Editors: N. Mastorakis, V. Mladenov, Z. Bojkovic
Associate Editor: D. Simian

# Latest Trends on Computers

## VOLUME II

14th WSEAS International Conference on Computers
(Part of the 14th WSEAS CSCC Multiconference)

Corfu Island, Greece, July 23-25, 2010

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**Preface**

This year the 14th WSEAS International Conference on COMPUTERS (Part of the 14th WSEAS CSCC Multiconference) was held on Corfu Island, Greece, July 23-25, 2010. The conference remains faithful to its original idea of providing a platform to discuss algorithms and theory of computation, artificial intelligence, graphics, computer networking, military communications, programming languages, fault tolerance, computational linguistics, algorithms and multiplexity, microprocessors, microcomputers, mobile computing, intelligent agents, mathematical logic and computers, image, video and internet technologies, web-based education, modelling and simulation etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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## Keynote Lecture 1

# Optimizing the Performance of Scientific Java Applications

**Professor Kleanthis Psarris**
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**Abstract:** As part of its type-safety regime, the Java semantics require precise exception at runtime when programs attempt out-of-bound array accesses. In general, this requires a dynamic bounds check each time an array element is accessed, which limits the performance of array intensive scientific applications implemented in Java. However, if it can be proven that the array index is within the bounds of the array, the check can be eliminated. We present a new algorithm based on extended Static Single Assignment (eSSA) form that builds a constraint system representing control flow qualified, linear constraints among program variables derived from program statements. Our system then derives relationships among variables, and provides a verifiable proof of its conclusions. This proof can be verified by a runtime system to minimize the analysis' performance impact. Our system simultaneously considers both control flow and data flow when analyzing the constraint system, handles general linear inequalities instead of simple difference constraints, and provides verifiable proofs for its claims. We present experimental results demonstrating that this method eliminates more bounds checks than prior approaches with minimal overhead during JIT compilation. Furthermore our algorithm increased the speed at which the Java benchmarks executed by up to 16%.

**Brief Biography of the Speaker:**
Kleanthis Psarris is Professor and Chair of the Department of Computer Science at the University of Texas at San Antonio. He received his B.S. degree in Mathematics from the National University of Athens, Greece in 1984. He received his M.S. degree in Computer Science in 1987, his M.Eng. degree in Electrical Engineering in 1989 and his Ph.D. degree in Computer Science in 1991, all from Stevens Institute of Technology in Hoboken, New Jersey. His research interests are in the areas of Parallel and Distributed Systems, Programming Languages and Compilers, and High Performance Computing. He has designed and implemented state of the art program analysis and compiler optimization techniques and he developed compiler tools to increase program parallelization and improve execution performance on advanced computer architectures. He has published extensively in top journals and conferences in the field and his research has been funded by the National Science Foundation and Department of Defense agencies. He is an Editor of the Parallel Computing journal. He has served on the Program Committees of several international conferences including the ACM International Conference on Supercomputing (ICS) in 1995, 2000, 2006 and 2008, the IEEE International Conference on High Performance Computing and Communications (HPCC) in 2008, 2009, and 2010, and the ACM Symposium on Applied Computing (SAC) in 2003, 2004, 2005 and 2006.

## Plenary Lecture 1

# Color Pattern Recognition for Computer Vision using Conversion of the Color Space, Neural Classifiers and Feature/Decision Fusion

**Professor Victor-Emil Neagoe**
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**Abstract:** This lecture is an approach dedicated to the improvement of color pattern recognition performances for computer vision. Like humans, the artificial intelligence systems use color for pattern recognition. There are a lot of systems for pictorial content representation and recognition based on color features. First section is dedicated to the evaluation of the color spaces for computer vision. One considers the conversion from the conventional RGB space into a color space with improved pattern recognition performances. In the second section, we present the model of Concurrent Neural Classifiers (CNC) representing a collection of small neural networks, which use a global winner-takes-all strategy. Each neural module is trained to correctly classify the patterns of one class only and the number of modules equals the number "M" of classes. One considers the case of choosing the SOM (Self-Organized-Map) as a neural module. We built "M" training pattern sets and each neural module is trained with the pattern set characterized by the corresponding class label. Third section has as theme data fusion for color pattern recognition as an emerging technology with significant advantages over simple source data . We consider data fusion and feature fusion for the channels of the considered color space. Fourth section is dedicated to the special technique of pattern recognition called decision fusion, by combining the classification powers of several classifiers. The combination function should take advantage of the strengths of the individual classifiers, avoid their weaknesses, and improve classification accuracy. We present the experimental results of our approach for color pattern recognition in the fields of biometrics and robotics.

