education. Application to these scholarships is open to all candidates that comply with the requirements established on Article 17 of the Regulation on Advanced Training and Qualification of Human Resources of the Foundation for Science and Technology. The candidates to PhD scholarships who have held the same type of scholarship under other FCT Programs will be limited to a maximum number of years of support. The number of years of support will be a sum of the previous and present scholarship. The evaluation of candidates will be based on the merit and motivation of the applicants. The evaluation panel will review the applications, analyze the candidate's merits and motivations, and produce an ordered list of the accepted applicants. Students approved through this process include:

- Diego Farias
- Levon Nurbekian
- Verónica Quítalo
- Rafayel Teymurazyan
- Hassan Najafi Alishah
- Vardan Voskanyan
- Tadeu Zavistanovicz Almeida
- Alvaro Veliz Osório
- Juliana Fernandes da Silva
- Luís Guilherme Alves Mateus

EVENTS

Colloquium: Bjorn Engquist, UCoimbra

Computational Multiscale Modeling: Crypt dynamics with budding and fission

Nov 4, 2009. It is generally accepted that colorectal cancer is initiated in the small pits, called crypts, which line the colon. This presentation examines progress in simulating the abnormal geometry of aberrant colonic crypts, by using reaction-diffusion equations, which model the dynamics of proliferative and apoptotic colonic cells.

Workshop: Classical and Random Dynamics in Mathematical Physics

March 30 – April 3, 2010. The University of Texas at Austin. The UT Math CoLab group provided a four-day workshop on classical and random dynamics in mathematical physics, consisting of a series of 45-minute plenary session talks. Abstracts included:

Recurrence times toward mixing rates and vice-versa

José Ferreira Alves, *Universidade de Porto*. One of the most efficient tools for studying the mixing rates of certain classes of dynamical systems is through Young towers: if a given system admits an inducing scheme whose tail of recurrence times decays at a given speed, then that system admits a physical measure with mixing rate of the same order. This talk considered the inverse problem: assume that a given dynamical system has a physical measure with a certain mixing rate; under which conditions does that measure come from an inducing scheme with the tail of recurrence times decaying at the same speed? Optimal results for the polynomial case were presented. The exponential case raises interesting questions on the regularity of the observables.

On the Boltzmann limit for a Fermi gas in a random medium with dynamical Hartree-Fock interactions

Thomas Chen, *The University of Texas at Austin*. This session addressed the dynamics of a Fermi gas in a weakly disordered random medium. First, some joint results reached with I. Sasaki (Shinshu University) were presented on the Boltzmann limit for the thermal momentum distribution function, and on the persistence of quasi-freeness, for the case of a free Fermi gas in a random medium. Subsequently, joint results with I. Rodnianski (Princeton University) were presented on the derivation of the Boltzmann limit for a Fermi gas in a random medium with nonlinear self-interactions modeled in dynamical Hartree-Fock theory.

Planar fronts in bi-stable coupled map lattices

Ricardo Coutinho, *Universidade Técnica de Lisboa*. Planar fronts in multidimensional coupled map lattices can be studied by reduction to a one-dimensional extended dynamical system that generalizes one-dimensional coupled map lattices. This methodology was fully investigated and developed. Continuity of front velocity with the coupling strength and with the propagation direction was proven. Examples were provided and illustrated by some numerical pictures.

Invariant objects in coupled map lattices

Rafael de la Llave, *The University of Texas at Austin*. Infinite dimensional systems were considered, which consist of copies of a finite dimensional system at each point in the lattice coupled by interactions which decrease fast enough. These objects have appeared in

applications under the name of *coupled map lattices*, *oscillator networks*, and in discretizations of PDE's. Detail hyperbolic systems were considered, with their invariant manifolds. In relation to Hamiltonian systems, whiskered invariant tori and their invariant manifolds were discussed. The method allows consideration of the persistence of tori with finitely many or infinitely many frequencies. This work was developed jointly with E. Fontich, P. Martin, Y. Sire (previous work with M. Jiang).

