

Seminar cycle & Projects management

-- Complex Systems -- Computer Sciences Implementation and Applications to Engineering

19-23 August 2007
Jordan

1. Context and Objectives

Jordan is one of the highest countries in the Middle East in the academic research and the development of Information Technologies and Communications.

Nowadays complexity and Distributed Artificial Intelligence is one of the most thrilling topics in this area. The conceptual approaches are innovative and lead to emergent computations. The applications are wide and concern robotic, web development, social networks, micro-economy, territorial intelligence, sustainable development, urban dynamic, etc.

The goals of this seminar cycle are to present an innovative research area and to initiate collaborations and joined projects.

2. Planning outline

Day 1:

Title: "Complex systems, emergent computing and applications to engineering"

Speaker: Professor Cyrille Bertelle (LITIS, Le Havre University, France)

- 09:30am – 10:20am: Part 1
- 10:20am - 10:40am: Pause and discussions
- 10:40am – 11:30am: Part 2
- 11:30am – 12:30am: Discussions and recommendation

Day 2:

Title: "Agent-based Modeling, spatial self-organization systems and applications to territorial management"

Speaker: Rawan Ghnemat (LITIS, Le Havre University, France)

- 09:30am – 10:20am: Part 1
- 10:20am - 10:40am: Pause and discussions
- 10:40am – 11:30am: Part 2
- 11:30am – 12:30am: Discussions and recommendation

Day 3:

Title: "Data Mining and applications"

Speaker: Doctor Fadi Thabtah (Philadelphia University, Jordan)

- 09:30am – 10:20am: Part 1
- 10:20am - 10:40am: Pause and discussions
- 10:40am – 11:30am: Part 2
- 11:30am – 12:30am: Discussions and recommendation

Day 4:

Title: "Dynamics combinatorics, complex systems and applications to physics"

Speaker: Professor Gérard H.E. Duchamp (LIPN, Paris 13 University, France)

- 09:30am – 10:20am: Part 1

- 10:20am - 10:40am: Pause and discussions
- 10:40am – 11:30am: Part 2
- 11:30am – 12:30am: Discussions and recommendation

Day 5:

Projects management discussions

Animators: Cyrille Bertelle, Gérard H.E. Duchamp, Rawan Ghnemat & Fadi Thabtah

- Young Researchers schools initiation
- Jordan-France cultural days (the first days are plan in Unesco, Paris, February 2008)
- European projects (Tempus, ...)

3. Seminars Details

Title: “Complex systems, emergent computing and applications to engineering”

Speaker: Professor Cyrille Bertelle (LITIS, Le Havre University, France)

Abstract:

Complexity is inherent to living systems. The meaning of living systems complexity is based on continuous evolution of structural organizations crossed by energetic fluxes. The whole comprehension of all the interactions of the living systems components inside their environment is needed to understand them. As a major complexity property, we can say that the reduction of the complete interaction network of the components of a living system does not allow to understand it, breaking with its complexity. The current natural and social World deals with this complexity property and need an accurate comprehension of this complexity, both for environmental purposes and for economical or geopolitic purposes. The Earth ecosystem equilibrium evolution is nowadays highlighted by local perturbations generated by human development and deep climatic perturbations could result of that. Geopolitic is also nowadays in fast and deep evolution as the result of the intensive development of modern communication processes which has transformed the old geographical cultural clustering. Interaction networks and patterns of emergent organizations are the keys of complex systems concepts understanding with which the current world must deal. Dissipative structures (following I. Prigogine) are the basis of the energetic approaches of self-organization criticality phenomena. We will present how computer science which can be considered as the science of modelling, dealing with information theory and systems conception can propose today, some models for self-organization processes. Cellular automata, sand pile models, segregation models (based on the works of the nobel price Thomas Schelling), agent-based modelling, social insects modelling for swarm intelligence can be the basis of relevant simulations for a better understanding of natural, economical or geopolitical systems that we have to face today.