**Brief Biography of the Speaker:**
Dr. Victor-Emil Neagoe is a Professor of the Department of Electronics, Telecommunications, and Information Technology at the Polytechnic University of Bucharest, Romania.
He teaches the following courses : Pattern Recognition and Artificial Intelligence; Digital Signal Processing; Computational Intelligence ; Detection and Estimation for Information Processing. He co-ordinates 10 Ph.D. candidates.His research interest corresponds to the fields of pattern recognition, computational intelligence, biometric technology , satellite image analysis and sampling theory. Prof. Neagoe is author of more than 120 published papers.His has internationally recognized results concerning concurrent self-organized maps, face recognition, optimum color conversion, syntactical self-organized maps, nonuniform sampling theorems, inversion of the Van der Monde matrix, predictive ordering and linear approximation for image data compression, Legendre descriptors for classification of polygonal closed curves.
He has been included in Who's Who in the World and Europe 500 and he has been nominated by the American Biographical Institute for American Medal of Honor and for World Medal of Honor. He has been a Member IEEE since 1978 and a Senior Member IEEE since 1984. He has been a plenary speaker for several WSEAS conferences since 2006 till 2009.

## Plenary Lecture 2

# The Maximum Clique Problem

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**Abstract:** A clique is a subgraph in which all pairs of vertices are mutually adjacent. A maximum clique is a clique of the maximum size. Thus, a maximum clique stands for a maximum collection of objects which are mutually related in some specified criterion.
The so called maximum clique problem, or the complementary problem, the maximum independent set problem, is one of the original 21 problems shown to be NP-complete by R. Karp. Therefore, it is strongly believed that the maximum clique problem is not solvable easily, i.e., it is not solvable in polynomial-time. Nevertheless, much work has been done on this problem, experimentally and theoretically. It attracts much attention especially recently since it has found many practical applications.
In this lecture, we are concerned with recent progress of efficient algorithms for finding a maximum clique. We focus on branch-and-bound algorithms in which appropriate bounding condition is most crucial. The step-by-step improvements on the bounding condition and their effectiveness are presented. Some algorithms for generating all maximal cliques are also shown. We give evaluations on these algorithms not only experimentally but also theoretically. We also give a natural condition in which the maximum clique problem can be proved to be polynomial-time solvable.
In addition, we address successful applications of these algorithms to bioinformatics, image processing, data mining, and others.

**Brief Biography of the Speaker:**
Etsuji Tomita received his B. Eng. and Dr. Eng. degrees in Electronics Engineering from Tokyo Institute of Technology, Japan, in 1966 and 1971, respectively. Then he was with the faculties of Tokyo Institute of Technology, and was appointed Associate Professor and subsequently Professor at the University of Electro-Communications, Japan. Since 2008, he has been Professor Emeritus at the University of Electro-Communications and Professor at the Research and Development Initiative of Chuo University. He also teaches at Hokkaido University as a part-time lecturer. He served as the Head of the department of Information and Communication Engineering, and the Head of the Advanced Algorithms Research Laboratory at UEC.
His research interests include design and analysis of computer algorithms, combinatorial optimization and its application to practical problems, algorithmic learning theory, and theory of automata and formal languages.
His academic contributions include Editor of IEICE (Institute of Electronics, Information and Communication Engineers) and Editor-in-Chief of IPSJ (Information processing Society of Japan), Local Arrangement Chair of ALT (Algorithmic Learning Theory), Chair of SIG Mathematical Modeling and Problem Solving of IPSJ, Program Committee Chair of ALT 2005, and he served as a Guest Editor of Theoretical Computer Science, Conference Chair of ICGI (International Colloquium on Grammatical Inference) 2006, Director of IPSJ, Chair of Computer Science Domain of IPSJ, and Councilor of JSAI (The Japanese Society for Artificial Intelligence). He is presently a member of Steering Committee of ICGI.
He was given the Yonezawa Award of IECE, the Funai Information Technology Prize, and the Contribution Award of SIG MPS of IPSJ, and is presently a Fellow of IEICE and IPSJ.
He is a co-author of two papers that were given Yamashita Research Award of IPSJ, and of a paper that was given Encouraging Award of Computer Science Domain of IPSJ.