Integrable billiards, Poncelet-Darboux grids and Kowalevski top

Vladimir Dragovic, Universidade de Lisboa. A progress in a thirty year program of Griffiths and Harris of understanding of higher-dimensional analogues of Poncelet porisms and synthetic approach to higher genera addition theorems was presented. A set T of lines tangent to $d-1$ quadrics from a given confocal family in a d -dimensional space, as equipped with an algebraic operation; applied to further develop well-known results of Donagi, Reid and Knorrer. Having derived a fundamental property of T : any two lines from T can be obtained from each other by at most $d-1$ billiard reflections at some quadrics of the confocal family. The interrelations among billiard dynamics, linear subspaces of intersections of quadrics and hyperelliptic Jacobians enabled us to obtain higher-dimensional and higher-genera generalizations of several classical genus 1 results. Among several applications, a new view on the Kowalevski top and Kowalevski integration procedure is presented. It is based on a classical notion of Darboux coordinates, a modern concept of n -valued Buchstaber-Novikov groups and a new notion of discriminant separability. An unexpected relationship with the Great Poncelet Theorem for a triangle was illustrated.

Extensions of the Kac N -particle model to multi linear interactions

Irene Gamba, The University of Texas at Austin. This session examined extensions Kac N -particle model of pair interactions to an N -particle model that includes multi-particle interactions in order to study the evolution of the corresponding probability density solution. Under the assumption of temporal invariance under scaling transformations of the phase space and contractive properties, we obtain a full description of existence, uniqueness and long time behavior from its spectral properties. This model can also be seen as an extension of the Boltzmann dynamics of Maxwell type for conservative or dissipative interactions and the formation of power tails for long time self similar behavior under very general conditions for the initial energy. Focus also included new examples of multi-agent dynamics and information percolation and some numerical simulations. This work is the result of collaboration with A. Bobylev, C. Cercignani. These numerical simulations are the result of collaboration with Harsha Tharkabhushanam and the recent studies for information dynamics models with Ravi Srinivasan.

Non Convex Aubry-Mather Measures

Diogo Gomes, Universidade Técnica de Lisboa. This discussion presented the adjoint method introduced by Evans to construct analogs to the Aubry-Mather measures for non-convex Hamiltonians. In particular, these prove the existence of Aubry-Mather measures for a class of strictly quasiconvex Hamiltonians.

A rigorous approach to the non-Abelian Chern-Simons path integral

Atle Hahn, Universidade de Lisboa. The study of the heuristic Chern-Simons path integral by E. Witten inspired (at least) two general approaches to quantum topology. Firstly, the perturbative approach based on the CS path integral in the Lorentz gauge and, secondly, the

“quantum group approach” by Reshetikhin/Turaev. While for the first approach the relation to the CS path integral is obvious for the second approach it is not. In particular, it is not clear if/how one can derive the relevant R -matrices or quantum \mathfrak{g} -symbols directly from the CS path integral. This discussion summarizes the results of a recent preprint, to sketch a strategy that might lead to a clarification of this issue in the special case where the base manifold is of product form. This strategy is based on the “torus gauge fixing” procedure introduced by M. Blau and G. Thompson for the study of the partition function of CS models. The presentation show that the formulas of Blau & Thompson can be generalized to Wilson lines and that at least for the simplest types of links the evaluation of the expectation values of these Wilson lines leads to the same state sum expressions in terms of which Turaev’s shadow invariant is defined. Finally, the presentation showed how, with the use methods from Stochastic Analysis or, alternatively, a suitable discretization approach, one can obtain a rigorous realization of the path integral expressions appearing in this treatment.

Homoclinic Tangle Dynamics in a Vortex-Bubble

Jay Mireles James, Rutgers University. This session presented a three dimensional, quadratic, volume preserving map, which is a normal form for quadratic diffeomorphisms with quadratic inverse. The map can also serve as a model for certain vortex dynamics that arise in fluid and plasma physics. Also discussed a quasi-numerical numerical scheme, based on the Parameterization Method, for accurately computing the one and two dimensional stable and unstable manifolds of the maps fixed points. A study of the embedding of the stable and unstable manifolds provided insights into the chaotic motions in the vortex.

