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# Single Machine Total Weighted Tardiness Problem with Genetic Algorithms

António Ferrolho[1] and Manuel Crisóstomo[2]

[1]*Department of Electrotechnical Engineering*
*Superior School of Technology of the Polytechnic Institute of Viseu*
*Campus Politécnico de Repeses, 3504-510 Viseu*
*Portugal*
*antferrolho@elect.estv.ipv.pt*
[2]*Institute of Systems and Robotics*
*University of Coimbra, Polo II, 3030-290 Coimbra*
*Portugal*
*mcris@isr.uc.pt*

**Abstract**

*Genetic algorithms can provide good solutions for scheduling problems. In this paper we present a genetic algorithm to solve the single machine total weighted tardiness problem, a scheduling problem which is known to be NP-hard. First, we present a new concept of genetic operators for scheduling problems. Then, we present a developed software tool, called HybFlexGA, to examine the performance of various crossover and mutation operators by computing simulations of scheduling problems. Finally, the best genetic operators obtained from our computational tests are applied in the HybFlexGA. The computational results obtained with 40, 50 and 100 jobs show the good performance and the efficiency of the developed HybFlexGA..*

# Intelligent Agents and Apache Cocoon for a CV Generation System

Evelio J. González, Alberto Hamilton, Lorenzo Moreno, Juan A. Méndez, G.N. Marichal, José Sigut,
Marta Sigut and J. Felipe
*Dpto. Ingeniería de Sist. y Automática y Arq. y Tecnología de Computadores*
*Universidad de La Laguna, CP 38207, La Laguna, SPAIN*
*E-mail: ejgonzal@ull.es*

**Abstract**

*A dynamic system – based on Multiagent Systems (MAS) with XML and Apache Cocoon - for the automatic and dynamic generation of CV documents is presented in this paper. This pretends to be a useful application in particular for an academic and research environment, since every University model usually requires its members to manage a big amount of personal data, such as publications in journals and conferences attended. The application presented in this paper appears as a web portal where the users – in this case, professors and research students- can manage their CV data, where the authors remark the dynamic generation of the web*

# An Approach for Specification-based Test Case Generation for Web Services

Samer Hanna Malcolm Munro
*Department of Computer Science*
*Durham University*
{samer.hanna, malcolm.munro}@durham.ac.uk

## Abstract

*Web Services applications are built by the integration of many loosely coupled and reusable services using open standards. Testing Web Service is important in detecting faults and assessing quality attributes. A difficulty in testing Web Services applications is the unavailability of the source code for both the application builder and the broker. This paper propose a solution to this problem by providing a formal, specification-based approach for automatically generating test cases for Web Services based on the WSDL input messages parts' XML Schema datatypes. Examples of using this approach are then given in order to give evidence of its usefulness. The role of the application builders and the brokers in using this approach to test Web Services is also described.*

Keywords: Web Services, WSDL, XML Schema, Software testing.

# Construct Metadata Model based on Coupling Information to Increase the Testability of Component-based Software

Ma Liangli
*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*
*Computer Science & Technique College, Hua Zhong University of Science and Technology,Wuhan,Hubei,China,430074*
maliangl@163.com
*Wang Houxiang*
*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*
*Li Yongjie*
*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*

## Abstract

*A software component must be tested every time it is reused, to guarantee the quality of both the component itself and the system in which it is to be integrated. So how to increase testability of component has become a key technology in the software engineering community. This paper introduces a method to increase component testability. Firstly we analyze the meanings of component testability and the effective ways to increase testability. Then we give some definitions on component coupling testing criterion. And we further give the definitions of DU-I(Definition-Use Information) and OPVs( Observation-Point Values). Base on these, we introduce a definition-use table, which includes DU-I and OP-Vs item, to help component testers understanding and observing the component better. Then a framework of testable component based on above DU-table is given. These facilities provide ways to detect errors, to observe state variables by observation-points based monitor mechanism. And we adopt coupling-based testing using information DU-table provided. Lastly, we applied the method to our application software developed before, and generate some test cases. And our method is compared with Orso method and Kan method using the same example, presenting the comparison results. The relevant results illustrate the validity of our method, effectively generating test cases and killing more mutants.*

# A Reference Model of Grouped-Metadata Object and a Change Model based on it Appling for Component-based Software Integration Testing

Ma Liangli

*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*

*Computer Science & Technique College, Hua Zhong University of Science and Technology,Wuhan,Hubei,China,430074*

maliangl@163.com

*Wang Houxiang*

*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*

*Li Yongjie*

*Department of Computer Engineering, Naval University of Engineering, Wuhan, Hubei,China,430033*

## Abstract

*Component metadata is one of the most effective methods to improve the testability of component-based software. In this paper, we firstly give a formal definition of component, and summarize the basic meanings of component metadata. Based on these, an idea of Grouped-Metadata Object (GMO) is introduced, which is divided into two types, respectively named descriptive metadata and operative metadata. And a general framework of descriptive metadata and operative metadata is further given, which is consisted of several groups. Each group includes several attributes, and their meanings are described in detail. Furthermore, we give a formal reference model of GMO using class diagram of UML. Combining with the above formal model, we present change model used in GMO and introduce an idea to map all changes inside component to the changes in component interfaces, mainly referring to changes of public method and variables. Here we introduce a concept of Method Dependency Graph(MDG) to implement the mapping. Then the changes are reflected in relevant attributes in GMO provided to component users in order to facilitate component-based software integration testing and regression testing. Finally the case study based on previous formal model is done, and the corresponding results are given. All these show effectively that the models we presented are valid and helpful for componentbased software integration testing and regression testing.*

## An Eclipse Plug-in: Dependency Browser

Dapeng Liu

Department of Computer Science

Wayne State University

Detroit, USA

dliu@wayne.edu

Shaochun Xu

Algoma University College

Laurentian University

Sault Ste. Marie, Canada

simon.xu@algomau.ca

Zhongyuan Liu

School of Computer and Communication

Lanzhou University of Technology

Lanzhou, China

boat2004@mail2.lut.cn

## ABSTRACT

Dependency search is an important tactic in many software activities, particularly during software maintenance. Eclipse has a few powerful tools to support such activity but they can be more convenient for programmers to use. In this paper, we proposed a light-weight and agile Eclipse plug-in: Dependency Browser, which parses call dependencies and presents them with a serfriendly interface which automatically reacts to some specific programmers' actions. We tested Dependency Browser on four open-source applications to check the usability, speed and memory usage. The test result demonstrated that our new Eclipse plug-in is convenient to use, fast to run, and has high precision Therefore, the Dependency Browser could be further developed into a useful commercial tool and help programmer to conduct software maintenance tasks

# A Component Model for Network Processor Based System

Hong Xiao Di Wu

*Guangdong University of Technology, computer system architecture research centre, Guangzhou, Guangdong*

*Wh_red@163.com*

## Abstract

*Network processors usually consist of multiple heterogeneous processing and memory units connected by on-chip network, and the target applications generally need to process packets at full line rate from Gbit/s to multiple 10 Gbit/s. Network processor based applications are real-time, resource-constrained and heterogeneous. We believe that component technology is a promising approach for complex embedded system development.However, the general purpose component technology is not suitable for the contexts of network processor. This paper gives general guidelines for applying component technology to network processor based systems. A component model is proposed according to the features of hardware architecture and target applications. We show that the component model could simplify composition and improve predictability for network processor based systems.*

# Using Maintainability Based Risk Assessment and Severity Analysis in Prioritizing Corrective Maintenance Tasks [1]

W. Abdelmoez, K. Goseva-Popstojanova, H.H. Ammar
Lane Department of Computer Science and Electrical Engineering,
West Virginia University
Morgantown WV 26506
{rabie, katerina, ammar}@csee.wvu.edu

## Abstract

*A software product spends more than 65% of its lifecycle in maintenance. Software systems with good maintainability can be easily modified to fix faults. We define maintainability-based risk as a product of two factors: the probability of performing maintenance tasks and the impact of performing these tasks. In this paper, we present a methodology for assessing maintainability-based risk in the context of corrective maintenance. The proposed methodology depends on the architectural artifacts and their evolution through the life cycle of the system. In order to prioritize corrective maintenance tasks, we combine components' maintainability– based risk with the severity of a failure that may happen as a result of unfixed fault. We illustrate the methodology on a case study using UML models.*

**Keywords:** maintainability-based risk, severity analysis, corrective maintenance, software architectures.

# Towards Maintainable Architecture for Process Control Applications [1]

I. A.M. El-Maddah
The Department of Computer and Systems Engineering,
Ain Shams University
Cairo, Egypt
islam_elmaddah@yahoo.co.uk
W. Abdelmoez , H.H. Ammar
Lane Department of Computer Science
and Electrical Engineering,
West Virginia University
Morgantown WV 26506
{rabie, ammar}@csee.wvu.edu

## Abstract

*Development of software systems utilizes only 20% 40% of the overall project cost; the rest is consumed by maintenance. Systems with poor maintainability are difficult to modify and to extend. Maintainability based risk is defined as a product of two factors: the probability of carrying out maintenance tasks and the impact of these tasks. The decision of adopting a single architecture over others should be verified through some pre-implementation analysis. This paper assesses different architectures for process control applications using a maintainability risk analysis. The paper illustrates the methodology using a simple example of a Gas Burner process control system.*

**Keywords:** maintainability-based risk, adaptive maintenance, software architectures, conflict analysis, goal-driven requirement analysis.

# A Meta-analysis Approach to Refactoring and XP

Steve Counsell, Robert M. Hierons,
*Department of Information Systems and Computing,*
*Brunel University, Uxbridge, Middlesex. UB8 3PH.*
*{steve.counsell, rob.hierons}@brunel.ac.uk*
George Loizou,
*School of Computer Science, Birkbeck, University of London,*
*Malet Street, London, WC1E 7HX.*
*george@dcs.bbk.ac.uk*

## Abstract

*The mechanics of seventy-two different Java refactorings are described fully in Fowler's text [13]. In the same text, Fowler describes seven categories of refactoring, into which each of the seventy-two refactorings can be placed. A current research problem in the refactoring and XP community is assessing the likely time and testing effort for each refactoring, since any single refactoring may use any number of other refactorings as part of its mechanics and, in turn, can be used by many other refactorings. In this paper, we draw on a dependency analysis carried out as part of our research in which we identify the 'Use' and 'Used By' relationships of refactorings in all seven categories. We offer reasons why refactorings in the 'Dealing with Generalisation' category seem to embrace two distinct refactoring sub-categories and how refactorings in the 'Moving Features between Objects' category also exhibit specific characteristics. In a wider sense, our meta-analysis provides a developer with concrete guidelines on which refactorings, due to their explicit dependencies, will prove problematic from an effort and testing perspective.*

# A Formal Approach for Functional and Structural Test Case Generation in Multi-Agent Systems

Yacine Kissoum Zaidi Sahnoun
*Lire Laboratory, Lire Laboratory,*
*Skikda University, Algeria. Mentouri University, Constantine Algeria.*
kissoumyacine@yahoo.fr sahnounz@yahoo.fr

## Abstract

*Testing can be functional or structural. Neglecting one technique to the prejudice of the other is fundamentally flawed. In this paper, we propose an automated test case generation for agent based systems. The approach uses the system's specification and implementation. The functional testing uses a combination of the formal language Maude and a new kind of diagrams calle InterElement Requirement Diagrams (IRD). For the structural testing, we propose a coverage criterion where the generated test cases will provide a level of coverage in the system's execution. We achieve our goal by translating agent's plans to Petri Nets where the computation is performed in the places and decisions, posted goals or dispatched messages are performed in the transitions. We have three levels of criteria: place, transition and plan.*

# Component based development of non-visual applications using braille-speech widgets

Amina Bouraoui
*UTIC-ESSTT*
*5, Av. Taha Hussein, B.P. 56, Bab Menara, 1008 Tunis, Tunisia*
*hannibal.a@topnet.tn*

## Abstract

*This paper exposes how to create reusable components that can be used by developers to implement applications for visually handicapped users. The non visual components are widgets adapted from graphical ones like menus, list boxes, edit boxes, and they use specific input/output devices and specific interaction principles. They are implemented as components to facilitate the component based development of non visual applications. The contribution of this work in the field of assistive technology is valuable, because there are no existing tools that facilitate the creation of interfaces for the blind users, and it may considerably improve computer access for this category of users.*

**Keywords**

Reusable software, component based development, assistive technology, model driven engineering.