## Plenary Lecture 3

# Fault Diameters of Graph Products and Bundles

**Professor Janez Zerovnik**
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**Abstract:** Fault tolerance and transmission delay of networks are important concepts in network design. The notions are strongly related to connectivity and diameter of a graph, and have been studied by many authors. Wide diameter of a graph combines studying connectivity with the diameter of a graph. Diameter with width $k$ of a graph $G$ is defined as the minimum integer $d$ for which there exist at least $k$ internally disjoint paths of length at most $d$ between any two distinct vertices in $G$. In the context of computer networks, wide diameters of Cartesian graph products have been recently studied [5, 6]. Cartesian graph bundles [7] is a class of graphs that is a generalization of the Cartesian graph products. We show that if $G$ is a $k_G$-connected graph and $D_c(G)$ denotes the $c$-diameter of $G$, then $D_{a+b}(G) \leq D_a(F) + D_b(B)$, where $G$ is a graph bundle with fiber $F \neq K_2$ over base $B \neq K_2$, $0 < a \leq k_F$, and $0 < b \leq k_B$ [4]. Not surprisingly, there are analogous inequalities known for some related invariants including vertex- and edge-fault diameters [3, 1] and hence it is interesting to study the relationships among these obviously related notions. I will briefly report on some recent work with Iztok Banič and Rija Erveš [1, 2, 3, 4].

**Brief Biography of the Speaker:**
Janez Zerovnik received the B.S. and M.S. degree in mathematics from University of Ljubljana, Slovenia. In 1992 he received Ph.D. degree in Computer Science from University of Ljubljana and in 1994 Ph.D. degree in mathematics from Technical University Graz, Austria. He is author or coauthor of over 80 journal articles and over 80 contributions in refereed conference proceedings, and wrote five textbooks for undergraduate students. Currently, he is Professor of mathematics at the Faculty of Mechanical Engineering at University of Ljubljana and part time researcher at the Institute of Mathematics, Physics and Mechanics. His research interests include discrete mathematics, in particular graph theory and its applications in computer science, operational research, mathematical chemistry, etc.

## Plenary Lecture 4

# Interpolation and Design of Geometric Algorithms

**Professor Dana Simian**
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**Abstract:** The aim of this talk is to present different interpolation schemes and their applications in the geometrical design of algorithms. Theoretical and computational aspects are discussed. We introduce new interpolation schemes and compare with the classical ones. Our interest is to obtain curves and surfaces of class Gk, satisfying given constraints and to visualize them. The implementation of the algorithms is made in MATLAB environment. We develop new functions and analyze their performance.

**Brief Biography of the Speaker:**
Dana Simian received the diploma. in engineering from the University of Sibiu, Romania, the diploma. in Mathematics - Informatics from the University Babes-Bolyai of Cluj-Napoca, Romania and the Ph.D. from Babes-Bolyai University of Cluj- Napoca, Romania. She graduated many courses in Computer Science. She is the head of the Department of Computer Science from the Faculty of Sciences, University Lucian Blaga of Sibiu, Romania. She has a great experience in algorithms and numerical methods for modelling and optimization. She published 16 books, more than 60 articles and participated in the editorial board of more than 22 scientific publications (proceedings of international conferences).
She organized 7 special sessions within WSEAS conferences, 2 international workshops and an international conference on topics related to algorithms and computational techniques in modeling, approximation and optimization. She was a member of many scientific committees of international conferences. She was plenary speakers in 6 international conferences. She is reviewer of many scientific publications. She was involved as director of many research grants. She has been included in "Who is Who in the World" in 2006-2009 and in the "IBC Foremost Engineers of the World", 2008.

## Plenary Lecture 5

# Improvement Research Activity Management in Universities, by using ICT Technology

**Professor Maria Moise**
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**Abstract:** Nowadays, the universities realize that research area is the most important asset for future development. In this context, the European Union and all the EU member states are committed to develop a common European Research Area. In this lecture I present an informatics system in order to improve the research activity management of the universities. This system is based on data base driven dynamic Web technologies and it provide: repository for collecting all the internal research results such as papers, books, contracts, patent, products etc. at each individual level, group level (research centers, faculties, university etc.) in order to coordinate the assessment processes; research dissemination and technology transfer in order to distribute and make available its patrimony of skills and resources in an accessible form that can be exploited by interested organizations; integration between the university research systems and national or EU institutional systems, in order to simplify and to increase the research development and administration; management all projects underway within a standard process which identifies various common operative phases, regardless of the nature of the financing body. In this way, the system realized can be integrated easily into the national/European research e-platform.