Shadowing orbits for dissipative PDEs

Hans Koch, The University of Texas at Austin. This session presented a computer-assisted technique for constructing and analyzing orbits of dissipative evolution equations. As a case study, the methods were applied to the Kuramoto-Sivashinski equation. In particular, a partial description of the bifurcation diagram for stationary solution was shown, which involves 23 bifurcations and 44 branches; and further illustrated how more general orbits may be obtained by solving the Duhamel equation for small time intervals, and then using shadowing techniques (covering relations). Estimates were described on the flow, its derivative, Poincaré maps, and a proof for the existence of a hyperbolic periodic orbit. This is a joint work with Gianni Arioli (Politecnico di Milano).

Equivariant Landau-Lifshitz equation of degree two

Kenji Nakanishi, Kyoto University. This presentation shared joint work that was developed with Stephen Gustafson and Tai-Peng Tsai on the global dynamics of the Landau-Lifshitz equation around the ground states under the equivariant symmetry. Having previously proved that in the degree higher than two, every solution with energy close to the ground states converges to a ground state of a fixed scaling at time infinity, whereas in the degree two, the family of the ground states is still asymptotically stable but the scaling parameter can blow up or oscillate at time infinity; the latter result, however, needed additional restrictions for which the dispersion was absent (i.e. the heat flow), and the map modulo the equivariant rotation was confined in a great circle. This work illustrates how those restrictions for the asymptotic stability might be removed.

Stochastic partial differential equations: Regularity of the probability law of the solution

David Nualart, University of Kansas. Recent results were shared on the regularity of the density of the solution of a general class of stochastic differential equations driven by a Gaussian white noise with an homogeneous spatial covariance. To show that the density of the solution is infinitely differentiable, the techniques of Malliavin calculus were applied, requiring the diffusion coefficient to satisfy some non degeneracy conditions. Discussions also covered the relation of this problem with the existence of negative moments for solutions to linear stochastic partial differential equations with random coefficients. A recent approach to this question using a stochastic version of Feynman-Kac formula was also presented.

Yang-Mills in 2 dimensions for $U(N)$ and its large- N limit

Ambar N. Sengupta, Louisiana State University. This presentation described quantum Yang-Mills theory on the plane with the gauge group $U(N)$, and the limiting behavior of this theory as N goes to infinity.

Stochastic wave equation model for heat-flow in non-equilibrium statistical mechanics

Lawrence E. Thomas, University of Virginia. In consideration of a one-dimensional non-linear stochastic wave equation system modeling heat flow between thermal reservoirs at different temperatures, this session provided a brief review of the problem of solving these equations in Sobolev spaces of low regularity. The system with ultraviolet cutoffs has, for each cutoff, a unique invariant measure exhibiting steady-state heat flow. Estimates were provided on the field covariances with respect to the invariant measures which are uniform in the cutoffs.

Transitivity of non-compact extensions of hyperbolic systems

Andrew Török, University of Houston. In consideration of the restriction to a hyperbolic basic set of a smooth diffeomorphism, this session focused on the transitivity of Hölder skew-extensions with fiber a non-compact connected Lie group. In the case of compact fibers, the transitive extensions contain an open and dense set. For the non-compact case, it was conjectured that this is still true within the set of extensions that avoid the obvious obstructions to transitivity. Results that support this conjecture were discussed. For $r > 0$, it was shown that in the class of C^r -cocycles with fiber the special Euclidean group $SE(n)$, those that are transitive form a residual set (countable intersection of open dense sets). This result is new for $n \geq 3$ odd. More generally, the presentation considered Euclidean-type groups G over Rn , where G is a compact connected Lie group acting linearly on Rn . When $\text{Fix } G = \{0\}$, it is again the case that the transitive cocycles are residual. When $\text{Fix } G \neq \{0\}$, the same result holds on the subset of cocycles that avoid an obvious and explicit obstruction to transitivity. Proof was shown that such genericity results for a class of nilpotent groups. This is a joint work with Ian Melbourne and Viorel Nitica.