# Development of a Web Based Database-Centric Workflow Management System Using Rapid Prototyping Approach

Zahra J. Muhsin
*School of Computing & Technology,*
*Sunderland University, UK*
*E-mail: zjmuhsin@yahoo.co.uk*

Ali H. El-Mousa
*Computer Engineering Dept.,*
*University of Jordan, Jordan.*
*E-mail: elmousa@ju.edu.jo*

Ian Potts
*School of Computing & Technology,*
*Sunderland University, UK*
*E-mail: Ian.Potts@sunderland.ac.uk*

## Abstract

*Workflow management systems have gained momentum in recent years due to the several benefits they provide. This paper describes the business process and development of a web based enterprise level Workflow Management Information System (WKFMIS). This system is suggested to manage workflow activities involved in the process of repair requests handling and maintenance of computer systems and associated peripherals in the Faculty of Engineering and Technology (FET) at the University of Jordan. This is achieved by analyzing the process activities involved in an existing paper-based manual workflow management system with the aim of improving the existing business process and automating most of the related activities. A fully functional prototype is developed and deployed in the FET working environment. Key technologies suitable for this approach are identified and implemented. Performance of the developed system is assessed practically and an efficient, stable and user-friendly operation is demonstrated.*

# SERP: Scalable Efficient Reservation Protocol for the

M. Mtshali
Telkom SA Ltd, South Africa
mzmtshali@yahoo.com
GE Ojong
University of Zululand, South Africa
gojong@pan.uzulu.ac.za
MO Adigun
University of Zululand, South Africa
madigun@pan.uzulu.ac.za

## ABSTRACT

The fast Internet growth has led to high demands requiring QoS provisioning mechanism to be implemented in the future Internet. This paper presents the development and implementation of a resource reservation scheme to allocate and manage resource in the future internet. We propose a Scalable Efficient Reservation Protocol (SERP) to efficiently allocate and manage resources in the future Internet. SERP takes into consideration the fact that the future Internet will accommodate both real time and non real time applications. Relevant design goals and principles were identified and these led to a formulation of a corresponding model. Simulation of the model was conducted to evaluate the performance of the developed scheme. The experimental results do show that SERP reduces the router load with less states information to be maintained. Use of aggregate-based reservation further reduces states information. Consequently SERP improves scalability. Results further demonstrate that request acceptance probability is high and more connections are established for end-to-end reservation.

## Keywords
Quality of Service, resource reservation, SERP

## On Secure Consensus Information Fusion over Sensor Networks

Mahdi Kefayati†⋆, Mohammad S. Talebi†, Hamid R. Rabiee†⋆, Babak H. Khalaj†
†Sharif University of Technology, ⋆Iran Telecommunication Research Center (ITRC)
kefayati@ce.sharif.edu, mstalebi@ee.sharif.edu, rabiee@sharif.edu, khalaj@sharif.edu

## Abstract

*In this work we have examined the problem of consensus information fusion from a novel point of view, challenging the fundamental assumption of mutual trust among the fusion parties. In quest for a method to make information fusion possible while preserving the mutual confidentiality and anonymity of the fused information even in case of collusion of the malicious nodes, we propose the* Blind Information Fusion Framework (BIFF). *In BIFF, which is a secure information fusion framework, the nodes are not aware of the actual information they are processing, yet converging to the intended result(s). We formulate BIFF according to the* anonymization transform *and discuss its robustness against collusions for privacy violation. As an example, two secure consensus averaging methods are formulated according to BIFF.*

# QoS Routing of VoIP using a Modified Widest-Shortest Routing Algorithm

Ala F. Khalifeh,
*Electrical and Computer Engineering Department,*
*University of California-Irvine, CA*
*akhalife@uci.edu*
Ali H. El-Mousa
*Computer Engineering Department,*
*Faculty of Engineering & Technology*
*University of Jordan, Amman, Jordan*
*elmousa@ju.edu.jo*

## Abstract

*Implementation of current real time services (of which one of the more important is Voice over IP) on the current Internet face many obstacles, among them the issue of routing. Quality of service (QoS) routing, attempts to provide real time services with the required guarantees to achieve acceptable performance. In this paper we study VoIP routing using the Quality of Service (QSR) network simulator utilizing the Widest-Shortest routing algorithm to provide QoS using different metrics. We show that this algorithm using a modified cost metric based on the hopnormalized is able to route real time traffic away from congested links thus providing acceptable jitter, end-toend delay and throughput to satisfy real time services requirements.*

# A Multi-Agent Flexible Architecture for Autonomic Services and Network Management

Yazeed Al-Obaisat, Robin Braun
Institute of Information and Communications Technology
Faculty of Engineering,
University of Technology, Sydney
Email: yazeedal@eng.uts.edu.au

## Abstract

*Modern data and communication networks have been growing dramatically in diversity, heterogeneity and complexity. Hence the management of such dynamic networks is an extremely difficult task due to some key issues such as; the increasing network size and functionality, rapidly and continuously changing network topology and complexity. This paper introduces a management paradigm to give rise to the autonomic management solutions (i.e., activation, monitoring, control, and administration) of management functionalities. It also introduces an architecture that (1) places the various management functions (FCAPS) into a design structure that can be used to select those functions that may give way to autonomic management and (2) to design the algorithms that may fulfill the management function. This architecture consists of four horizontal logical layers (Products, Components, Services, and Resources Layers) and two vertical logical layers (Management layer and information layer). Autonomous management agents (Swarm agents in this context) sit in the management layer and can sense changes/events in the four horizontal layers and react autonomically to reconfigure and adapt themselves based on the information scattered and gathered over the network.*

paradigm to give rise to the autonomic management solutions (i.e., activation, monitoring, control, and administration) of management functionalities. It also introduces an architecture that (1) places the various management functions (FCAPS) into a design structure that can be used to select those functions that may give way to autonomic management and (2) to design the algorithms that may fulfill the management function. This architecture consists of four horizontal logical layers (Products, Components, Services, and Resources Layers) and two vertical logical layers (Management layer and information layer). Autonomous management agents (Swarm agents in this context) sit in the management layer and can sense changes/events in the four horizontal layers and react autonomically to reconfigure and adapt themselves based on the information scattered and gathered over the network.

# Performance Analysis of Reflection Paths for Millimeter Wavelength Systems

Z. Muhi-Eldeen, M. Al-Nuaimi & J. Richter
University of Glamorgan, UK
{zmuhield, malnuaim, jrichter}@glam.ac.uk

L. Ivrissimtzis
University of Ioannina, Greece
livrisim@uoi.gr

## Abstract

The work presented here aims at providing deeper knowledge on the behavior of non-line-of-sight (NLOS) links that particularly benefit from a specular reflection for fixed wired access systems (FWA) operating in the 40GHz bands. For comparison purposes, the performance of the proposed NLOS link has been assessed in contrast with that of an unobstructed line-of-sight (LOS) link. Both of the measured links were carried out in urban environments in order to explore the statistical propagation effects in such areas. Both links attain a dominant signal and hence are modeled using a Rician envelope distribution. Comparisons considered in terms of signal variations, cumulative curves and Rician K-factor have indicated the potential usefulness of the received reflected signals.

# An Adaptive Polling Scheme to Improve Voice Transmission over Wireless LANs

Ashraf D. Milhim and Yaw-Chung Chen
Department of Computer Science, National Chiao Tung University, Hsinchu, Taiwan
{amilhim@cs.nctu.edu.tw, ycchen@cs.nctu.edu.tw}

## Abstract

Motivated by the promising voice over IP technology, and the wide availability of WLANs, the application of Voice over WLAN (VoWLAN) is expected to encounter dramatic growth in the near future. IEEE 802.11e standard was established to achieve a high level QoS, it introduced a new medium access mechanism HCF in order to solve the QoS provisioning problem in the legacy IEEE 802.11. In this work we propose an adaptive polling scheme, which works on the HC side in HCCA mode, in which HC maintains two dynamic polling lists to reduce both access delay and polling overhead. Both VBR and CBR traffic are taken into consideration. Simulation results showed that the polling overhead is reduced significantly, in addition to high throughout and low access delay comparing to the classical Round-Robin polling scheme and the reference scheme in the standard.

# Resource Sharing Systems: A Combinatorial Application to Pervasive Computing

Amgad Madkour
The American University In Cairo
amadkour@eg.ibm.com

Sherif G. Aly
The American University In Cairo
sgamal@aucegypt.edu

## Abstract

*This paper presents the state of the art research achieved in resource sharing systems, and the application of such research in the highly promising field of pervasive computing. We discuss different resource sharing systems including peer to peer computing, utility computing, cluster computing, autonomic computing and grid computing, as well as their field of applications. We subsequently illustrate how such systems along with their applications can be adopted in a pervasive computing environment. We also present the open spaces architecture which utilizes many of the previously mentioned technologies for application in the field of pervasive computing.*

# Packet Reservation Multiple Access (PRMA) with Random Contention

Ahed Al-Shanyour, Ashraf Mahmoud, Tarek Sheltami, and Salman A. AlQahtani
*Computer Engineering Department, King Fahd University of Petroleum and Minerals*
*Dhahran, Saudi Arabia*
*shanyour@ccse.kfupm.edu.sa*

## Abstract

*Packet reservation multiple access (PRMA) can be considered as a merge of slotted ALOHA protocol and time division multiple access (TDMA) protocol. Independent terminals transmit packets to base station by contending to access an available time slots. A terminal that succeeds in reserving a certain time slot keeps on this reservation for transmitting its subsequent packets. Speech activity detection is used in PRMA to improve system capacity. In this work we propose a simpler contention mechanism that does not depend on a predetermined permission probability as in the original PRMA. In the new method, terminals select the contention slot uniformly from the pool of remaining free slots in the current frame. We evaluate the performance of the new contention mechanism in terms of various metrics including maximum number of carried voice calls and packet delays for a given acceptable drop rate of voice packets. We show that the new mechanism is superior to that of the original PRMA for loaded systems and is expected to be insensitive for traffic source burstiness.*

# Solving P2P Traffic Identification Problems Via Optimized Support Vector Machines

Yue-xiang Yang[1], Rui Wang[2],Yang Liu[3] , Shang-zhen Li[4], Xiao-yong Zhou[5]
[1)2)3)4)5)]*National University of Defense Technology*
*ruiwang@nudt.edu.cn, lyhn12003@yahoo.com.cn*

## Abstract

*Since the emergence of peer-to-peer (P2P) networking in the last 90s, P2P traffic has become one of the most significant portions of the network traffic. Accurate identification of P2P traffic makes great sense for efficient network management and reasonable utility of network resources. Application level classification of P2P traffic, especially without payload feature detection, is still a challenging problem. This paper proposes a new method for P2P traffic identification and application level classification, which merely uses transport layer information. The method uses Support Vector Machines which have been optimized for performing large learning tasks, rendering that this method become more suitable for large network traffic. The experimental results show that this method achieved high efficiency and is suitable for real-time identification. And carefully tuning the parameters could make the method achieve high accuracy.*

## A QoS-Oriented Protocol for Burst Admission Control in OBS Networks

**Amor Lazzez, Noureddine Boudriga, Mohammad S. Obaidat and Sihem Guemara El Fatmi**
*University of November 7th at Carthage, Tunisia and Monmouth University, NJ, USA*
*Corresponding author: Mohammad S. Obaidat, Department of Computer Science, Monmouth Universe, W. Long Branch, NJ 07764, USA*
*E-mail*: obaidat@monmouth.edu, http://www.monmouth.edu/mobaidat

## Abstract

*Among the promising solutions for next generation Internet backbones, one can consider the optical burst switching (OBS) technology. One of the main aspects in the design of optical burst-switched networks is the development of a burst admission control protocol suitable for QoS provisioning. In this paper, we develop a method to address the call admission control (CAC) in OBS networks that is QoS-oriented. For this, an analytic model is developed for formulating the burst admission control problem. A QoS-constraints based burst admission control protocol is developed. Finally, simulation experiments are performed to validate the proposed schemes.*

# Session awareness issues for next generation cluster based network load balancing frameworks

Narjess Ayari, Denis Barbaron
*France Telecom R&D – Lannion, France*
*{narjess.ayari,denis.barbaron}@orange-ftgroup.com*

Laurent Lefèvre, Pascale Primet
*INRIA / LIP (UMR CNRS, ENS, INRIA, UCB), France*
*{laurent.lefèvre,pascale.primet}@ens-lyon.fr*

## Abstract

*While a lot of researches focused on how to efficiently spread the offered network load on the available cluster resources, less interest has been granted to the impact of the used mechanisms on the reliable execution of the upper layer services. On the other hand, emerging NGN services as well as some of the already familiar services involve multiple flows during the lifespan of a single end-to-end session, hence, raising the challenge of session awareness while processing the incoming network traffic.*

*In this paper, we grasp the need for fine grained session awareness to efficiently allocate the cluster resources to the offered network traffic. The analysis of load balancing scenarios of some representative IP services provides us with solid reasons to use deep packet inspection to achieve fine grained network traffic load distribution, and to meet NAT and firewall traversal constraints as well.*

## A Heuristic Genetic Algorithm for the Single Source Shortest Path Problem

Basela S. Hasan
*Faculty of Computing and Information Technology, Arab Open University, Amman, Jordan*
*b_hassan@aou.edu.jo*

Mohammad A. Khamees
*Department of Basic Science, Al-Isra'a Private University, Amman, Jordan*
*M_khamees@isra.edu.jo*

