

OVERVIEW

The iCIS Summer School 2015 is an exciting opportunity to get in contact with, analyze, and discuss exciting research topics and directions currently being addressed in the scope of the project. The summer school is dedicated to the general theme of **Internet of Things, Cyber-Physical Systems, and Platforms for Connected Smart Objects**, and will take place in the Department of Informatics Engineering of the University of Coimbra (<http://www.uc.pt/fctuc/dei/contactos>) and is scheduled for the 23rd through 26th of June 2015, and will comprise three full days of invited courses plus one day of projects, spin-off companies, and SME presentations. Registration is free of charge for iCIS researchers, PhD students and post-docs but, as there is a limit to the number of participants, it is mandatory to register. For registration send an e-mail message to avila@dei.uc.pt no later than June 9th, 2015.

PROGRAM

June 23rd, 2015

8:45 - 9:15 - Registration

9:15 - 9:30 - Opening

COURSE 1 - RESOURCE COMPETITION IN A HIGHLY NETWORKED WORLD OF HUMANS AND THINGS

Course 1 Schedule:

9:30 - 10:45 - Class 1.1

10:45 - 11:15 - Coffee break

11:15 - 12:30 - Class 1.2

12:30 - 14:00 - Lunch

14:00 - 15:15 - Class 1.3

15:15 - 15:45 - Coffee break

15:45 - 17:00 - Class 1.4

Instructor: Prof. Ioannis Stavrakakis *, University of Athens, Greece

Course 1 Abstract:

Advances in Information and Communication Technologies (ICT) have enabled the generation and dissemination of vast amounts of information that enhance awareness about the environment and its resources. While awareness brings benefits, it also intensifies competition and results in potentially significant congestion penalties in distributed, uncoordinated environments.

Following a simple case study illustrating the point, the course will focus largely on the uncoordinated (congestion penalty inducing) resource selection problem, that appears to have a broad applicability in smart city environments. This problem is mostly formulated as a binary decision problem: to compete or not to compete for some limited resources.

The case of fully rational decision-making in a competitive environment will be presented to introduce the basic analytical framework and derive the benchmark for the more relevant human-driven decision-making machinery that will follow; the case of limited information decision-making is also presented and shown to possibly lead to less-is-more phenomena.

As very frequently humans ultimately drive the decisions, such decisions are "constrained" by computational, cognitive or other limitations or biases. Decision-making modelling and analysis machinery under such bounded rationality is presented, including fast and frugal heuristics invoked by humans for this purpose. It is shown that such bounded rationality decisions are frequently more effective (of lower congestion cost) than those under the full rationality model. Humans employ heuristics (threshold-based) to also solve sequential search problems, which can be seen as a binary decision whether to take an available resource or risk opting for a better one; such a heuristics-based resource selection problem will also be discussed.

Besides producing and disseminating resource availability information, ICT technologies can also enable and support mechanisms that can provide for alternative ways of addressing the resource selection problem in a competitive environment. This can be done by resolving the competition in the pricing arena (auctioning of resources) or through ICT applications that bring some distributed coordination to the resource allocation.

By resolving the competition in the pricing arena, the original congestion penalty of the distributed, uncoordinated approach is eliminated, but the competition now results in a higher than before price paid by the winner of the resource. This alternative decision-making framework is presented and it is shown that

Project acronym: iCIS

Project name: Intelligent Computing
in the Internet of Services

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002003

Start date: 4 January 2013
Duration: 36 months

Total budget: EUR 1 176 248
Total effort in person-months:
2150

Website: <http://icis.uc.pt/>
Contact: icis@dei.uc.pt

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the average user will experience most of the times lower overall cost than under the earlier approach, while at the same time the resource owner always increases its profit (win-win situations).

Finally, an ICT application is presented to coordinate the allocation of a public resource (parking spots) of a city to its users. Desirable properties and characteristics of such applications, coordinating the usage of public resources among its subscribers, are discussed: effectiveness of the application, resilience to user misbehaviour, fairness and efficiency of the incentive's mechanism, non-exclusion of non-users, etc. As not every user is required to subscribe to an application coordinating (among its users) the usage of public resources, the issue of potential monopolization of public resources (goods) by the application users emerges; that is, causing non-users to suffer from poor access opportunities and finally be discouraged from using the resources. It is shown for this application that for a wide range of parameters both the application users and the non-users experience reduced cost in accessing the resource, compared to the fully uncoordinated access.

If time permits, the issue of user misbehaviour in an opportunistically-assisted search for distributed resources will finally be discussed, pointing to an observed robustness against user misbehaviours, due to spatial-temporal-interest diversity that is frequently present in (large-scale) distributed environments.