**Brief Biography of the Speaker:**
At present, Maria Moise is full-time professor at the Faculty of Computer Science for Business Management of the Romanian American University of Bucharest, Romania, and also she is Vice Rector with research activity. Between 1999-2003 she was Dean and Rector at AISTEDA University of Bucharest. She received the M. Sc. in Mathematics at the University of Bucharest, specialized in Operation Research in 1972, and in 1996 she obtained his doctoral degree in Economic Informatics at the Academy of Economic Studies of Bucharest in the field of information systems & intelligent systems applied in economic area. Since 1972 until 1999 she worked as scientific researcher at National Institute for Research & Development in Informatics (1972-1999), and also she was teaching at University of Craiova, Polytechnic University of Bucharest and Academy of Economic Studies of Bucharest. Between 1993-1994, Professor Moise obtained two Research Fellowships at LAFORIA Laboratory of P. M. University, Paris VI and she worked in the field of Decision Support System, Expert Systems and Fuzzy Logic. Between 2001-2003 she was standing member of Steering Committee regarding "Promoting Multimedia Access for Education and Training in European Society" - PROMETEUS - EU, as Romanian representative. Her research interests include intelligent systems, neural networks, fuzzy logic, rough sets, mathematic modeling, web technologies, e-learning environments, e-business, e-government and e-health. She is the author/co-author of 16 books and over 170 scientific papers. She has extensive experience in IT project management, having more than 50 research contracts funded by National/International Programs. She has been the organizer of several national/international conferences. She is also national assessor of National Programs (CEEX, PNCDI) and also European expert at FP6 (e-business) and FP7.

## Plenary Lecture 6

# Semantic Schema: A Graph Based Mechanism for Cooperating Structures in Knowledge Representation

**Professor Nicolae Tandareanu**
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**Abstract:** A semantic schema S is a graph structure such that each arc is labeled by an element of a Peano algebra. Two kinds of computations can be defined in such a structure: a formal computation and a semantic computation. The result of a formal computation is an element of a certain Peano algebra generated by means of the arcs of S. This is an abstract computation. The semantic computation is defined by means of an interpretation such that each node of S becomes an object of a real world and an arc describes a transformational process of two objects. Finally the result of the formal computation is interpreted by means of the semantic computation.
In this lecture we are concerned with recent progress in this domain. More precisely, the use of semantic schemas to obtain cooperating structures in order to increase the generative power of this mechanism of knowledge representation and reasoning systems is presented. We focus on the following cooperating structures based on semantic schemas: master-slave systems and hierarchical distributed reasoning systems. The first structure includes one master schema and several slave-schemas. These structures cooperate in a specific manner in order to find an answer to a query. The second structure is an arborescent one, such that each node is a semantic schema and the cooperation is based on a transfer of knowledge between nodes. Other kinds of cooperating structures are also discussed: cooperation based on maximal graphs and cooperation based on inheritance. Several applications of cooperating structures based on semantic schemas are discussed: image generation, semantics of communication, contact centers, dialogue systems.

**Brief Biography of the Speaker:**
Nicolae Tandareanu received the diploma in mathematics and Ph.D. from the University of Bucharest, Romania, in 1970 and 1975, respectively. He is currently Professor of Computer Science at the Faculty of Mathematics and Computer Science at University of Craiova, Romania. Nicolae Tandareanu is the Head of the Research Center for Artificial Intelligence and the Dean of the Faculty of Mathematics and Computer Science at University of Craiova. He teaches the following courses: Knowledge Bases, Algebraic Representation of Knowledge, Object Oriented Systems for Knowledge Representation, Intelligent Dialogue Systems, Speech Processing.
Nicolae Tandareanu has published over 70 papers in refereed journals, lectures and monographs in the following domains: automata theory, formal languages, algorithms, numerical computation, generalized Boolean functions, logic programming, knowledge representation. He has chaired several international conferences in Romania and USA. He is quoted in the following encyclopedic works: International Book of Honor, Fourth World Edition (p. 223), Dictionary of International Biography, Twenty Fourth Edition (p. 328). His research includes algebraic methods for knowledge representation and their applications. Nicolae Tandareanu is reviewer at Zentralblatt fur Mathematik and Mathematical Reviews and member of the American Mathematical Society, Society for Computing Technologies and Romanian Mathematical Society.