Ashraf S. Hasan Mahmoud
*Computer Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia*
*ashraf@kfupm.edu.sa*

## Abstract

*This paper addresses one of the potential graph-based problems that arises when an optimal shortest path solution, or near optimal solution is acceptable, namely the Single Source Shortest Path (SSP) problem. To this end, a novel Heuristic Genetic Algorithm (HGA) to solve the SSSP problem is developed and evaluated. The proposed algorithm employs knowledge from deterministic techniques and the genetic mechanism to achieve high performance and allow consistent convergence. In addition, the proposed HGA is implemented and evaluated using a developed software tool that is easily amenable for future extensions and variations of our HGA.*

*The schema introduced in this proposal depends on starting with initial population of candidate solution paths constraints as an alternative of a randomly generated one. To preserve the high performance candidate solutions, the HGA also uses a new heuristic order crossover (HOC) operator and mutation (HSM) operator to keep the search limited to feasible search domain. Simulation results indicate that the developed HGA is highly efficient in finding an optimal also quantify the effect initial population size and the increase of generation numbers.*

# RC-MAC: Reduced Collision MAC for Bandwidth Optimization in Wireless Local Area Networks

Mahmoud Taifour, Farid Naït-Abdesselam and David Simplot-Ryl
IRCICA/LIFL - CNRS UMR 8022 - INRIA POPS.
University of Sciences and Technologies of Lille, France.
email: {taifour, nait, simplot}@lifl.fr

## Abstract

*The IEEE 802.11 standard for Wireless Local Area Networks (WLANs) employs a mechanism for Medium Access Control (MAC), named Distributed Coordination Function (DCF), which is based on Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). The collision avoidance mechanism uses the random backoff prior to each frame transmission attempt. The random nature of the backoff reduces the collision probability, but cannot eliminate completely these collisions. It is well known that as the number of contending stations increases, the number of collisions is also likely to increase and the performance of the 802.11 WLAN is significantly compromised. In this paper, we propose a novel distributed MAC protocol, named Reduced Collision MAC (RC-MAC). In our algorithm, a station will access the channel by following a cyclic method. After a certain period of contention resolution, the stations will be simply organized in a cycle and each of them will access the channel while its turn comes. In this case, there is no more collision in the future and the bandwidth is used efficiently. Through extensive simulations, we show that RC-MAC achieves a significant increase in the overall performance compared to the standard 802.11 DCF.*

**Keywords:** *WLAN, IEEE 802.11, DCF, RC-MAC, guarantee the access to the channel without collision.*

## New Scheduling Architecture for IEEE 802.16 Wireless Metropolitan Area Network

Haidar Safa[1], Hassan Artail[2], Marcel Karam[1], Rawan Soudah[1], and Samar Khayat[1]
[1] *Department of Computer Science*
[2] *Department of Electrical and Computer Engineering*
*American University of Beirut, Beirut, Lebanon*
*E-mails: {hs33, hartail, mk62, rns15, smk22}@aub.edu.lb*

## Abstract

*IEEE 802.16 standard defines the specifications for emerging WiMAX networks. It did not however define the scheduling algorithms that determine the uplink and downlink bandwidth allocation. This paper proposes a Preemptive Deficit Fair Priority Queue (PDFPQ) scheduling architecture for QoS management for the IEEE 802.16 standard. The proposed scheduling architecture is an extension of the DFPQ scheduling technique found in the literature. It enhances the QoS requirements of real time polling service (rtPS) flow class, and improves its delay and throughput. Compared to DFPQ, preliminary results show that a significant rtPS delay reduction and throughput increase can be realized with our new scheduling technique.*

# A QoS Scheduler Packets for Wireless Sensor Networks

Nesrine Ouferhat       Abdelhamid Mellouk

*Laboratory of Image, signal and Intelligent Systems Lab-LISSI/SCTIC*
*IUT C/V, University of Paris XII*
*122, Rue Paul Armangot 94400 Vitry / Seine FRANCE*
*E-mail:* nesrineouferhat@yahoo.com , Mellouk@univ-paris12.fr

## Abstract

*QoS routing in a wireless sensor network is difficult because the network topology may change constantly, and the available state information for routing is inherently imprecise.*

*Ever more complex sensors have become available to create and maintain situational awareness during missions. Choosing the most suited sensor for the execution of a sensor function is based on sensor capabilities and function attributes. To increase performance of the entire sensor network, the total set of sensors should be scheduled in a single system. This paper puts forward for scheduling prioritised tasks in sensor networks. Use a reinforcement learning formalism to optimise the set of schedules. In this paper, node actively infer the state of other nodes, using a reinforcement learning based more particularly Q-learning, thereby achieving high throughput by improving the delay for a wide range of traffic conditions.*

## Event Boundary Detection Using Autonomous Agents in a Sensor Network

Adil Jaffer[1], Muhammad Jaseemuddin[1], Mandana Jafarian[1], and Hesham El-Sayed[2]
[1]*Ryerson University, Toronto, Canada,* [2] *UAE Univesity, Al-Ain, UAE*
jaseem@ee.ryerson.ca

### Abstract

*A novel approach to event boundary detection is proposed, where autonomous agents are deployed in order to minimize the number of transmissions required to discover an event boundary. The goal of the algorithm is to localize node transmission along the event boundary, since the sensory data from nodes not along the boundary is not required for event boundary detection. Simulations demonstrate that the algorithm has a linear efficiency function when related to event radius of sufficient size and further demonstrates that the boundary of an event may be successfully mapped using agents.*

# Implementation of the Sensor-MAC Protocol for the JiST/SWANS Simulator

Veerendra Tippanagoudar, Imad Mahgoub, Ahmed Badi
*Computer Science & Engineering Department*
*Florida Atlantic University, Boca Raton, Florida*
*imad@cse.fau.edu*

## Abstract

Wireless sensor networks consist of very large number of resource constrained nodes. Therefore, protocols and applications for wireless sensor networks need to be very scalable and efficient. To properly evaluate the performance of these networks a scalable ad-hoc wireless network simulator is needed. The JIST/SWANS is a highly scalable ad hoc wireless network simulator that has been recently developed. However, JIST/SWANS does not have an energy model or a MAC protocol for wireless sensor networks. In recent work, we developed an energy model for JiST/SWANS. This work presents our implementation of the S-MAC protocol for the JiST/SWANS simulator. The implementation is validated through simulations. Results using JiST/SWANS and NS-2 are obtained and compared for similar network scenarios.

# Congestion Avoidance Mechanism for Optical Label Switched Networks: A Dynamic QoS-based Approach

**Yassine Khlifi, Noureddine Boudriga and Mohammad S. Obaidat**
University of November 7th at Carthage, Tunisia and Monmouth University, NJ, USA
Corresponding author: Mohammad S. Obaidat, Department of Computer Science, Monmouth Universe, W. Long Branch, NJ 07764, USA
E-mail: obaidat@monmouth.edu, http://www.monmouth.edu/mobaidat

## Abstract

*Optical Label Switching (OLS) has been proposed as a promising technology for providing fast switching capabilities, resource provisioning and quality of service (QoS) support. In this paper, we address the issue of providing congestion avoidance in OLS networks inn order to guarantee efficient resource utilization and QoS requirements, and allow the network to operate safely. We develop a novel congestion avoidance protocol through the use of a core node architecture and dynamic contention resolution. The proposed scheme handles signaling tasks, admission control, resource provision and QoS needs. Finally, simulation analysis is used to validate the proposed technique.*

# Integration of Technologies for Smart Home Application

Saeed O. Al Mehairi, Hassan Barada and Mahmoud Al Qutayri

Etisalat University College, Sharjah, UAE
hbarada@euc.ac.ae, maq@euc.ac.ae

## Abstract

*This paper discusses the design and implementation of a prototype system which integrates various existing technologies for home monitoring and control that fits with the future smart home concept. The system provides two way communications between home appliances /electronics devices, and a mobile phone. The home devices which are connected wirelessly using Bluetooth technology to a home server can be monitored and controlled via the mobile phone using a portable MIDlet application. The prototype system supports three main services: monitoring the status of devices; controlling their setting through configurations that are device dependent; and periodic notification of the status of all devices. The wireless technologies to realize the project are GSM and Bluetooth. J2ME for the mobile application, Java for the server application, and C for the microcontroller application are the programming languages used in the prototype system*

# Using Modified Conditional Second-Order Statistics in Blind Source Separation in Noisy Environment

*M. R. Zoghi and M.H.Kahaei*
*Department of Electrical Engineering*
*Iran University of Science and Technology (IUST)*
*Tehran, 16846, Iran*
*mrzoghi@iust.ac.ir , kahaei@iust.ac.ir*

## Abstract

*Higher-order statistics (HOS) has been proposed as a solution to blind separation of an instantaneous mixture of sources with the same PSDs. However, in this paper, we'll introduce a new method based on the first and second order of conditional statistics and modifying it for noisy sensor conditions. Comparing the performance of our newly proposed algorithm with that of the previous ones, it is demonstrated that our newly proposed algorithm results in a better result.*

# Doppler Effect on Location-Based Tracking in Mobile Sensor Networks

Mohamed Hamdi, Ramzi Bellazreg, Noureddine Boudriga
*Communication Networks and Security Research Lab.*
*University of 7$^{th}$ of November at Carthage, Tunisia*
*{mmh,nab}@supcom.rnu.tn*

## Abstract

*Mobile Sensor Networks (MSNs) consist of large number of small and computationally impoverished devices deployed over an area to track mobile objects. Mobility is becoming an important feature of MSNs. Recently, sensors have began to be deployed on mobile platforms such as robots. In this paper, we propose an evaluation of the mobility impact on MSN tracking efficiency. More precisely, we consider the Doppler effect on the results of several target location approaches. Two radar-based angle estimation techniques have been considered: Frequency-Modulated Continuous Wave (FMCW) Radar, and monopulse angle estimation. We also analyze the control of the uncertainty due to Doppler shift through a manipulation of the area coverage (i.e., number of sensors per area coverage).*

## *WSNodeRater* - An Optimized Reputation System Framework for Security Aware Energy Efficient Geographic Routing in WSNs

Ismat K. Maarouf    and    A. R. Naseer

*Department of Computer Engineering*
*King Fahd University of Petroleum and Minerals, Dhahran, KSA*
{ismat,arnaseer}@ccse.kfupm.edu.sa

**Abstract.** *Secure routing in wireless sensor networks (WSN) is a crucial problem that has drawn the attention of researchers. The motivation for tackling this problem comes directly from the highly constrained nature of WSN and its easy exposure to insecure conditions. In this paper, we adopt a reputation-based methodology which has not been studied in depth as an appropriate solution for secure routing in WSN. This research work proposes an optimized reputation system framework for WSN, named as WSNodeRater which includes some novel sensor node monitoring and rating techniques. Moreover, different optimization methods are also proposed to achieve more efficiency in the reputation system, in terms of security and resources usage.*

# A Novel Scheme for Traffic Monitoring in Optical Burst-Switched Networks

Amor Lazzez, Noureddine Boudriga, and Mohammad S. Obaidat

*University of November 7th at Carthage, Tunisia and Monmouth University, NJ, USA*
*Corresponding author: Mohammad S. Obaidat, Department of Computer Science, Monmouth Universe, W. Long Branch, NJ 07764, USA*
*E-mail*: obaidat@monmouth.edu, http://www.monmouth.edu/mobaidat

## Abstract

*Optical Burst Switching (OBS) technology offers a promising solution for the next generation Internet backbone. One of the main aspects in the deployment of OBS services is the development of an optical traffic/performance monitoring scheme allowing the provision of user-specified quality of service (QoS). In this paper, we develop a performance monitoring scheme for an OBS network architecture suitable for contention resolution and QoS provisioning. It mainly addresses congestion control and QoS monitoring. Simulation experiments are also performed to validate the proposed scheme and analyze its performances.*

# A New Class of Services for Mobile Devices using Bluetooth Connectivity

Zahy Abou-Atme, Nabeel Sulieman, Leila El-Aawar, and Zaher Dawy
American University of Beirut
Electrical and Computer Engineering Department
Beirut, Lebanon
Email: zaher.dawy@aub.edu.lb

## Abstract

*In this paper, we present the design and implementation of a telecommunication system architecture that is capable of providing a new class of services for personal mobile devices such as cellular mobile phones and PDAs. The idea is to facilitate pervasive communication and information acquisition for mobile devices by taking advantage of their location and inherent Bluetooth capabilities. This includes providing free-of-charge voice and data services to the subscribers of the system. The offered services can be customized to different environments such as universities, hospitals, and companies. An example prototype implementation with specific services will be presented for the campus of the American University of Beirut.*

# The Performance Evaluation of a Local Transaction Service in support of Juxtaposed CORBA Components

Mohammad Ghaem Tajgardoon[1] and Mohammad Hassan Tajgardoon[2]

[1]Ministry of Science, Researches and Technology of Islamic Republic of Iran
Deputy of Higher Education
Bureau for Evaluation and Control of Higher Education

[2]Electrical Engineering Department
Khaje Nasir Toosi University of Technology

[1]mtajgardoon@msrt.ir and [2]mhtajgardoon@kntu.ac.ir

## Abstract

The communication between CORBA juxtaposed components suffer from unnecessary Object Request Broker participation overhead in available implementations of CORBA Component Model. Some efforts have been made to optimize CORBA Component Model structure by differentiating remote requests from local requests to efface Object Request Broker interventions to realize components communications and make it possible to use Object Request Broker services such as Naming, Event and Transaction services. One such solution presented by ourselves has merely proposed a local transaction service model to minimize the response time of communication by managing four types of events occurring during execution of a transaction over distributed components using CORBA Component Model. This paper attempts to show the attained optimization of the proposed local transaction service model by implementing the model and providing a real local transaction service support for juxtaposed components. In the best-case we got a 25% optimization rate when all of the components involved in a transaction were juxtaposed.