June 24th, 2015

COURSE 2 - INTELLIGENT ALGORITHMS WITH ENVIRONMENTAL APPLICATION EXAMPLES

Course 2 Schedule:

9:30 - 10:45 - Class 2.1

10:45 - 11:15 - Coffee break

11:15 - 12:30 - Class 2.2

12:30 - 14:00 - Lunch

14:00 - 15:15 - Class 2.3

15:15 - 15:45 - Coffee break

15:45 - 17:00 - Class 2.4

Instructor: Prof. Mikko Kolehmainen **, Science University of Eastern Finland, Finland

Course 2 Abstract:

Introduction and environmental informatics

Large amounts of data are nowadays being collected from the environment and this trend continues increasingly in the future. Environmental informatics is based on applying computational methods for analysing and modelling this data. Using these methods, the data is refined into more usable form for the end-user. In the introduction of the course day, environmental informatics is defined and the nature and challenges of large datasets are described. Additionally, the steps for performing data-mining are given.

Pre-processing the data

The computational methods are usually based on iteration and their inner working consists of calculating some distance between data lines and prototype vectors. Metrics for these calculations is defined and the implications of their use described. Following that, the most important transformations for pre-processing the data are defined and their use for emphasizing different aspects of the data are discussed. For example, some data like wind direction include discontinuities which have to be treated before applying the algorithms themselves. Also, the algorithms can be forced to focus their calculation to relative differences between the channels/variables instead of absolute levels.

Algorithms: Sammon's mapping, k-means and MLP neural networks

The data mining process commences by visualization of the data for getting an overview and understanding of the problem at general level. K-means is a well-known algorithm for achieving the clustering (grouping) of data. Its use can be enhanced by combining it with the Sammon's mapping algorithm for visual inspection. These algorithms and their computation steps are described and their use for different kinds of datasets illustrated. Additionally, one more method needed in the application examples namely MLP neural network is introduced.

Application examples

Two real world examples of past projects of environmental informatics are described in detail. The first one consists of electricity customer profiling and its linkage to energy efficiency. Adding to that the current projects in that field are surveyed shortly. Another example describes an application for monitoring visitors in recreational area. This is accompanied by information about some current projects in the field of environmental monitoring.

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June 23rd-26th, 2015

Demonstration with Matlab software

One widely used software used for intelligent data-processing is the Matlab software. Two toolboxes called “CommonTools” and “MTools” developed in our research group are introduced. The CommonTools includes basic data-mining operations mainly for time-series clustering and visualization. MTools can be used to create models for predictive modelling i.e. classification and regression.

Closing remarks and info

The use of computationally intelligent methods in handling environmental data is summarized and courses for further studies described. Additionally, information about study possibilities in the University of Eastern Finland is also given for enhancing student exchange between universities.

June 25th, 2015

COURSE 3 - TECHNOLOGIES, APPLICATIONS AND FUTURE CHALLENGES FOR THE INTERNET OF THINGS

Course 3 Schedule:

9:30 - 10:45 - Class 3.1

10:45 - 11:15 - Coffee break

11:15 - 12:30 - Class 3.2

Instructor: Prof. Victoria Torres Bosch ***, Polytechnic University of Valencia, Spain

Course 3 Abstract:

The Internet of Things (IoT) offers a new eco-system of heterogeneous and distributed physical objects and services that are available anytime and anywhere and that can be potentially accessed by any properly connected device and user. This new eco-system brings up new opportunities to improve our personal and professional way of life. However, it also raises new technological and social challenges that did not exist before. To better understand the impact that the IoT has on the development of new systems/applications this course presents an overview of existing technologies, platforms and frameworks and the abilities that are needed to successfully built applications within the context of the IoT. Finally, the course will present a specific case on the definition and execution of service compositions made by and for the crowd by using smartphones. The combined use of IoT services can bring users new added-value services. In addition, end-users are nowadays getting more and more familiar with technology, turning them into more active roles willing to participate in the specification of applications. However, different challenges need to be faced to achieve this. For example, more powerful and easy-to-use tools running in mobile devices need to be developed. Only in this case, there will be a chance to ensure that these tools are successfully used and adopted by end-users.

12:30 - 14:00 - Lunch

COURSE 4 - THE FIWARE OPEN INITIATIVE

Course 4 Schedule:

14:00 - 15:15 - Class 4.1

15:15 - 15:45 - Coffee break

15:45 - 17:00 - Class 4.2

Instructor: Prof. Juan Manuel Corchado ****, University of Salamanca, Spain

Course 4 Abstract:

To be announced

June 26th, 2015

9:30 - 10:45 - Projects presentation session

Session chair: To be decided

Presentation 1 - “Community Networks Testbed for the Future Internet”, Rui Campos, INESC Porto

Presentation 2 - “Sensing, monitoring and actuating on the UNDERwater world through a federated Research InfraStructure Extending the Future Internet”, José Pinto, FEUP

10:45 - 11:15 - Coffee break

11:15 - 12:30 - Enterprises presentation session

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Session chair: Luís Paquete (CISUC)