Strong stochastic stability for non-uniformly expanding maps

Helder Vilarinho, Universidade da Beira Interior. This discussion addressed the strong stochastic stability of a broad class of discrete-time dynamical systems – non-uniformly expanding maps – when some random noise is introduced in the deterministic dynamics. A weaker form of stochastic stability for this systems was established by J. F. Alves and V. Arajo (2003) in the sense of convergence of the physical measure to the SRB probability measure in the weak* topology. A strategy was presented to improve this result in order to

obtain the strong stochastic stability, i.e., the convergence of the density of the physical measure to the density of the SRB probability measure in the L1-norm, and in a more general framework of random perturbations. A result was illustrated for two examples of non-uniformly expanding maps: the first as related to an open class of local diffeomorphisms introduced by J. F. Alves, C. Bonatti and M. Viana (2000) and the second to Viana maps—a higher dimensional example with critical set introduced by M. Viana (1997). This is a joint work with J. F. Alves.

Stochastic completeness of graphs

Radosław Wojciechowski, Universidade de Lisboa. This presentation introduced the heat kernel on graphs and gave geometric conditions which imply the stochastic completeness or incompleteness of the underlying diffusion process. Furthermore, connections to the spectrum of the discrete Laplacian were considered. The proofs rely on studying the stability of solutions of difference equations.

Stochastic reversible deformation of dynamical systems

Jean-Claude Zambrini, Universidade de Lisboa. This session described a program of symmetrization in time of Stochastic Analysis. Its main purpose being to deform stochastically the classical approaches to the theory of elementary dynamical systems, but it may be of interest more generally when random modeling of reversible phenomena is necessary.

Colloquium: Mary Wheeler, U Coimbra

June 8, 2010 A fundamental difficulty in understanding and predicting large-scale fluid movements in porous media is that these movements depend upon phenomena occurring on small scales in space and/or time. The differences in scale can be staggering. Aquifers and reservoirs extend for thousands of meters, while their transport properties can vary across centimeters, reflecting the depositional and diagenetic processes that formed the rocks. In turn, transport properties depend on the distribution, correlation and connectivity of micron sized geometric features such as pore throats, and on molecular chemical reactions. Seepage and even pumped velocities can be extremely small compared to the rates of phase changes and chemical reactions. The coupling of flow simulation with mechanical deformations is also important in addressing the response of reservoirs located in structurally weak geologic formations.

The presentation focused on the mortar mixed finite element method (MMFE) that was first introduced by Arbogast, Cowsar, Wheeler, and Yotov for single phase flow and later extended to multiphase flow by Lu, Peszynska, Wheeler, and Yotov for multiphase flow. The MMFE method is quite general in that it allows for non-matching interfaces and the coupling of different physical processes in a single simulation. This is achieved by decomposing the physical domain into a series of subdomains (blocks) and using independently constructed numerical grids and possibly different discretization techniques in each block. Physically meaningful matching conditions are imposed on block interfaces in a numerically stable and accurate way using mortar finite element spaces. The mortar approach can be viewed as a subgrid or two scale approach. Moreover, the use of mortars allows one to couple MFE and discontinuous Galerkin approximations in adjacent subdomains. Discussions also explored the use of mortars for poroelastic problems. This presentation discussed theoretical *a priori* and *a posteriori* results and computational results were presented.

Summer School and Workshop: Imaging Sciences & Medical Applications

by Isabel M. Narra Figueiredo, UCoimbra, Organizer

June 15-23, 2010 The Summer School and Workshop on Imaging Sciences and Medical Applications was an initiative of the UT Austin | Portugal Program, for Mathematics, in partnership with CIM (Center for International Mathematics). It took place at the Department of Mathematics at the University of Coimbra Faculty of Sciences and Technology, in Coimbra, Portugal, on June 15-23, 2010. This event had also the scientific support of CMUC (Centre for Mathematics, University of Coimbra), and two Portuguese medical associations, the Brain Imaging Network and the Society of Digestive Endoscopy.

The choice of the topic (and, a posteriori, its location) was chosen to support a research project (reference UTAustin/MAT/0009/2008), in the framework of the UT Austin | Portugal Program (for Mathematics), and one of the project main subjects is precisely image processing of medical images, more exactly, endoscopic images in gastroenterology. Moreover, this Summer School and Workshop on Imaging Sciences and Medical Applications was also, in some sense, a natural consequence (and a continuation) of the Workshop on Mathematical Aspects of Imaging, Modeling and Visualization in Multiscale Biology, in which this group was directly and strongly involved, and that took place at the Institute for Computational Engineering and Sciences (ICES), The University of Texas at Austin, March 31 to April 4, 2009.