Keywords: CORBA Component, Transaction Service, Juxtaposing , CCM, ORB, Communication Overhead.

# A Novel Algorithm for Adaptive and Neutral Evolutionary Patterns Associated with HIV Drug Resistance

A. Al Mazari, A.Y. Zomaya, M. Charleston
School of Information Technologies, ANRG
University of Sydney
NSW 2006, Australia
{almazari, zomaya, mcharleston}@it.usyd.edu.au

R. J. Garsia
Department of Medicine, RPAH
University of Sydney
NSW 2006, Australia
roger.garsia@email.cs.nsw.gov.au

## Abstract

This paper presents the development and application of a novel algorithm for the detection and classification of the adaptive and neutral evolutionary patterns associated with HIV drug resistance. Here, the Bayesian theorem will be used to predict the prevalence of an evolutionary pattern over a population to determine the class of its behaviour, whether it arose predominantly from neutral evolution, positive selection or negative selection. As an illustration, we will explain the algorithmic procedure in an application to real data, focusing on two- and three-mutation patterns that confer resistance to a drug agent.

# MA-GMA: A Mobile Agent-based Grid Monitor Architecture

Guoqing Dong[1,2], Weiqin Tong[1]

[1]*School of Computer Engineering and Science, Shanghai University, Shanghai, P. R. China*
[2]*School of Computer and Communication Engineering, China Petroleum University*
*donggq@hdpu.edu.cn*

## Abstract

*Grid based computational infrastructure is a promising next generation computing platform for solving large-scale resources- intensive problems. With the developing Grid technologies and applications, the research on the Grid monitoring system gets increasingly essential and significant. As far as the present research are concerned, there exist two mainly technologies in grid performance monitoring: MDS (Monitoring and Directory Service) and GMA(Grid Monitoring Architecture). In this paper the author puts forward a novel Mobile Agent-based Grid Monitoring Architecture (MA-GMA), which introduces the mobile agents and cache mechanism of MDS. Based on the Open Grid Service Architecture (OGSA) standard, we merge the characteristics of intelligence and mobility of mobile agent into the current OGSA to construct a dynamic and extensible monitoring system. In the end, we do some experiments under different environments. From the results of experiments shown, this MA-GMA is proved to be effective and improves the monitoring performance greatly.*

# High Level Modelling and Design For a Microthreaded Scheduler to Support Microgrids

| Nabil Hasasneh | Ian Bell | Chris Jesshope |
|---|---|---|
| Institute for Informatics | Engineering Dept. | Institute for Informatics |
| University of Amsterdam | University of Hull | University of Amsterdam |
| Kruislaan 403 | HU6 7RX, Hull, UK | Kruislaan 403 |
| 1098 SJ Amsterdam, NL | I.M.Bell@hull.ac.uk | 1098 SJ Amsterdam, NL |
| Nabilh@hebron.edu | | Jesshope@science.uva.nl |

## Abstract

*Microgrid CMPs, that is based on microthreaded processors, use hardware scheduling and synchronisation and have structures to support this that are distributed, fully scalable and which can support hundreds of microthreads per processor and their associated microcontexts. The chip has locality in communication wherever possible, and supports a globally-asynchronous locally-synchronous (GALS) design approach, where all its global communications are asynchronous, creating independent clocking domains for each microthreaded processor. Each microthreaded processor has its own instruction window and local register file, both of which are fully scalable. Any remote access is fully decupled from the pipeline operations including memory. This paper introduces the microgrid CMP architecture model and discusses in general terms how our approach meets the challenges facing CMP architectures. It also summarizes microgrid CMP performance simulations published elsewhere and presents a local scheduler and the microthreaded in-order pipeline.*

# A Novel Algorithm to Extract Tri-Literal Arabic Roots

Mohanned Momani
*AABFS, Jordan*
pc_doctor_est@yahoo.com

Jamil Faraj
*AABFS, Jordan*
jamilfaraj@yahoo.com

## Abstract

*Stemming role and root extraction in the context of Information Retrieval Systems is significant particularly for the Arabic language. In this article, we proposed and implemented a novel algorithm to extract tri-literal Arabic roots. Rootless words are filtered out then prefixes and suffixes removal is performed. Double letters that belong to the Arabic word ( سألتمونيها ) are removed after sorting term letters. Letter removal is conducted until three letters are remained. Finally, the remaining letters are arranged according to their order in the original word. The implementation of the algorithm has been tested on two types of Arabic text documents. The results of both runs were very promising and satisfactory showing over 73% of accuracy.*

# Knowledge Versus Information Contents

Fouad B. Chedid
Department of Computer Science
Notre Dame University - Louaize
P.O.Box: 72 Zouk Mikael, Zouk Mosbeh, Lebanon
fchedid@ndu.edu.lb

## Abstract

*While the information contents of a binary string $x$ can be measured by its prefix Kolmogorov complexity $K(x)$, it is not clear how to measure the knowledge stored in $x$. In this paper, we argue that the knowledge contained by $x$ is relative to the hypothesis assumed to explain $x$. So, if $H$ is a hypothesis for $x$, we suggest to measure the knowledge in $x$ by $K(H)$. The absolute knowledge in $x$ is $K(H_0)$, where $H_0$ is a simplest model capable of explaining $x$. Using Bayes' rule and Solomonoff's universal distribution, we obtain $K(x) = K(H) + K(x \mid H)$. We interpret $K(H)$ as the knowledge part in $x$ and $K(x \mid H)$ as the random aspect (accidental information) in $x$ relative to $H$. Furthermore, we provide a sim-*

*ple explanation forKolmogorov's innovative proposal for a non-probabilistic approach to statistics and model selection. We observe that the expression used by Kolmogorov to describe positively probabilistically random objects is a rewrite of Bayes' rule combined with approximations based on Solomonoff's universal distribution. We revisit the role of algorithmic sufficient statistic in the theory of hypothesis selection and prediction, especially as related to Kolmogorov's structure function and non-stochastic objects. Also, We derive a fundamental result relating Kolmogorov's structure function and two of its variants.*

# New Election Algorithm based on Assistant in Distributed Systems

## Mahdi Zargarnataj

Electrical and Computer Engineering Department

Shahid Beheshti University, Tehran, Iran

M_Zargarnataj@std.sbu.ac.ir

## Abstract

In distributed computing systems, a process or node as a leader used to coordinate some tasks. Leader election is influential as performance of other nodes depends on leader's ability in making its responsibilities. Conventional algorithms for leader election present particular methods to resolve any leader crash. We introduce a new method based on electing a leader and assistant. If the leader crash, the assistant takes, care of the leader's responsibilities. Our results revealed that often, after a leader crash, leader assistant elect as a leader and continue to work. This is important when the scale of network increases.

# Terminal Mobility Services in the Middleware Environment

Syed Zubair Ahmad [1], Mohammad Abdul Qadir [2]

[1, 2] *Center for Distributed and Semantic Computing, Mohammad Ali Jinnah University, Islamabad campus*

[1]szubair@jinnah.edu.pk, [2]aqadir@jinnah.edu.pk

## Abstract

*Terminal Mobility is a much more common activity today then it was anticipated a few years back. Mobility itself is a complex phenomenon which is further complicated in a distributed application environment due to abstraction of cross-platform details and cross-realm handoffs. CORBA is a widely used middleware service used for remote method invocation in distributed applications. Vertical handoffs in cross-realm environment puts a serious constraint on effective resolution of resource names and hence CORBA utility in mobile heterogeneous environment. We propose a robust middleware architecture which takes into account multiple access services at link-layer performs optimization of connectivity services at middleware with the help of decision making support provided by application needs and network status. The proposed architecture promises resilient middleware services for terminal mobility.*

## Multiple Sequence Alignment by Immune Artificial System

ABDESSLEM LAYEB
*LIRE laboratory, PRAI group,
University Mentouri of
Constantine Algeria
layeb@yahoo.fr*

ABDEL HAKIM DENECHE
*LIRE laboratory, PRAI group,
University Mentouri of
Constantine Algeria
a_deneche@yahoo.fr*

## Abstract

*In this paper we describe ClonAlign a new iterative approach for the well-known bioinformatics problem: Multiple Sequence Alignment (MSA). It is a significant task which is used to solve other problems like construction of phylogenetic trees and structural and functional prediction of proteins, etc. In this work, MSA is viewed as an optimization problem for which a new framework relying on Natural Computing is proposed. The originality in our approach consists in using an Artificial Immune System (AIS) to deal with the MSA problem, the general motivation is the ability to optimise any objective function that one can invent. Using the BAliBASE benchmark database, the experimental results have shown the effectiveness of the proposed framework and its ability to achieve good quality solutions comparing to other existing packages.*

# Simulation-Based Performance Evaluation of Deterministic Routing in Necklace Hypercubes

S. Meraji[1,2], A. Nayebi[1,2], H. Sarbazi-Azad[2,1]
[1]IPM School of Computer Science, Tehran, Iran.
[2] Sharif University of Technology, Tehran, Iran.
{meraji, nayebi}@ce.sharif.edu, azad@ipm.ir

## Abstract

*The necklace hypercube has recently been introduced as an attractive alternative to the well-known hypercube. Previous research on this network topology has mainly focused on topological properties, VLSI and algorithmic aspects of this network. Several analytical models have been proposed in the literature for different interconnection networks, as the most cost-effective tools to evaluate the performance merits of such systems. This paper proposes an analytical performance model to predict message latency in wormhole-switched necklace hypercube interconnection networks with fully adaptive routing. The analysis focuses on a fully adaptive routing algorithm which has been shown to be the most effective for necklace hypercube networks. The results obtained from simulation experiments confirm that the proposed model exhibits a good accuracy under different operating conditions.*

# An Intelligent Replication Framework for Data Grids

Ali Elghirani, Albert Y. Zomaya, Riky Subrata
*Advanced Networks Research Group, University of Sydney, NSW 2006 Australia*
{aghirani, zomaya, efax}@it.usyd.edu.au

## Abstract

*Data Grid systems are evolving as prominent platforms of choice for many scientific disciplines. Many of the experiments and applications of such disciplines require use of huge amounts of data located at geographically distributed locations. In this paper, we present an intelligent data and replica management framework coupled with computational job scheduling, to provide an integrated environment for efficient access to data and job scheduling. The main goal of our approach is to build a replica management service that integrates replica placement optimization mechanisms, and dynamic replication techniques, coupled with computation and job scheduling algorithms to provide better system performance in data grids. We evaluate our framework on a Data Grid model adopted from the Eu-Data Grid project. Our results show promising improvement in the performance of the grid and job execution time.*

# Encoding Algorithms for Logic Synthesis

Valery Sklyarov, Iouliia Skliarova
*University of Aveiro, Department of Electronics,
Telecommunications and Informatics/IEETA
3810-193 Aveiro, Portugal
skl@det.ua.pt, iouliia@det.ua.pt*

## Abstract

*This paper presents an encoding algorithm that is very efficient for many different logic synthesis problems. The algorithm is based on the use of special tables and includes two basic steps: searching for predefined graphical shapes in the tables, and swapping coded variables in the tables taking into account some constraints. The latter are specified with the aid of an auxiliary graph that reflects the overlap between coded variables in different subsets that have to be accommodated in the tables. The examples in the paper and the results of experiments have shown that the use of the proposed algorithm for state encoding allows the number of logic elements for combinational circuits of finite state machines to be decreased.*

# The Maximum Common Subgraph Problem:
## Faster Solutions via Vertex Cover[*]

Faisal N. Abu-Khzam[†]
Division of Computer Science and Mathematics
Lebanese American University
Beirut, Lebanon
faisal.abukhzam@lau.edu.lb

Nagiza F. Samatova
Computer Science and Mathematics Division
Oak Ridge National Laboratory
P.O. Box 2008, Oak Ridge, TN 37831–6367, USA
samatovan@ornl.gov

Mohamad A. Rizk
Division of Computer Science and Mathematics
Lebanese American University
Beirut, Lebanon
mohammad.rizk@lau.edu.lb

Michael A. Langston
Department of Computer Science
University of Tennessee
Knoxville, TN 37996–3450, USA
langston@cs.utk.edu

## Abstract

*In the maximum common subgraph (MCS) problem, we are given a pair of graphs and asked to find the largest induced subgraph common to them both. With its plethora of applications, MCS is a familiar and challenging problem. Many algorithms exist that can deliver optimal MCS solutions, but whose asymptotic worst-case run times fail to do better than mere brute-force, which is exponential in the order of the smaller graph. In this paper, we present a faster solution to MCS. We transform an essential part of the search process into the task of enumerating maximal independent sets in only a part of only one of the input graphs. This is made possible by exploiting an efficient decomposition of a graph into a minimum vertex cover and the maximum independent set in its complement. The result is an algorithm whose run*

# Neuro-Fuzzy Systems Modeling Tools for Bacterial Growth

*Emad A. El-Sebakhy,* I. Raharja, S. Adem, and Y. Khaeruzzaman*

Information and Computer Science Department

College of Computer Science and Engineering

King Fahd University of Petroleum & Minerals

Dhahran 31261, Saudi Arabia

`dodi05,raharja,adam,khaeruzy@ccse.kfupm.edu.sa`

## Abstract

Many techniques have been used in classification of bacterial growth-non-growth database are network based. This paper proposes adaptive neuro-fuzzy System for classifying the bacterial growth/non-growth and modeling the growth history. A brief description of the neuro-fuzzy intelligent systems scheme is proposed. The performance of neuro-fuzzy system is investigated for their quality and accuracy in classification of growth/no-growth state of a pathogenic Escherichia coli R31 in response to temperature and water activity. A comparison with the most common used statistics and data mining classifiers was carried out. The neuro-fuzzy system classifier was found to do better than both linear/nonlinear regression and multilayer neural networks. Results show bright future in implementing it in food science and medical industry.