## Plenary Lecture 7

# Digital Video Tamper and Forgery Detection Techniques

**Assistant Professor Girija Chetty**
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**Abstract:** DIGITAL Image tampering or forgery has become major problem lately, due to ease of artificially synthesizing photographic fakes- for promoting a story by media channels and social networking websites. This is due to significant advances in computer graphics and animation technologies, and availability of low cost off-the-shelf digital image manipulation and cloning tools. With lack of proper regulatory frameworks and infrastructure for prosecution of such evolving cyber-crimes, there is an increasing dissatisfaction about use of such tools for law enforcement, and a feeling of cynicism and mistrust among the civilian operating environments.
Another problem this has lead to, is a slow diffusion of otherwise extremely efficient image based surveillance and identity authentication technologies in real-world civilian operating scenarios. In this talk, we present novel algorithmic frameworks being developed for detecting image tampering and forgery based on different source features, their transformation in optimal subspaces and and statisical modelling of intra-frame and inter-frame image pixel sub blocks in video sequences. The proposed algorithmic models allow detecting the tamper or forgery in low-bandwidth video (Internet streaming videos), using blind and passive tamper detection techniques and attempt to model the source signatures embedded in camera pre-processing chain, and show immense potential in detections of evolving image tampering attacks, such as JPEG double compression, re-sampling and retouching. The promising results obtained can result in the development of digital image forensic tools, that can help investigate and solve evolving cyber crimes.

**Brief Biography of the Speaker:**
Dr. Girija Chetty has a Bachelors and Masters degree in Electrical Engineering and Computer Science from India and a PhD in Information Sciences and Engineering from University of Canberra, Australia. Presently she is a Assistant Professor in Software Engineering in University of Canberra, and her research interests are in the area of Biometric Security, Computational Intelligence, Image Processing, Computer Vision and Pattern Recognition. She has published extensively in refereed conferences and journals serves on Editorial Board and International Program and Review Committee' for several conferences and journals related to her research interests.

## Plenary Lecture 8

# Uncertain Knowledge Expressing and Processing

**Professor Guoyin Wang**
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**Abstract:** Uncertainty exists almost everywhere in the whole world. Uncertain knowledge expressing and processing has become one of the most important key problems of artificial intelligence research. There are many kinds of uncertainties in knowledge, such as randomness, fuzziness, vagueness, incompleteness, inconsistency, etc. Randomness and fuzziness are the two most important and fundamental ones. There are many studies about randomness and fuzziness in the past decades. Many theories and models for expressing and processing uncertain knowledge, such as probability & statistics, fuzzy set, rough set, interval analyses, cloud model, grey system, set pair analyses, extenic, etc have been proposed. In this talk, some key expanded set theories for expressing and processing uncertain knowledge, such as fuzzy set, rough set, type-II fuzzy set, interval-valued fuzzy set, intuitionistic fuzzy set, and cloud model are discussed. Their key idea and basic notions are introduced. Their difference and relationship are further analyzed. Rough set theory, which expresses and processes uncertain knowledge with certain methods, is discussed in detail. At first, the growing history of rough set theory is introduced briefly, and the developing trend of rough set theory is analyzed in several views. Then, the expansion of rough set theory to classical set theory is explained. The key set operators of rough set theory, such as intersection, union, difference, and complement, are explained with notions of classical set theory. Rough logic defined on information systems is also analyzed. Several typical application cases of rough set theory in artificial intelligence fields, such as fault diagnosis, intelligent decision, image processing, huge data processing, intelligent control and etc., are discussed to show the power of rough set for dealing with real world problems. These application cases illustrate the importance and advantages of rough set theory for expressing and processing the uncertain problems. At last, some key topics and problems to be further studied in the future for expressing and processing uncertain knowledge are discussed.