The main goal of the Summer School and Workshop on Imaging Sciences and Medical Applications was to promote new collaborations, to exchange and share new ideas and scientific results, and simultaneously, to give an opportunity to PhD students and young researchers for improving their scientific knowledge in the complex area of imaging sciences, which has strong interdisciplinary features.

The summer school featured five excellent short courses, each one with the duration of five hours, presented by experts in imaging sciences. In the workshop there were nine plenary lectures, with a predominance of Portuguese guest speakers. The workshop also included four sessions of contributed talks and a poster session that provided young researchers the opportunity to report their ongoing work and results. A broad audience of sixty participants attended this event, which included mathematicians, electrical and computer engineers, mechanical engineers, biomedical engineers, geographical engineers, computer scientists and a neuroscientist. This premier event featured speakers who strongly contributed to a top level scientific atmosphere, promoting and encouraging interactions and collaborative research among all the participants. Abstracts of these sessions follow.

Highly accurate image restoration and matching

June 15-19, 2010. Andres *Almansa*, *Telecom Paris Tech, France*. Image sampling (hexagonal and irregular) restoration (of band limited blurred and noisy images from those samples), and reliable sub-pixel block-matching were addressed. Techniques discussed included harmonic and non-harmonic analysis, TV minimization, and a particular kind of statistical hypothesis testing called “a contrario” methods.

Variational models in image inpainting

Selim Esedoglu, University of Michigan, USA. Image inpainting is the process of automatically filling in damaged regions in digitized pictures with information gleaned from surrounding, undamaged areas. It has been a very active area of mathematical research in image processing. This presentation described some of the variational and partial differential equations based models proposed for this application, and discuss efficient numerical methods for their solution. Topics included some of the more recent non-local models.

Image segmentation

Sung Ha Kang, Georgia Inst. of Technology, Atlanta, USA. Deterministic approaches for image segmentation and active contours will be presented, using variational formulations, non-linear partial differential equations and level sets. The segmentation problem in image processing and computer vision, aims to find boundaries of objects in images or to partition a given image into its constituent objects. One of the main applications of segmentation is in the medical field. Most relevant edge-based and region-based models were described in detail, together with their extensions to color, texture, or medical images. Numerical algorithms were presented in details.

Image reconstruction in tomography

Alfred K. Louis, Saarland University, Germany. In imaging technologies, both in medicine and in non-destructive testing, the task is to reconstruct the desired information from measured data. First the development of mathematical models needs to be addressed. The reconstruction then is the inverse problem. This discussion explored several imaging technologies including x-ray CT, MRI, and ultrasound CT. As a case model, the radon transform was presented as mathematical model for 2D CT. Inversion formulae were derived and principles for constructing fast algorithms were analyzed. The questions of uniqueness and resolution for a given data set were reviewed. Finally the presentation included the data analysis part into the reconstruction in order to determine features of the image in just one step. Optimal filters were discussed, with a study of the behavior for real data sets, as well as the extensions of the methods to 3D X-ray CT and ultrasound CT.

Flexible algorithms for image registration

Jan Modersitzki, McMaster University, Canada. A generic task in modern image processing is image registration, needed for integration and/or comparison of data obtained from different images. Particularly in a medical environment, there is a huge demand for comparing pre- and post-intervention images, integrating modalities like anatomy (obtained, e.g., from computer tomography) and functionality (obtained, e.g., from positron emission tomography), motion correction and/or reconstruction of two-dimensional projections from a three-dimensional volume (applies to all tomography techniques and histology). The problem is easily stated: given two images (a reference and a template image), and a transformation, such that the transformed image is similar to the reference image.

This course presented a general and unified approach to image registration. The course covered central problems arising in typical applications, including both theoretical as well as practical components. Implementation issues were discussed on the basis of the FAIR software, see www.cas.mcmaster.ca/fair/index.shtml for details.