Keywords: Bacterial growth; Logistic regression; Support Vector Machines; Multilayer Perceptron; adaptive neuro-fuzzy system.

# Population Sizing Scheme for Genetic Algorithm

Rose Al Qasim
Rose_rmq@yahoo.com

Taisir Eldos
Eldos@just.edu.jo

*Department of Computer Engineering*
*Jordan University of Science and Technology*

## Abstract

*Cell placement is a phase in the chip design process, in which cells representing well-defined functions are assigned physical locations. Cell placement is an NP-complete problem, for which we intend to devise an adaptive genetic algorithm. Genetic algorithms have many parameters such as population size, mutation rate, crossover rate, and selection strategy, which are constants most of the time and need to be carefully set for efficient implementation. However, adaptive approaches tend to vary one or more of those parameters as the process evolve. In this work, we propose a scheme to adjust the population size in a way that provides a balance between exploration and exploitation, hence result in a time-efficient implementation of genetic algorithms. We compare this scheme with three sizing schemes proposed in the literature.*

# Remote Monitoring of Vehicle Diagnostics and Location Using a Smart Box with Global Positioning System and General Packet Radio Service

Majid A. Al-Taee, SMIEEE
*Dept. of Computer Engineering,*
*University of Jordan, Jordan.*
*E-mail: altaeem@ju.edu.jo*

Omar B. Khader
*Dept. of Computer Engineering,*
*University of Jordan, Jordan.*
*E-mail: khader.omar@gmail.com*

Nabeel A. Al-Saber
*Dept. of Computer Engineering,*
*University of Jordan, Jordan.*
*E-mail: nabeel.saber@gmail.com*

## Abstract

*This paper presents a distributed system for remote monitoring of vehicle diagnostics and geographical position. This is achieved by using on-board microcomputer system, called On-Board Smart Box (OBSB), General Packet Radio Service (GPRS) and a remote server. The OBSB which is equipped with an integrated Global Positioning System (GPS) receiver is empowered by a software application that manages the processes of local data acquisition and transmission of the acquired data to the remote server via GPRS. When programmed with speed limits in a certain geographical region, the OBSB allows the traffic control authority to supervise violations of speed limits from inside vehicles rather than outside supervision via certain check points. Appropriate vocal and text warning messages are issued when a vehicle exceeds the permitted speed limit at a certain location. A prototype system is designed and implemented with a small number of sensors. On-road experiments have demonstrated the robustness, efficiency and applicability of the proposed system.*

# On Multi-Relational Data Mining for Foundation of Data Mining

Miao Liu, Hai-Feng Guo, Zhengxin Chen
*Department of Computer Science*
*University of Nebraska at Omaha*
*Omaha, NE 68182-0500, USA*
*{miaoliu,haifengguo,zchen}@mail.unomaha.edu*

## Abstract

*Multi-Relational Data Mining (MRDM) deals with knowledge discovery from relational databases consisting of one or multiple tables. As a typical technique for MRDM, inductive logic programming (ILP) has the power of dealing with reasoning related to various data mining tasks in a "unified" way. Like granular computing (GrC), ILP-based MRDM models the data and the mining process on these data through intension and extension of concepts. Unlike GrC, however, the inference ability of ILP-based MRDM lies in the powerful Prolog-like search engine. Although this important feature suggests that through ILP, MRDM can contribute to the foundation of data mining (FDM), the interesting perspective of "ILP-based MRDM for FDM" has not been investigated in the past. In this paper, we examine this perspective. We provide justification and observations, and report results of related experiments. The primary objective of this paper is to draw attention to FDM researchers from the ILP-based MRDM perspective.*

# Database Replication: Availability and Consistency Assurance via Stream Processing

| Morteza Abbaszadeh Meinagh | Ayaz Isazadeh | Bager Zarei | Mehdi Zarei |
|---|---|---|---|
| *Islamic Azad University, Sofian, Iran* | *Department Of Computer Science* | *Dept. of Computer Engineering* | *Young Researcher Club* |
| *M_A138@Yahoo.com* | *Tabriz University, Tabriz, Iran* | *Azad University, Shabestar, Iran* | *Azad University, Tabriz, Iran* |
| *+989143166694* | *Isazadeh@Tabrizu.ac.ir* | *Zarei_Bager@yahoo.com* | *mehdi.nn@gmail.com* |

## ABSTRACT

*In this paper we present an approach to fault-tolerant stream processing. In contrast to previous techniques that handle node failures, our approach also tolerates network failures and network partitions. The approach is based on a principled trade-off between consistency and availability in the face of failure, that (1) ensures that all data on an input stream is processed within a specified time threshold, but (2) reduces the impact of failures by limiting if possible the number of results produced based on partially available input data, and (3) corrects these results when failures heal. Our approach is well-suited for applications such as environment monitoring, where high availability and "real-time" response is preferable to perfect answers.*

*Our approach uses replication and guarantees that all processing replicas achieve state consistency, both in the absence of failures and after a failure heals. We achieve consistency in the former case by defining a data-serializing operator that ensures that the order of tuples to a downstream operator is the same at all the replicas. To achieve consistency after a failure heals, we develop approaches based on checkpoint/redo and undo/redo techniques.*

*We have implemented these schemes in a prototype distributed stream processing system, and present experimental results that show that the system meets the desired availability-consistency trade-offs.*

# Quine-McCluskey Classification

Javad Safaei
Department of Computer Engineering
Sharif University of Technology
safaei@ce.sharif.edu

Hamid Beigy
Department of Computer Engineering
Sharif University of Technology
beigy@ce.sharif.edu

## Abstract

*In this paper the Karnaugh and Quine-McCluskey methods are used for symbolic classification problem, and then these methods are compared with other famous available methods. Because the data in classification problem is very large, some changes should be applied in the original Quine-McCluskey (QMC) algorithm. We proposed a new algorithm that applies the QMC algorithm greedily calling it GQMC. It is surprising that GQMC results are most of the time equal to QMC. GQMC is still very slow classifier and it can be used when the number of attributes of the data is small, and the ratio of training data to the all possible data is high.*

# Caching Intermediate Results for Multiple-Query Optimization

Ali-Asghar Safaeei, Mehran Kamali, Mostafa S. Haghjoo, Kamyar Izadi
Department of Computer Engineering, Iran University of Science and Technology
Tehran, Iran
{safaeei, kamali, haghjoom, izadi}@iust.ac.ir

## Abstract

Multiple-query optimizers create materialized view from multi queries, to execute common operations of different queries not more than once. This technique is useful especially in subsumption and overlapping queries with common parts. Moreover, caching intermediate or final results of previous queries and using them for future ones can noticeably improve response time. Using intelligent decision making mechanism to cache the desired results is a major consideration to achieve this goal. In this paper, we present a novel method for multiple-query optimization which efficiently caches intermediate results of materialized views of received queries in a sliding window. The method is independent of database models. Its performance in term of response time and cache hit ratio as well as reduction in data retrieval rate is evaluated via simulation.

## Data Mining – Redefining the Boundaries

Malik Shahzad Kaleem Awan
*Ph.D. Student*
*Department of Computer Science,*
*Lahore University of Management Sciences*
*(LUMS), Lahore - Pakistan*
*05030001@lums.edu.pk*

Mian Muhammad Awais
*Associate Professor*
*Department of Computer Science,*
*Lahore University of Management Sciences*
*(LUMS), Lahore - Pakistan*
*awais@lums.edu.pk*

## Abstract

*Ever since its emergence as a new field, Data Mining has been described as a confluence of different disciplines primarily database systems, statistics, machine learning and information science. Strategic Management, an emerging discipline of management sciences, focuses on setting mission, vision, goals and objectives, analyzing internal and external organizational environments, making strategic decisions and taking actions to implement the designed strategy. In this paper, we have revealed that the whole data mining process forms a part of strategic analysis phase of strategic management. We have mapped the data mining activities to the strategic analysis phase from both the conceptual as well as the practical perspectives. We have found that if data mining is used for conducting environmental analysis, much better results could be yielded by helping the managers to formulate target-oriented strategies more efficiently and effectively. Thus, the boundaries of this emerging field - Data Mining - have been redefined using the essence and the key attributes of strategic management.*

# FGC: An Efficient Constraint Based Frequent Set Miner

Russel Pears and Sangeetha Kutty
*School of Computer and Information Sciences*
*Auckland University of Technology, Auckland, New Zealand*
*rpears@aut.ac.nz*

## Abstract

*Despite advances in algorithmic design, association rule mining remains problematic from a performance viewpoint when the size of the underlying transaction database is large. The well-known Apriori approach, while reducing the computational effort involved still suffers from the problem of scalability due to its reliance on generating candidate itemsets. In this paper we present a novel approach that combines the power of pre-processing with the application of user-defined constraints to prune the itemset space prior to building a compact FP-tree. Experimentation shows that that our algorithm significantly outperforms the current state of the art algorithm, FP-bonsai.*

# Mining Streaming Emerging Patterns from Streaming Data

Hamad Alhammady

*Etisalat University College - UAE*

*hamad@euc.ac.ae*

## Abstract

*Mining streaming data is an essential task in many applications such as network intrusion, marketing, manufacturing and others. The main challenge in the streaming data model is its unbounded size. This makes it difficult to run traditional mining techniques on this model. In this paper, we propose a new approach for mining emerging patterns (EPs) in data streams. Our method is based on mining EPs in a selective manner. EPs are those itemsets whose frequencies in one class are significantly higher than their frequencies in the other classes. Our experimental evaluation proves that our approach is capable of gaining important knowledge from data streams.*

# Weighted Naive Bayesian Classifier

Hamad Alhammady

*Etisalat University College - UAE*

*hamad@euc.ac.ae*

## Abstract

*The naive Bayesian (NB) classifier is one of the simple yet powerful classification methods. One of the important problems in NB (and many other classifiers) is that it is built using crisp classes assigned to the training data. In this paper, we propose an improvement over the NB classifier by employing emerging patterns (EPs) to weight the training instances. That is, we generalize the NB classifier so that it can take into account weighted classes assigned to the training data. EPs are those itemsets whose frequencies in one class are significantly higher than their frequencies in the other classes. Our experiments prove that our proposed method is superior to the original NB classifier.*

# Use of Rough Sets for the Identification and Analysis of Dependencies and Relationships in Biocontrol of Weeds

Mohamed Elhadi
Department of Computer Science
Sultan Qaboos University
P.O. Box 36, Alkhod 123, Oman
elhadi@squ.edu.om

Wojciech Ziarko
Department of Computer Science
University of Regina
Regina, Saskatchewan Canada S4S 0A2
ziarko@cs.uregina.ca

## Abstract

*This paper is a presentation of results obtained in experiments in which rough set theory's methods and techniques were applied in the identification and analysis of data dependencies and relationships on an empirical data. The data used pertains to the biological control of the Leafy Spurge weed in the prairies of Western Canada. The project used an agent beetle known as* Aphthona nigriscutis (A. n.). *The rough set theory was applied to the data in order to identify and analyze the different factors affecting the success of the biological control of the host weed. Discovery and confirmation of meaningful patterns and the computation of a set of rules for the critical application of agent beetle in the control of the host weed were very encouraging.*