Outline:

- Why complexity modeling?
- Complex systems concepts
- Emergent computing example 1: sand pile model from Per Bak
- Emergent computing example 2: segregation model from Thomas Schelling
- Emergent computing example 3: ant systems and applications to engineering

Speaker short biography:

Cyrille Bertelle is professor in Computer Science in Le Havre University, France. He is director of Le Havre component of LITIS which is the research laboratories aggregation of Computer Science, Information Technologies and Systems in Haute-Normandie region. This research center is labelled by the French Ministry of High Education and Research (EA 4108) and include more than 150 researchers (half of them are professors and assistant professors and half of them are PhD students). Professor Cyrille Bertelle is also co-director of Le Havre University Master of Science in Mathematics and Computer Science. He manages the research orientation of this master (MIASC) specialized in complex systems modelling. He contributes to many international conferences organizations. During the past years, he has managed and he will manage the organization of many international workshops: "Emergent Properties in Natural and Artificial Complex Systems" in ECSS 2005, Paris, France, November 2005 and in ECSS 2007, Dresden, Germany, October 2007, "Modeling, Computation and Systems" in IEEE-ICECS 2005, Gamarth, Tunisia, December 2005, "Complex Systems and Self-organization Modelling" in ESM 2006, Toulouse, France, October 2006 and in ESM 2007, St Julian's Malta,

October 2007. He has edited 2 books in 2006 for Springer Verlag "Understanding Complex Systems" collection and for ESM 2006 conferences proceedings.

Title: "Agent-based Modeling, spatial self-organization systems and applications to territorial management"

Speaker: Rawan Ghnemat (LITIS, Le Havre University, France)

Abstract:

Agent-based modeling is an efficient implementation to describe complex systems, using distributed artificial intelligence. Agent can be seen as an extension of object modeling with more abstract and autonomous properties to the program entities. Multi-agent systems extends agent modeling by social interactions and our goal is to implement automatic self-organization from these social artificial systems. We will describe an innovative way to represent the agent behavior using automata with multiplicities and we will use genetic approaches allowing to model an efficient way to control the whole system, according to some objectives more than by constraining the system entities. We will focus the applications to environmental systems, territorial management and sustainable development : what is currently called "territorial intelligence". The goal is to give some tools for decision support systems according to urban dynamics for example, by modeling the control of the system based on dynamic evolution of interactions networks. For that purpose, we will present how mixing agent-based modeling with geographical information system. Practical aspects of GIS will be presented and how complex system could allow to extend the GIS in intelligent system, including self-organization models . A practical presentation will be based on the agent platform Repast and its implementation for GIS: agent analyst.

Outline:

- agent concept and implementation architecture
- multi-scale complex system modeling
- agent behavior model based on automata with multiplicities
- genetic automata
- example for evolutive negotiation
- behavioral distance
- communities detection
- application to GIS and Agent based modeling mixing
- Repast and GIS agent analyst implementation
- application to territorial management and to urban dynamic

Speaker short biography:

Rawan Ghnemat is currently PhD student in LITIS laboratory from Le Havre University, France, from French government scholarship, after obtaining an engineering bachelor in geomatics and a master of sciences in computer sciences in Al-Balqa Applied University, Jordan. She has already published many papers and has presented her work in many international conferences from November 2005, in ECSS 2005 (Paris, France 2005), ESM 2006 (Toulouse, France, 2006), Ecosummit 2007 (Beijing, China, 2007), WCE 2007 (London, UK, 2007), ECSS 2007 (Dresden, Germany, 2007), ESM 2007 (St Julian's Malta, 2007). She has written a chapter in a book from Springer collection "Understanding complex systems".

Title: "Data Mining and applications"

Speaker: Doctor Fadi Thabtah (Philadelphia University, Jordan)

Abstract:

The availability of high speed computers, automated data collection tools and large memory capacities made the process of collecting and storing huge quantities of information possible. For instance, the number of sales transactions during one year for a large retail store in the UK is large and the amount of data on the World Wide Web (WWW) is large as well. This enormous growth of stored databases provided an opportunity for new intelligent data techniques, which can produce useful information from these databases. The process of extracting this useful knowledge is accomplished using data mining techniques. Data mining is one of the main phases in Knowledge Discovery from Databases (KDD), which extracts useful patterns from data. Data mining can be used for many tasks, including, classification, clustering, association rule discovery and outlier analysis. These tasks can be accomplished using various data mining techniques

that are adopted from different scientific fields, particularly statistics and artificial intelligence. There is no single data mining technique applicable to all tasks and when it comes to choosing a technique for a particular problem, the choice is very critical as one technique could work well for one problem and poor else where. There are many factors that can be considered before taking such a decision like the size and nature of the data, attribute types (text, real, ..., etc), number of columns, output format and more importantly the goal of application.