Summer Workshop Plenary Sessions

Interest point detection and matching for 3D reconstruction in medical endoscopy, João Pedro Barreto (University of Coimbra, Portugal)

Unmixing of positive sources in hyperspectral imaging, José Bioucas (Instituto Superior Técnico, Lisbon, Portugal)

From models of brain function to clinical applications: new challenges in neuroimaging, Miguel Castelo-Branco (University of Coimbra, Portugal)

CAGE: Computer assisted gastroenterology examination, Miguel Coimbra (University of Porto, Portugal)

A combinatorial point of view for non-linear evolutions, Jérôme Darbon (Ecole Normale Supérieure de Cachan, France)

Removing non-additive noise using variable splitting and augmented lagrangian optimization, Mário Figueiredo (Instituto Superior Técnico, Lisbon, Portugal)

Spatially adapted regularization in total variation based image restoration, Michael Hintermüller (Humboldt-University of Berlin, Germany)

New trends in photogrammetry and computer vision applied to 3D city modeling and cultural heritage, Marc Pierrot-Deseilligny (Laboratoire MATIS, IGN, France)

Tracking moving objects in image sequences, João Manuel R. S. Tavares (University of Porto, Portugal)

Ciência 2010

July 4-7, 2010, Lisboa CoLab mathematics students presented scientific posters related to their PhD theses and the work they are developing in the CoLab program. The posters were on display for the length of the conference. One conference session was organized to provide students an opportunity to answer questions on their work. Gabriele Terrone, a UT Austin | Portugal Mathematics CoLab Postdoctoral Fellow (IST), presented a session titled, *Limiting relaxed controls and homogenization of moving interfaces*.

Post-doctoral Academy in Mathematics

September 23-24, 2010, Universidade Nova de Lisboa. CoLab's 2010 Post-doctoral Academy in Mathematics addressed a number of in-depth subjects, as follows.

Long-time nonlinear dynamics of waves and clusters

Robert Pego, CMU. Nonlinear dynamics in infinite-dimensional systems exhibit a rich set of phenomena. These lectures focused on two of these. First: the stability and scattering questions for solitary waves in fluids and particle lattices. These particle-like nonlinear waves appear robust in these systems, but variational methods fail to work. Discussion addressed how scattering behavior can be used to produce 'dissipation' estimates that allow one to extend stability results for integrable models like the KdV and Toda lattice equations. Second: the kinetic models of coagulation and clustering. Here the study of dynamic scaling limits provides close analogies connections with classical probability theory. The notion of the scaling attractor and the linearization of dynamics on it achieved by Bertoin's Levy-Khintchine representation of eternal solutions was described. The series of lectures included:

- *Solitary waves in fluids and particle lattices.* Geometric stability theory in Hamiltonian systems of particles: symplectic tubular coordinates, Howland-type Floquet theory, Backlund transform for the Toda lattice. Mizumachi's results on stability in the energy space.
- *Solitary water waves.* KdV limit and spectral stability. Neumann-Dirichlet and Riemann mappings, Gohberg-Sigal-Rouche theorem.
- *Clustering models, Smoluchowski's coagulation equation.* Random shock clustering; Burgers turbulence and the Carraro-Duchon-Bertoin theorem. Necessary and sufficient criteria for approach to self-similar form.
- *Scaling dynamics in general for solvable coagulation equations.* The scaling attractor and its measure representation. Conjugacy with dilational dynamics. Signatures of chaos. Analogy to stable laws of probability and infinite divisibility.

Financial Markets: Black-Scholes and Beyond

Gordan Zitkovic, UT Austin. The (by now) classical mathematical theory of continuous-time financial markets, based on the notion of "no arbitrage," provides a simple framework for study and analysis of many phenomena observable in financial markets. However elegant, this theory has severe limitations and a rather restricted domain of applicability. These lectures will provide a quick overview of some of its main features and present solutions to several problems outside its scope:

- *A Crash-Course In Stochastic Analysis:* random walks and Brownian motion; continuous-time martingales; quadratic variation; stochastic integration; representation of martingales; Girsanov's theorem.
- *Samuelson's (Black-Scholes-Merton) Model And Basic Notions Of Mathematical Finance:* geometric Brownian motion; portfolios and trading; no arbitrage; pricing by replication and the formula of Black and Scholes; martingale measures; complete vs. incomplete markets.
- *Risk Aversion and Utility Maximization:* St. Petersburg paradox; utility functions and risk aversion; Merton's problem; variants; Hamilton-Jacobi-Bellman equations vs. the convex-analytic approach.
- *Pricing Derivatives Beyond Black-and-Scholes:* the notion of a competitive equilibrium; utility-based and indifference pricing.