# XPLC: A Novel Protocol for Concurrency Control in XML Databases

Kamyar Izadi          Fatemeh Asadi          Mostfa S. Haghjoo
*Department of Computer Engineering, Iran University of Science and Technology*
*Tehran, Iran*
izadi@iust.ac.ir      asadi@comp.iust.ac.ir      haghjoom@iust.ac.ir

## Abstract

*Nowadays XML is widely used by many applications. XML is not only used for exchanging data among the applications but also is used to store the semi-structured data. Managing huge data stored in XML documents, emphasizes the need for XML databases. One of the most important features of a database in a multi-user environment is its concurrency control mechanism. We discuss that many concurrency control protocols found in the literature either provide a restricted concurrency level which is less than what logically could be or provide a high level of concurrency which may lead to some defects. To overcome these problems, we offer a novel locking protocol with some rich locks named "XML Path Locking by Child Consideration" (XPLC). In our approach unlike the previous ones, we consider the child of the node which we want to lock. Also our locks have different granularities according to their types.*

# Personalized Web Page Ranking Using Trust and Similarity

Lara Srour    Ayman Kayssi    Ali Chehab

*Department of Electrical and Computer Engineering*
*American University of Beirut*
*Beirut, Lebanon*
*{les03,ayman,chehab}@aub.edu.lb*

## Abstract

*Search engines, like Google, use link structure to rank web pages. Although this approach provides an objective global estimate of the web page importance, it is not targeted to the specific user preferences. This paper presents a novel approach for the personalization of the results of a search engine based on the user's taste and preferences. The concepts of trust and similarity, captured from explicit user input and implicit user behavioral patterns, are used to compute personalized page rankings.*

# Digital Library Framework for Arabic Manuscripts

Wasfi G. Al-Khatib, S.A. Shahab, Sabri A. Mahmoud
Information and Computer Science Department
King Fahd University of Petroleum & Minerals
Dhahran 31261, Saudi Arabia
{wasfi,sadnans,smasaad}@ccse.kfupm.edu.sa

## Abstract

*Handwritten Arabic manuscripts have been highly underutilized owing to the fact that, to our knowledge, there is no system or interface in existence, utilizing which user can browse or search the desired information. Given vast content of these manuscripts, it is important to develop indexing systems that support content-based retrieval from historical manuscripts. In this paper, we propose a "Digital library framework for Arabic Manuscripts". A prototype system has been implemented which supports preprocessing of document images. To enhance their quality, feature extraction of the user identified words for similarity matching purposes is carried out. Utilizing relevance feedback from the user, the system indexes the manuscript pages for later efficient retrieval. The prototype system has been tested and encouraging results were achieved.*

# Floating-Point Matrix Product on FPGA

Faycal Bensaali
University of Hertfordshire
f.bensaali@herts.ac.uk

Abbes Amira
Brunel University
abbes.amira@brunel.ac.uk

Reza Sotudeh
University of Hertfordshire
r.sotudeh@herts.ac.uk

## Abstract

*The nature of some scientific computing applications involves performing complex tasks repeatedly on floating-point data, often under real-time requirements. Therefore, high performance systems are required by the developers for fast computations. Many researchers have begun to recognize the potential of reconfigurable hardware such as field-programable gate arrays in implementing floating-point arithmetic. In this paper a floating-point adder and multiplier are presented. The proposed cores are used as basic components for the implementation of a parallel floating-point matrix multiplier designed for 3D affine transformations. The cores have been implemented on recent FPGA devices. The performance in terms of area/speed of the proposed architectures has been assessed and has shown that they require less area and can be run with a higher frequency when compared with existing systems.*

## A New Design for 7:2 Compressors

Mahnoush Rouholamini [1], Omid Kavehie [2], Amir-Pasha Mirbaha [3], Somaye Jafarali Jasbi [1], and Keivan Navi [2]

[1] Science and Research Center of Hesarak, Tehran, Iran
Email: {rouholamini,jasbi}@sr.iau.ac.ir

[2] Department of Electrical & Computer Engineering, Shahid Beheshti University, Tehran, Iran
Email: {kavehie, navi}@sbu.ac.ir

[3] Department of Information and Decision, University of Paris I, Paris, France
Email: amir-pasha.mirbaha@malix.univ-paris1.fr

## Abstract

*High order compressors play a specific role in realizing high speed multipliers. By increasing the demand for fast multiplication process, high order compressors have attracted many researchers to this field. In this paper a new implementation for 7:2 compressors, based on the conventional architecture, is proposed. According to the results, the design presented achieves a remarkable improvement in terms of speed (especially in low voltages) and power consumption over the best counterpart. This accomplishment is the direct result of shortening the critical delay path in the proposed circuit design. As the simulation results demonstrate, the structure presented here has improved the power consumption from minimum 0.07 % (at supply voltage = 3.5 volt) through maximum 11% (at 1.2 volt), and the speed of the circuit from minimum 19 % (at 3.5 volt) through maximum 23 % (at 1.2 volt). HSPICE is the circuit simulator used, and the technology being used for simulations is 0.25μm technology.*

# Reversible Barrel Shifters

Saeid Gorgin                                                   Amir Kaivani
*Department of Electrical and Computer Engineering*
*Shahid Beheshti University, Tehran, Iran*
*Gorgin@sbu.ac.ir, A_Kaivani@std.sbu.ac.ir*

## Abstract

*Data shifting is required in many key computer operations from address decoding to computer arithmetic. Full barrel shifters are often on the critical path, which has led most research to be directed toward speed optimizations. With the advent of quantum computer and reversible logic, design and implementation of all devices in this logic has received more attention. This paper proposes a reversible implementation of a barrel shifter, and also evaluation of its quantum cost is presented.*

## Simulation of a Secure CPU with SecureTag Technique to Defend Embedded Systems Against Buffer Overflow Attacks

Michael Georg Grasser, Johannes Priebsch, Georg Hofer, Thomas Hodanek
*Graz University of Technology, Institute for Technical Informatics*
*michael.grasser@TUGraz.at, {johannes.priebsch, georg.hofer, thomas.hodanek}@student.TUGraz.at*

## Abstract

*The research on security issues is getting more important, as the number of embedded and networked computing systems is constantly increasing. Due to strict restrictions and strong requirements, only special software applications can be used in security-critical embedded systems. So, it is necessary to secure those software applications with a special hardware implementation of a secure processor architecture.*

*In this paper, we propose the architecture of the Secure CPU, including a memory structure using the SecureTag technique for marking memory lines. Our basic idea was to extend CPU registers by two replicas, which represent the lowest and highest value of a particular register. The advantages of this concept are minor changes in the architecture, the permanent and implicit checking of bounds, the secure storage of bounds in the memory and the high compatibility to several software applications. We verified our concept with an adapted processor simulator and describe its adaptations.*

# A Methodology for the Formal Verification of RISC Microprocessors
## A Functional Approach

S. Merniz
LIRE Laboratory
Computer Science  Department
Constantine University, Constantine, Algeria
Email : s_merniz@hotmail.com

M. Benmohammed
LIRE Laboratory
Computer Science Department
Constantine University, Constantine, Algeria,
Email: ibnm@yahoo.fr

## Abstract

We propose a methodological approach for the formal specification and verification of RISC processor micro-architectures within a functional framework. The approach exploits only the next state function to formally specify both ISA and MA levels and proves their equivalence in a systematic way. Moreover, the proof could be performed at different architectural levels. The central idea consists of decomposing the next state function into coordinates such that to model the micro-architecture at the component level. Such decomposition allows the proof to be systematically decomposed into a set of verification conditions more simple to reason about and to verify. The potential features of the proof methodology are demonstrated over the MIPS processor within Haskell framework.

**Keyword**s: *Functional design, Verification, RISC processors*


## System Level Voltage Scheduling Technique Using UML-RT Model

M.H. Neishaburi, Masoud Daneshtalab, Majid Nabi, Simak Mohammadi
{mhnisha,mnabi}@cad.ece.ut.ac.ir ; {m.daneshtalab,s.mohammadi}@ece.ut.ac.ir
University of Tehran-Iran

## Abstract

In this paper, we present optimized methodology for Intra-task voltage scheduling. Our proposed method gets data flow and control flow of application that represents coloration between different parts of the application at the early stage of design using UML-RT model and decides to schedule processor's voltage. By applying this technique on JPEG encoder system experimental results show reduction in energy consumption by 18-54 % over common Intra-DVS algorithm.

# Automated Software Power Optimization for Smart Card Systems with Focus on Peak Reduction

M. Grumer, M. Wendt, C. Steger, R. Weiss
Institute for Technical Informatics
Graz University of Technology
grumer@iti.tugraz.at

U. Neffe, A. Mühlberger
NXP Semiconductors
Business Line Identification
ulrich.neffe@nxp.com

## Abstract

*The complexity of embedded systems is continuously growing due to the increasing requirements on performance. In portable systems such as smart cards, not only performance is an important attribute, but also the power and energy consumed by a given application. Sources of energy used in smart card systems like batteries and electromagnetic fields are not such ideal elements, as their effectiveness depends heavily on the energy consumed over time. Optimization strategies proposed so far are implemented statically. Often a manual measurement of the current profile followed by manual optimizations is carried out. This procedure is very time consuming. We present a method for reducing automatically the power of an application based on a compiler optimization.*

# Mapping and Performance Analysis of Lookup Table Implementations on Reconfigurable Platform

Sohaib Majzoub and Hassan Diab
Faculty of Engineering and Architecture
American University of Beirut
P.O.Box 11-0236 Riad El Solh
Beirut 1107 2020 - Lebanon.
sohaib.majzoub@ieee.org, diab@aub.edu.lb

## Abstract

*Reconfigurable computing has a recognized potential in processor design. It provides a middle trade-off between speed and flexibility. It provides performance close to application-specific-hardware, yet preserves the general-purpose-processor flexibility. This paper presents the mapping and performance analysis of the implementation of the lookup table for two encryption algorithms, namely Rijndael and Twofish, on a coarse grain dynamic reconfigurable platform, namely MorphoSys. MorphoSys is a dynamic reconfigurable architecture targeted for computer intensive applications with parallel nature. Since the MorphoSys does not support the indirect addressing, we present in this paper a methodology to implement an alternative. We present the details of the mapping of the two lookup tables with thorough analysis. The methodology we used can be utilized in other Memoryless systems. Finally, an instruction set extension was proposed to enhance the performance.*

# Towards an Extension of Real-Time Java Supporting Several Multimedia Applications *

M. Teresa Higuera-Toledano
Universidad Complutense de Madrid Ciudad Universitaria, Madrid 28040, Spain
mthiguer@dacya.ucm.es

## Abstract

*Multimedia applications are supported by several tasks, some of them being response time limited, while others being high performance oriented, we must consider the real-time characteristics of our collector. In order to adapt the Java memory model to an embedded system (e.g. wireless PDA) executing multimedia applications. We propose to distribute the memory heap among the different applications in the system. Since high priority real-time tasks cannot tolerate unbounded garbage collection pauses, some effects that the garbage collection introduces in the application, such as overhead and latency, has been studied; as well as the way to adapt the reclamation rate to the application needs.*

# Improving Robustness of Real-Time Operating Systems (RTOS) Services Related to Soft-Errors

M.H Neishaburi, Masoud Daneshtalab, Mohammad Reza Kakoee, Saeed Safari,
University of Tehran, Iran.
mhnisha@cad.ece.ut.ac.ir
{kakoee, safari}@cad.ece.ut.ac.ir ; m.daneshtalab@ece.ut.ac.ir

## Abstract

*Nowadays, more critical applications that have stringent real-time constraint are placed and run in an environment with Real-Time operating system (RTOS). The provided services of RTOSs are subject to faults that affect both functional and timing of Tasks which are running based on RTOS.*

*In this paper, we try to evaluate and analyze robustness of services due to soft-errors in two proposed architecture of RTOS which are (SW-RTOS and HW/SW-RTOS). According to experimental result we finally propose an architecture which provides more robust services in term of soft-error.*

*Real-Time Operating System (RTOS) users desire predictable response time at an affordable cost, due to this demand Hardware/Software Real-Time Operating Systems (HW/SW-RTOS) appeared. This paper analyzes the impact of soft-errors in real-time systems running applications under purely Software RTOS versus*

*HW/SW-RTOS. The proposed model is used to evaluate robustness of services like scheduling, synchronization time management and memory management and inter process communication in Software based RTOS and HW/SW-RTOS. Experimental results show HW/SW-RTOS provide more robust services in term of soft-error against purely software based RTOS*

**General Terms**
Reliability. Verification.

**Keywords**
Software Real-Time Operating System (SW-RTOS), Hardware/Software Real-Time Operating System (HW/SW-RTOS), Soft-Error.