Association rule mining and classification are analogous tasks, with the exception that classification's main aim is the prediction of class labels, while association rule mining describes associations between attribute values in a database. In the last few years, association rule mining has been successfully used to build accurate classifiers, which resulted in a new approach, known as Associative Classification (AC). Several studies provide evidence that AC approaches are able to extract more accurate classifiers than traditional classification techniques, such as decision trees, rule induction and probabilistic approaches. In contrast to rule induction approaches, which greedily and locally derive rules, AC explores the complete training data set and aims to construct a global classifier.

Outline:

- Data Mining and its main applications
- Classification and association rule mining
- Associative Classification and its importance
- Recent research publications in associative classification
- Challenges and new research directions in associative classification

Speaker short biography:

Dr. Fadi is a senior Lecturer at Philadelphia University. His research interests lie in the investigation and development of new data mining, scheduling and machine learning techniques, which bridge the gap between the theory and practice of decision making, using artificial intelligence techniques. In the last few years Dr. Fadi participated in several technical committees board for international journals and conferences, i.e. Chair for the IEEE ITNG '08 conference, AI-05, AI-06, AI-07, DBA-06, Journal of Applied Soft Computing, Journal of Software Engineering and Knowledge Engineering, etc. Dr. Fadi is currently supervising 5 PhD students and 2 Mphil students working in Data Mining and Computer Networks. Previously Dr. Fadi was working as a senior Lecturer at the University of Huddersfield where he successfully published multiple journal and conference papers in data mining and Computer Networks many of which were published by IEEE, and Springer. Dr. Fadi was active in research as a member of the Modelling Optimisation Scheduling And Intelligent Computing (MOSAIC) research group at Bradford University where he has investigated the use of association rule data mining in real world scheduling problems. From 2002 to 2005, he has published 13 research papers, 3 sponsored by IEEE computer society and 3 are journal papers in recognised international data mining and scheduling journals. Outside academia, he has worked as a Database Administrator for an insurance company and as a software developer, responsible for the development of an in-house billing system. He remains active in software development, having recently developed a system for credit card scoring

Title: "Dynamics combinatorics, complex systems and applications to physics"

Speaker: Professor Gérard H.E. Duchamp (LIPN, Paris 13 University, France)

Abstract:

We focus our attention for this seminar on some innovative works on emergence computation from interaction networks which are nowadays powerful tools for modeling complexity. A special care will be addressed to dynamic structures which motion can follow some properties or can be in correspondence to some enumerative structures. The associated evolutionary systems which can be modeled by these structures, are often built on elementary transition rules and lead to emergent properties. The goal is to find a better understanding of evolvable complex systems by these methodologies. Applications of dynamics structures will be given in physics.

Outline:

- Transition systems (finite and infinite) examples will be taken from Computer Sciences and Quantum Physics
- Variations on coefficients : semirings
- Rationality, matrices and paths
- Distances
- Control and genetic algorithms

- Collective modelling (communities, schelling etc...)

Speaker short biography:

Professor Gérard H.E. Duchamp is one of the founders of the series of congresses FPSAC. Born in 1951 (Paris, France), he took his studies and degrees in the region of Ile de France and began trainer for the competitive examinations of "Grandes écoles". He received his Ph. D. and Habilitation in Paris VII under the direction of Dominique Perrin and Marcel-Paul Schützenberger (a member of French Academy of Sciences), both founders of the french school of Theoretical Computer Science. Pr.G.H.E. Duchamp's interests cover essentially the interplay between computation and the other areas of knowledge. His publications cover many domains where computation is involved such as: Automata Theory, Lie algebras, Quantum groups, Combinatorics (he made a video on the subject with Xavier Viennot), Computer algebra, Representation Theory and Quantum Physics.