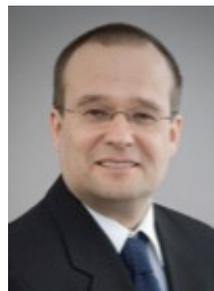
12:30 - Closing remarks

Instructors' biographies



* **Prof. Ioannis Stavrakakis** (IEEE Fellow, Dept Chair 2013 -) (<http://cgi.di.uoa.gr/~ioannis/>), is Professor in the Dept of Informatics and Telecommunications of the National and Kapodistrian University of Athens. He received his Diploma in Electrical Engineering from the Aristotelian University of Thessaloniki and his PhD in the same field from University of Virginia, USA. He served as Assistant Professor in CSEE, University of Vermont (USA), 1988-1994; Associate Professor of Electrical and Computer Engineering, Northeastern University, Boston (USA), 1994-1999; Associate Professor of Informatics and Telecommunications, National and Kapodistrian University of Athens (Greece), 1999-2002; and as Professor since 2002. Teaching and research interests are focused on resource allocation protocols and stochastic traffic management and congestion control for communication networks (peer-to-peer, mobile, ad hoc, autonomic, delay tolerant, social and future Internet), with recent emphasis on human driven decision-making in distributed competitive environments and information-centric networking. His research has been published in over 220 scientific journals and conference proceedings and was funded by USA-NSF, DARPA, GTE, BBN and Motorola (USA) as well as Greek and European Union (IST, FET, FIRE) funding agencies. He has received 2 Marie-Curie grants for training post and has supervised about 20 Ph.D. graduates. He has served repeatedly in NSF and EU-IST research proposal review panels and involved in the TPC and organization of numerous conferences sponsored by IEEE, ACM, ITC and IFIP societies. He has served as chairman of IFIP WG6.3 and elected officer for IEEE Technical Committee on Computer Communications (TCCC). He has been in the editorial board of Proceedings of IEEE (2015-), Computer Communications (2008-), IEEE/ACM transactions on Networking, ACM /Springer Wireless Networks and Computer Networks journals. He has served as head of the Communications and Signal Processing Division, Director of Graduate Studies and Dept Chair.

** **Prof. Mikko Kolehmainen**, Sc.D., Environmental informatics and modelling, Department of Environmental Science, University of Eastern Finland - The current focus areas of my research are environmental safety and security as well as sustainable energy systems. My professional goals are usually linked to developing methods for utilizing data and databases in the information society. An emerging topic in my research is modeling of complex systems in life sciences. During my career, I have first worked as system analyst and chief software engineer in the software industry, developing solutions for energy companies. In the 90's I have moved to the academic world working as researcher both in bioinformatics and environmental sciences, followed by a nomination to research director of environmental informatics; a new and emerging field. Currently as a professor, I am leading a research group of environmental informatics at the University of Eastern Finland (UEF). I'm lecturing and developing courses on environmental data mining, environmental bioinformatics and ecological risk assessment. In the future, my goal is to create strong international research in the focus areas, as well as develop e-learning to enable students worldwide to take part in the studies of environmental of environmental informatics and modeling.



*** **Prof. Victoria Torres Bosch** obtained her Ph.D. in Computer Science from Universidad Politécnica de Valencia in 2008, where she holds an Assistant Professor position. She is a member of the Software Production Methods (PROS) research center, working actively in areas such as the Business Process Management, Process Variability, Internet of Things, Web Engineering, and Model Driven Development. She has published several papers and articles, among others Information and Software Technology, Information Systems, and Software and System Modeling. Since 2010, she is leading the participation of the PROS center in European Projects, currently

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working in SITAC (Social Internet of Things - Apps by and for the Crowd).

**** **Prof. Juan Manuel Corchado** (born May 15, 1971 in Salamanca, Spain) is a Spanish computer scientist, professor, researcher and author. He is Vice President for Research and Technology Transfer since December 2013 and Full Professor with Chair at the University of Salamanca. He is the Director of the Science Park of the University of Salamanca and Director of the Doctoral School of the University. He has been twice elected Dean at School of Science of the University of Salamanca. In addition to a PhD in Computer Sciences from the University of Salamanca, he holds a PhD in Artificial Intelligence from the University of the West of Scotland. Corchado is the Director of the BISITE (Bioinformatic, Intelligent Systems and Educational Technology) Research Group, which he created in 2.000, President of the IEEE Systems, Man and Cybernetics Spanish Chapter, Academic Director of the Institute of Digital Art and Animation of the University of Salamanca. He also oversees the Master's programs in Digital Animation, Security, Mobile Technology, Community Management and Management for TIC enterprises at the University of Salamanca. Corchado is also editor and Editor-in-Chief of Specialized Journals like ADCAIJ (Advances in Distributed Computing and Artificial Intelligence Journal) and IJDCA (International Journal of Digital Contents and Applications).



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