# Speech Unit Selection Based on Matching Pursuit

M. Hosseinpour, M.N. Ranjbar, M. Mousavinejad
*Multimedia Computing Group, Iran Telecommunication Research Center*
*E-mail: {mhossein, nezami, m.musavi }@itrc.ac.ir*

## Abstract

*This paper introduces a new method based on Matching Pursuit for speech unit selection. We used the Matching Pursuit transform parameters with a comparison algorithm to find the best match for a selected unit in a Text-To-Speech system based on concatenation. We chose Gabor atoms. Also Wigner-Ville distribution implemented for the time-frequency presentation of the transform and we used image processing approach to compare these time-frequency presentations of the acoustic units. On a database of 42 units 92% accuracy was obtained.*

## Software/Configware Implementation of Combinatorial Algorithms

Iouliia Skliarova, Valery Sklyarov
*University of Aveiro, Department of Electronics, Telecommunications and Informatics, IEETA, 3810-193 Aveiro, Portugal*
*iouliia@det.ua.pt, skl@det.ua.pt*

## Abstract

*This paper discusses an approach for solving combinatorial problems by combining software and dynamically reconfigurable hardware (configware). The suggested technique avoids instance-specific hardware compilation and, as a result, allows obtaining higher performance than currently available pure software approaches as well as instance-specific reconfigurable solutions. Moreover, the technique permits problems to be solved that exceed the resources of the available reconfigurable hardware. The architecture of dynamically reconfigurable hardware problem solver is modeled in software allowing to estimate different characteristics, such as the time of reconfiguration, performance, etc., and to speed up the overall design process.*

# Improving Inter-processor Data Transfer Rates over Industrial Networks

Syed Misbahuddin, Dr Engr
Department of Computer Science
and Software Engineering
University of Hail,
PO BOX 2440
Hail, Kingdom of Saudi Arabia
smisbah@uoh.edu.sa

Nizar Al-Holou, PhD
Department of Electrical and Computer
Engineering
The University of Detroit Mercy
4001 West Mc Nichols, Detroit, MI 48221, USA
alholoun@udmercy.edu

## Abstract

*Industrial networks allow information exchange between processors connected to them in industrial automation systems. Special protocols are used for inter-processor communication over industrial networks. In order to achieve optimum functionality, the inter-processor communication should be in real time. Data reduction and compression algorithms are used to transfer the information in a relatively short period of time. Data reduction algorithms can be used to improve information transfer rates over the industrial networks to achieve better performance. However, the nature of industrial networks demands special data reduction techniques compared to other networks. This paper proposes a data reduction algorithm for industrial networks. The proposed data reduction algorithm is based on a commonly used industrial protocol called Controller Area Network (CAN) protocol. However, the presented algorithm may be extended to other communication protocols without the loss of generality.*

# An Exact Resource Constrained-Scheduler using Graph Coloring technique

Hadda Cherroun
Département d'informatique
A.T. University BP. 37G, 03000 Laghouat, Algeria
hadda_cherroun@mail.lagh-univ.dz

Paul Feautrier
LIP, ENS-Lyon
46, Alle d'Italie, 69007 Lyon, France
Paul.feautrier@ens-lyon.fr

## Abstract

*Scheduling is an important technique in high-level synthesis to match application computations and hardware resources. Scheduling a whole program is not possible as too many constraints and objectives interact. We decompose high-level scheduling in three steps. Step 1: Coarse-grain scheduling tries to exploit parallelism and locality of the whole program (in particular in loops, possibly imperfectly nested) with a rough view of the target architecture. This produces a sequence of logical steps, each of which contains a pool of macro-tasks (with no loops). Step 2: Fine-grain scheduling refines each logical step by scheduling all its macro-tasks. Between both steps a resource assignation is done by mapping each macro-task independently. We uniformly expressed the data dependences and resource constraints. As most scheduling problems, scheduling tasks under resources constraints to minimize the total duration is NP-complete. Our goal here is to design strategy for*

*reaching optimal solutions in reasonable time. Our algorithmic contribution is an exact branch-and-bound algorithm, where each evaluation is accelerated by both maximal and greedy clique computation. The effectiveness and efficiency of the approach are good, which is illustrated by means of some practical benchmarks.*

# Software Defined Radios: A Software GPS Receiver Example

Mohammad S. Sharawi
Computer Engineering Department
Philadelphia University
Amman 19392, JORDAN
m.sharawi@ieee.org

Oleksiy V. Korniyenko
Electrical Engineering Department
Oakland University
Rochester, Michigan, 48309 USA
ovkornie@oakland.edu

## Abstract

*Software Defined Radios (SDR) are gaining popularity because of the capability of reprogramming them to work under different standards with minimum hardware change. A software radio can be programmed to acquire data from a GPS satellite as well as a GLONASS satellite. This paper describes the implementation of a non-real time GPS software receiver. The receiver was verified to decode a set of non-real time raw GPS data bin on the L1 carrier and the civil navigation message using the C/A code that was stored on a hard drive.*

Global Positioning System (GPS) is a satellite-based navigation system that is widely used in civil and military location based services. The location estimates on earth are determined by analyzing the incoming satellite signals in the user receiver. Current GPS receivers capture the radio frequency modulated signals at the L1 (Link 1) frequency of 1.57542 GHz, down convert to an intermediate frequency (IF), then digitizes them and perform signal processing to extract the location information. The driver behind this architecture was the high frequency of the incoming signal and the limited sampling rate of the available analog-to-digital converters (ADC). This architecture is shown in Figure 1.

The design of a heterodyne receiver has limited flexibility. Once the receiver is designed, the user has limited options in the radio frequency (RF) tuning and digital signal processing (DSP) portions. This limitation can be overcome by the use of software based receivers that utilize the theory behind band-pass sampling [1]. In this architecture, the RF signal is digitized without the need for down conversion, and the bandwidth of interest is captured. Then, the DSP part can be reconfigured to perform different signal processing tasks for different standards. FPGA based software receivers and interfaces for GPS applications have been addressed in some literature [2]-[3]. An ideal software receiver will follow that in Figure 1 but without the RF and IF portions. The main limitation of ideal software receivers

# 3D GIS Modeling of BAU: Planning Prospective and Implementation Aspects

**Nedal Al-Hanbali and Balqies Sadoun**
Surveying and Geomatics Engineering Department
Al-Balqa' Applied University
Al-Salt, Jordan
nhanbali@cyberia.jo and balqiessadoun@yahoo.com

## Abstract:

*Three-dimensional modeling is the true simulation of reality, especially if it is relatively accurate. On the other hand, using 3D modeling in GIS environment offers a flexible interactive system for providing the best visual interpretation, planning and decision making process. The 3D models are becoming one of the most efficient technologies for spatial data management and analysis. The objective is to demonstrate the usefulness of three-dimensional modeling, and explore the capabilities of current technologies. Through this, the corresponding required production workflow for building three-dimensional GIS Model of Al-Balqa Applied University (BAU) using new up-to-date digital camera technology and adding true texture mapping will be discussed*

# Three Dimensional (3D) GIS Modeling for High Buildings and Applications

**Balqies Sadoun and Nedal Al-Hanbali**
Surveying and Geomatics Engineering Department
Al-Balqa' Applied University
Al-Salt, Jordan
balqiessadoun@yahoo.com and nhanbali@cyberia.jo

## Abstract

Our world is becoming more and more interested in virtual city modeling. This trend coincides with the need to better understand the spatially related problems and issues visually. With the increase types of information that can be linked spatially, and also, the increase size of population and buildings, better city planning to manage the third dimension is becoming a necessity. Meanwhile, 3D virtual city models do not have to be accurate but well representing the reality. Thus the paper is presenting a simple procedure to follow for a study area to show the effectiveness of such approach in 3D modeling for Cadastral, real estate evaluation purposes.

# LBS and GIS Technology Combination and Applications

Balqies Sadoun and Omar Al-Bayari
Surveying and Geomatics Engineering Department
Al-Balqa' Applied University Al-Salt, Jordan
e-mail: balqiessadoun@yahoo.com ; obayari@bau.edu.jo

## Abstract

*Location Based Services (LBSs) provide personalized services to the subscribers based on their current position using Global Navigation Satellite System (GNSS), Geographic Information System (GIS) and Wireless Communication (WC) technologies. LBS offers modern world the tool for efficient management and continuous control. More and more people involve LBS in their industry and day to day life to better achieve their goals. The increasing demand for commercial LBS has driven scientists to focus on more accurate positioning solutions. It employs accurate, real-time positioning to connect users to points of interest and advises them of the current conditions such as traffic and weather conditions, or provides routing and tracking information using wireless devices. It is important to integrate the mobile computing technology and the GIS technology in order to meet the needs of LBS, which is considered one of the most promising applications of GIS.*

*The location of the caller could be determined by other position determination techniques. These include Cell-ID, Enhanced Observed Time Difference (E-OTD), Observed Timed Difference of Arrival (OTDOA), Wireless Assisted GNSS (A-GNSS) and hybrid technologies (combining A-GNSS with other standard technologies). Cell-ID is used for positioning purposes, but it is not accurate. In the following we will present an introduction on the LBS, its combination with GIS and WC, and some of our recent related work.*

# ARTIFICIAL NEURAL NETWORKS vs LINEAR REGRESSION IN A FLUID MECHANICS AND CHEMICAL MODELLING PROBLEM: ELIMINATION OF HYDROGEN SULPHIDE IN A LAB-SCALE BIOFILTER

G.Ibarra-Berastegi,   A. Elias,  R. Arias,  A. Barona

*Dpt. NI & Fluid Mechanics   Dpt. of Chemical & Environmental Engineering*

*Email:*gabriel.ibarra@ehu.es

*Engineering Faculty. University of the Basque Country. Alda Urkijo s/n. 48013 Bilbao (Spain)*

## Abstract

*A biofilter is a biological reactor in which a certain pollutant is eliminated by the action of microorganisms. In this work, the removal efficiency of a lab-scale biofilter for eliminating hydrogen sulphide ($H_2S$) has been modelled. To that end, multilayer perceptron (MLP) neural networks and multiple linear regression (MLR) have been used and then, results obtained with both techniques have been compared. The biofilter has been operating during 194 days and for modelling purposes, it has been considered as a system in which changes in the flow and concentration of $H_2S$ entering the biofilter are followed by changes in the removal efficiency of the reactor. In all cases, to obtain true representative values corresponding to the different equilibrium situations, before removal efficiencies (outputs) were measured, 24 hours were allowed after the $H_2S$ load was changed by altering the inlet concentration and flow. The results showed that a multilayer perceptron 2-2-1 (MLP) model was able to explain 92% ($R^2=0.92$) of the overall variability detected in the removal efficiency of the biofilter corresponding to a wide range of operating conditions. The MLR model yielded a value of $R^2=0.72$. The MLP outperforms the MLR though not dramatically. The explanation might be that the combination of a great number of highly non-linear mechanisms tends to linearize the overall effect, at least to a certain extent. As a conclusion, the use of neural networks and more specifically, MLP models can describe the behaviour of a biofilter more accurately than simple linear regression models.*

# AR Model Identification Using Higher Order Statistics

Adnan M. Al-Smadi[1], *Senior Member, IEEE*
*Department of Computer Science, College of Information Technology*
*Al Al-Bayt University, Al-Mafraq, Jordan*
*smadi98@aabu.edu.jo*

# Abstract

*This paper presents a new approach to identify the parameters of autoregressive (AR) model from the third order statistics of the output sequence. The observed signal may be corrupted by additive colored Gaussian or non-Gaussian noise. The system is driven by a zero-mean independent and identically distributed (i.i.d) non-Gaussian sequence. The simulation results confirm the good numerical conditioning of the algorithm and the improvement in performance with respect to existing methods.*

# MODELING THE COMMUNICATION PROBLEM IN WIRELESS SENSOR NETWORKS AS A VERTEX COVER

Maytham Safar, Mohammad Taha and Sami Habib
*Kuwait University*
*Computer Engineering Department*
*P. O. Box 5969 Safat 13060 Kuwait*
{maytham, shabib}@eng.kuniv.edu.kw

## Abstract

*The communication problem is to select a minimal set of placed sensor devices in a service area so that the entire service area is accessible by the minimal set of sensors. Finding the minimal set of sensors is modeled as a vertex cover problem, where the vertex cover set facilitates the communications between the sensors in a multi-hop fashion keeping in mind the limited communication range and battery lifespan of all sensors. The vertex cover set is a subset of the coverage set of sensors; therefore, we transform the search space from continuous into discrete space. We encoded the vertex cover problem into the evolutionary domain, where the objective function is to select a minimal set of sensors out of the coverage sensors to act as a vertex cover so that the communication range of the vertex cover set covers the entire service area. The experimental results demonstrate the feasibility of our evolutionary approach in finding minimal vertex cover set; which is less than 16% of total sensors used as communication sensors; in under 5 minutes seconds with 91% coverage of the sensor nodes in wireless sensor network.*

## Robust Control Design for a Wind Turbine-Induction Generator Unit

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| Alireza Khosravi | Aliakbar Jalali | Hamed Mojallali |
| *Iran Univ. of Science &Tech* | *Iran Univ. of Scienc &Tech* | *Guilan Univ.* |
| akhosravi@iust.ac.ir | ajalali@iust.ac.ir | mojallali@guilan.ac.ir |