**Brief Biography of the Speaker:**
Professor Guoyin Wang was born in Chongqing, China, in 1970. He received the bachelor's degree in computer software, the master's degree in computer software, and the Ph.D. degree in computer organization and architecture from Xi'an Jiaotong University, Xi'an, China, in 1992, 1994, and 1996, respectively. He worked at the University of North Texas, USA, and the University of Regina, Canada, as a visiting scholar during 1998-1999. Since 1996, he has been working at the Chongqing University of Posts and Telecommunications, where he is currently a professor and PhD supervisor, the Chairman of the Institute of Computer Science and Technology (ICST), and the Dean of the College of Computer Science and Technology. He is also a part-time professor with the Xi'an Jiaotong University, Shanghai Jiaotong University, Southwest Jiaotong University, Xidian University, and University of Electronic Science and Technology of China. Professor Wang is the Chairman of the Steering Committee of International Rough Set Society (IRSS), Chairman of the Rough Set Theory and Soft Computation Society, Chinese Association for Artificial Intelligence (CRSSC). He served or is currently serving on the program committees of many international conferences and workshops, as program committee member, program chair or co-chair. He is an editorial board member of several international journals. Professor Wang has won many governmental awards and medals for his achievements. He was named as a national excellent teacher and a national excellent university key teacher by the Ministry of Education, China, in 2001 and 2002 respectively. Professor Wang was elected into the Program for New Century Excellent Talents in University by the Ministry of Education of P R China in 2004, and won the Chongqing Science Fund for Distinguished Young Scholars in 2008. He has delivered many invited talks at international and national conferences, and has given many seminars in USA, Canada, Poland, and China. The teaching group directed by Professor Wang was elected as a national excellent teaching group of China in 2010. The institute (ICST) directed by Professor Wang was elected as one of the top ten outstanding youth organizations of Chongqing, China, in 2002. Professor Wang is the author of 2 books, the editor of dozens of proceedings of international and national conferences, and has over 200 reviewed research publications. His books and papers have been cited over 4000 times. His research interests include rough set, granular computing, knowledge technology, data mining, machine learning, neural network, soft computing, cognitive computing, etc.

## Plenary Lecture 9

# Computationally Recognizing Causality in an Imprecise World

**Professor Lawrence J. Mazlack**
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**Abstract:** Causal reasoning perceptions play an essential role in human decision-making. Recognizing and developing causal relationships is essential for reasoning; it forms the basis for acting intelligentially in the world. Causal knowledge provides a deep understanding of a system; and, the potential control over a system that comes from being able to predict action's consequences. Relationships with a known cause/effect relationship have a high decision value. Causality description must necessarily be imperfect as knowledge is imperfect and limited. Commonsense understanding of the world tells us that we have to deal with imprecision, uncertainty and imperfect knowledge. Consequently, knowledge of at least some causal effects is inherently imprecise. A difficulty is striking a good balance between precise formalism and commonsense imprecise reality.
Causality is imprecisely granular in many ways. Causal complexes are groupings of smaller causal relations that make up a large grained causal object. Usually, commonsense reasoning is more successful in reasoning about a few large-grained events than many fine-grained events. However, the larger-grained causal objects are necessarily more imprecise as some of their constituent components. A satisficing solution might be to develop large-grained solutions and then only go to the finer-grain when the impreciseness of the large-grain is unsatisfactory.

**Brief Biography of the Speaker:**
Professor Mazlack studied computer science and applied mathematics at Washington University (St. Louis) and electrical engineering at both SDSM&T and Marquette University. He received his Doctorate of Science from Washington University. He also studied philosophy at both Washington University and at Marquette University. Along the way to his degrees, he did research in computer science, electrical engineering, and biomedical engineering. At Marquette both a Bacon Scholarship and an athletic scholarship (football) supported him. He is a member of the Omega Rho honorary. He has been a visiting scholar at the University of California, Berkeley (imprecise reasoning) and at the University of Geneva (computational linguistics). He is on the editorial board of several journals and has served on the program committee of many conferences.
Dr. Mazlack currently is at the University of Cincinnati where he is the head of the Applied Artificial Intelligence Laboratory and the chair of the Data and Knowledge Management research group. Beyond academia, at a large computer company, he was responsible for database software development. He has been closely involved with several small company startups. Away from technology, he has been professionally active in the visual, written, and dramatic arts.
Dr. Mazlack's current research is directed toward three areas:
• Causality, both theoretical and applied to observational data.
• Unsupervised data mining and the closely associated topic of autonomous recognition of web page ontologies in the context of the Semantic Web.
• Clustering multi-modal computational objects.
These interests are in the context of broader interests in: soft computing, natural language understanding, artificial intelligence, and databases.