Graduate researchers in the CMU | Portugal and UT Austin | Portugal programs also made presentations:

- Filippo Cagnetti (Instituto Superior Técnico, Portugal)
- Mohammad El Smaily (Pacific Institute for the Mathematical Sciences and at The University of British Columbia)
- Rita Ferreira (Carnegie Mellon University and Universidade Nova de Lisboa)
- Carolin Kreisbeck (Carnegie Mellon University)
- Stefania Patrizi (Instituto Superior Técnico, Portugal)
- Rafayel Teymurazyan (Universidade de Lisboa)

PENDING EVENTS

Summer School and Workshop: Optimization in Machine Learning

May 31 - June 7, 2011. The University of Texas at Austin, Texas, USA. In addition to support from UT Austin | Portugal CoLab, this event is also part of the programs of the Portuguese Operations Research Society (APDIO) and the Portuguese International Center for Mathematics (CIM).

The Summer Course on Optimization in Machine Learning (May 31 - June 4, 2011) will consist of two 10-hour modules given by Katya Scheinberg (Lehigh University) and Nati Srebro (Toyota Technological Institute at Chicago). This Summer Course introduces a range of machine learning models and optimization tools that are used to apply these models in practice. For the students with some Machine Learning background the course will introduce what lies behind the optimization tools often used as a black box as well as an understanding of the trade-offs of numerical accuracy and theoretical and empirical complexity. For the students with some Optimization background this course will introduce a variety of applications arising in Machine Learning and Statistics as well as novel optimization methods targeting these applications. The models we will cover include: support vector machines, sparse regression, sparse PCA, collaborative filtering, dimensionality reduction. The optimization methods will include interior point, active set, stochastic gradient, coordinate descent, cutting planes method.

The Workshop on Optimization in Machine Learning (June 6-7, 2011) will consist of 60-minute plenary talks and a number of talks and poster presentations. Plenary speakers already confirmed for the workshop include:

- Kristin P. Bennett (Rensselaer Polytechnic Institute)
- Inderjit S. Dhillon (University of Texas at Austin)
- Lieven Vandenbergh (University of California, Los Angeles).

Organizers of this event are:

- Omar Ghattas (University of Texas at Austin)
- Katya Scheinberg (Columbia University)
- Luis Nunes Vicente (University of Coimbra).

Contact and deadlines

The deadline for the course registration is March 31, 2011. For course and workshop registration please send email to oml2011@math.utexas.edu

Events in Planning

Aubry Mather Theory and Optimal Transport Summer School

June 13-17, 2011, Lisbon

Lectures by Alessio Figalli, Luigi Ambrosio, Yann Brenier, Patrick Bernard.

Nonlinear PDEs conference

June 20-24, 2011, Lisbon

3. COLAB ANNUAL CONFERENCE

Cross-program Research Conference

CoLab held its first cross-program CoLab Research Conference from September 21-22, 2010 at the Gulbenkian Foundation in Lisbon. Representatives from Portuguese universities and UT Austin presented updates in Advanced Digital Media and Mathematics. The conference opened with a talk by Mariano Gago, Minister for Science, Technology and Higher Education. In the talk, Minister Gago stressed the importance of Portugal to establish research programs that can compete on a global scale. Representing another corner of the globe, Austin, Robert Peterson, Associate Vice President for Research at The University of Texas at Austin and IC² Institute, gave the audience an overview of the program's progress and highlighted the unique opportunities for Portugal through the program.

Students from the different areas of the UT Austin Portugal program shared their work through poster sessions of their research projects, and the winners of ZON Award on Multimedia Creativity screened their projects. Nuno Cintra Torres, Director of Strategy at ZON Content, introduced some of the films including "3x3" by Nuno Rocha and "Romeu e Julieta, o Musical" by Zara Pinto. A parallel program highlighted several Portuguese "creative cities" initiatives that nurture creative programs within their regions. These presentations were contributed by representatives of the city council of Cascais, Óbidos, Paredes, Montemor-o-Velho, Guimarães, and Porto as well as Addict, an industry partnership promoting creative businesses in Portugal.