## Abstract

*An application of a new $l_1$-Optimal control technique based on linear matrix inequality optimization to a wind turbine-induction generator unit is presented. This technique combines the original concept of peak-to-peak gain of designed system with optimal control theory. Application of this new controller to the wind turbine-induction generator unit provides fast response with a good steady state error, suitable settling time and stability upon severe wind gust.*

# Removing the GSC Noise Reduction deficiencies in Reverberant Environments by Proposing Joint AEC-GSC algorithm

Pejman Mowlaee[1], Mahdi Orooji[2], Mohammad Hossein Kahaei[3]
[1]Msc student at Iran University of Science and Technology (IUST).
[2]Msc student at IUST.
[2]Associate Professor at IUST.
Department of Electrical Engineering
IUST, Tehran, Iran
E-mail address: pejman_mowlaee@ee.iust.ac.ir , morooji@ee.iust.ac.ir , kahaei@iust.ac.ir

## Abstract

*In this paper, a new joint structure for noise reduction in a reverberant environment will be proposed. The proposed structure consists of an Acoustic Echo Canceller (AEC) followed by a noise reduction stage like Generalized Side-lobe Canceller (GSC). This configuration is called AEC-GSC. It improves noise cancellation of the GSC beamformer in the presence of acoustic echoes in highly reverberant environments where GSC-alone fails to work properly. The AEC section is accomplished by our recently proposed Segment Variable Step-size Proportionate Normalized Least Mean Squares (SVS-PNLMS) algorithm. The proposed AEC-GSC algorithm is evaluated through both computer simulations and experimental results. The results demonstrate that the proposed AEC-GSC algorithm performs significantly better than GSC-alone in terms of speech distortion parameters and resulting ERLE.*

## SiMBCN: An Interactive Simulation Tool for Multihop Based Cellular Networks

Sami Arayssi, Marc Akl, Sami Abou Saab, and Zaher Dawy
American University of Beirut
Electrical and Computer Engineering Department
Beirut, Lebanon
Email: zaher.dawy@aub.edu.lb

## Abstract

*Multihop transmission is expected to play a central role in the design of 4G cellular standards. To evaluate the system level performance of multihop based cellular networks, there is a need to develop simulation tools that support relaying capabilities. In this work, we present the design, development, and capabilities of a new Simulator for Multihop Based Cellular Networks (SiMBCN) that has research and demonstration modes with a user-friendly graphical user interface. The research mode can be used to test a large set of system parameters and advanced enhancement options (multiple relaying, multihop diversity, directional antennas, etc.) using Monte-Carlo simulations whereas the demonstration mode can be used to visualize the network operation and performance in real time. Example results are presented which show the capabilities of relaying in reducing power consumption and combatting shadowing.*

# Modeling and Evaluation of Call Centers with GSPN Models

Maryam Fanaeepour, Leila Naghavian and Mohammad Abdollahi Azgomi

*Department of Computer Engineering,*
*Iran University of Science and Technology,*
*Tehran, Iran*
*fanaeepour@comp.iust.ac.ir, naghavian@comp.iust.ac.ir and azgomi@iust.ac.ir*

## Abstract

*Call centers, or their contemporary successors, contact centers, are the preferred and prevalent way for many companies to communicate with their customers. The call center industry is thus vast and rapidly expanding in terms of both workforce and economic scope. It enjoys an annual growth rate of 20% and, overall, more than half of the business transactions are conducted over the phone. The design of such a system, and the management of its performance, surely must be based on sound scientific principles. Our goal in this paper is to survey the structure and technology of call center systems, point out some available special modeling and analysis tools, propose a high-level Generalized Stochastic Petri Net (GSPN) model, and evaluate the model, aiming to minimize the workload of agents (servers) in order to provide self-serve.*

*Keywords: Call Center, Modeling and Evaluation, Generalized Stochastic Petri Nets (GSPNs), SHARPE.*

# Loss rates bounds in IP buffers by Markov chains aggregations

Hind Castel
GET/INT/SAMOVAR
9,rue Charles Fourier
91011 Evry Cedex, France
hind.castel@int-evry.fr

Lynda Mokdad
Laboratoire Lamsade
Univ. Paris Dauphine
Pl du Maréchal de L. de Tassigny
75775 cedex 16, France
mokdad@lamsade.dauphine.fr

Nihal Pekergin
Centre Marin Mersenne,
Université Paris 1,
90, Rue de Tolbiac, 75013 France
PRISM,
Université Versailles-St Quentin
45, Av. des Etats Unis, 78038 France
Email : nih@prism.uvsq.fr

## Abstract

*We use a mathematical method based on stochastic comparison of multidimensional Markov chains in order to compute packet loss rates in IP routers for MPLS networks. The key idea of this methodology is that given a complex system represented by a Markov chain which is too large to be solved, we propose to build smaller Markov chains providing performance measures bounds.*

keywords : loss rates, Markov chains, stochastic comparison, QoS, MPLS networks

# Performance Evaluation and Analytical Modeling of Novel Dynamic Call Admission Control Scheme for 3G and Beyond Cellular Wireless Networks

Salman A. AlQahtani, Ashraf S. Hassan Mahmoud and A. Alshanyour

*King Fahd University of Petroleum & Minerals, Dhahran 31261, Saudi Arabia*

alqahtani.s@gmial.com

## Abstract

*The wide-band code division multiple access (WCDMA) based 3G and beyond cellular mobile wireless networks are expected to provide a diverse range of multimedia services to mobile users with guaranteed quality of service (QoS). The main contribution of this paper is to design and analyze a novel dynamic priority call admission control (DP-CAC) that can be able to achieve a better balance between system utilization and quality of service provisioning. More importantly, the analytical model of this system is valid for the real-time (RT) and non-real-time (NRT) calls having different bit-rate ( i.e. different bandwidth requirements), channel holding time , time out, and $E_b/N_o$ requirements. Its performance is compared with another two call admission control strategies, referred to as the complete partitioning CAC (CP-CAC) and the queuing priority CAC (QP-CAC). The DP-CAC analytical model can be used easily to derive the analytical model of the QP-CAC and to the CP-CAC. We present numerical examples to demonstrate the performance of the proposed CAC algorithms and we show that analytical and simulation results are in total agreement. Results also indicate the superiority of DP-CAC as it is able to achieve a better balance between system utilization and quality of service provisioning.*

# Mahak: A Test Collection for Evaluation of Farsi Information Retrieval Systems

Kyumars Sheykh Esmaili, Hassan Abolhassani, Mahmood Neshati,
Ehsan Behrangi, Asreen Rostami and Mojtaba Mohammadi Nasiri

Web Intelligence Laboratory
Sharif University of Technology
Tehran, Iran
shesmail@ce.sharif.edu, abolhassani@sharif.edu, neshati@ce.sharif.edu,
behrangi@ce.sharif.edu, asreen@gmail.com, m_mohammadi@ce.sharif.edu

*Abstract*— **Currently there is no standard test collection for evaluation of Farsi information retrieval systems. In this paper we introduce Mahak, the first complete test collection generally available for evaluating Farsi information retrieval systems. We also discuss our construction process in detail. As a goal, we hope that Mahak will foster the development of Farsi information retrieval systems.**

# A Controlled Experiment to Investigate the Effect of 'Process Patterns' on the Quality of Requirement Analysis

Ahmad Estabraghy
Middlesex University, London.
a.estabraghy@mdx.ac.uk

Darren Dalcher
Middlesex University, London.
d.dalcher@mdx.ac.uk

## Abstract

*This paper presents a controlled experiment specifically designed to investigate the influence of 'process patterns' on the requirement analysis phase of software development projects. To differentiate, the experimental groups were given a set of process patterns to use in their software development projects, while the controlled groups employed non-pattern solutions. A goal-oriented measurement process, involving a number of metrics, was designed through which measurements of software quality attributes were taken during the life of the projects. The measurements taken, as well as an assessment of the completed project reports, were evaluated and statistically analyzed to investigate the effect of process patterns on the quality of the software projects. The results indicate that the use of process patterns in the management of software development projects improves the quality of the requirement analysis phase in terms of both process and product.*

# Performance Evaluation of an Ultra-Fast Pipeline Scheduler for Next-Generation Networks

M. T. Anan*, G. M. Chaudhry* and J. Qaddour **
*School of Computing and Engineering, Univ. of Missouri-Kansas City
** School of Information Technology, Illinois State University
mtanan@umkc.edu, chaudhryg@umkc.edu, & jqaddour@ilstu.edu

*Abstract* — The Internet Protocol (IP) plays a dominant role in current networking technologies and the Wavelength Division Multiplexing (WDM) technology provides tremendous bandwidth. The IP-over-WDM is becoming the right choice for Next-Generation Internet networks where Optical Burst Switches (OBS) is a promising technique to bridge the gap between IP and WDM. However, traditional OBS scheduling algorithms either have low computational complexity with high burst dropping probability or high computational complexity with low burst dropping probability. A critical design issue in OBS is how to reduce burst dropping probability as a result of resource contention using a high performance scheduling algorithm. In this paper, we present an ultra-fast scheduler which integrates the merits of both low computational complexity and low burst dropping probability. The key idea is to maintain all scheduled data bursts and void intervals in a binary representation. Then, fast hardware logic operations are performed to schedule incoming data bursts without the need to traverse and search all scheduled bursts in all channels. The new approach provides an effective optical burst switching for variable-length bursts with low computational complexity compared to existing scheduling algorithms.

*Index Terms* – Optical Burst Switching, Core Node Architecture, Wavelength Conversion, Channel Scheduling, Contention Resolution, Optical Fiber Delay Lines

# The Effect of Routing-Update Time on Network's Performability

M. Shaad Zolpirani, M.-M. Bidmeshki, S. G. Miremadi
*CE Dept., Sharif University of Technology, Tehran, Iran*
*{m_shaad, bidmeshk}@ce.sharif.edu, miremadi@sharif.edu*

## Abstract

*By occurring failures in computer networks, routing protocols are triggered to update routing and forwarding tables. Because of invalid tables during update-time, transient loop may occur and packet-drop rate and end-to-end delay increase which means that the quality of service decreases. This paper studies the effect of routing-tables update-time on networks' performability, i.e. the ability of network to deliver services at predefined level. A sample network is studied and the simulation results show that faster updates of routing table, improve network's performability in the presence of failures. Since it may not worth or even be practical to accelerate all routers in the network, this paper suggests finding bottleneck routers and accelerating them in order to improve the performability of the network. The simulation results show that by speeding-up the bottleneck routers of the network, instead of all routers, the desired performability could be achieved.*

# A QoS Adaptive Multi-path Reinforcement Learning Routing Algorithm for MANET

Saïda Ziane, Abdelhamid Mellouk,

*Image, Signal and Intelligent Systems Lab – LISSI/SCTIC*
*University of Paris XII-Val de Marne, IUT Creteil-Vitry*
*120-122, Rue Paul Armangot - 94400 Vitry / Seine - FRANCE*
*Tel.: 00 33 (0)1 41 80 73 74 - fax. : 00 33 (0)1 41 80 73 76*
*Corresponding author: mellouk@univ-paris12.fr*

## Abstract

*The goals of QoS routing are in general twofold: selecting routes with satisfied QoS requirement, and achieving global efficiency in resource utilization. The prediction of these goals in real time is quite difficult, making the effectiveness of "traditional" protocols based on analytical models questionable. In this paper we first discuss some key design considerations in providing QoS routing support, and present a review of previous work addressing the problem of route selection in interaction with QoS constraints. We then devise a solution based on swarm intelligence paradigm based on reinforcement learning approach that we find more adapted for this kind of problems. Finally, we discuss some possible future directions for providing efficient QoS routing mechanisms in wireless ad hoc networks.*

# MRI Fuzzy Segmentation of Brain Tissue Using IFCM Algorithm with Genetic Algorithm Optimization

Youness Aliyari Ghassabeh, Nosratallah Forghani, Mohamad Forouzanfar, Mohammad Teshnehlab
*Electrical engineering department, K. N. Toosi University of Technology*
*y_aliyari@sina.kntu.ac.ir , n_forghani@ee.kntu.ac.ir, mohamad398@ee.kntu.ac.ir*
*teshnehlab@eetd.kntu.ac.ir*

## Abstract

*Fuzzy c-mean (FCM) is a common clustering algorithm which is used for segmentation of magnetic resonance (MR) images. However in the case of noisy MR images, efficiency of this algorithm considerably reduces. Recently, researchers have been introduced two new parameters in order to improve performance of traditional FCM in the case of noisy images. New parameters are computed using artificial neural networks and through an optimization problem, where need complex and time consuming computations. In this paper, we present a new method for efficient computation of these two parameters. We used genetic algorithm (GA) optimization method and showed capability of GA for finding optimal values of these parameters. Simplification of computation is advantage of new proposed method. Simulation results using noisy MR images, demonstrated effectiveness of proposed optimization method for noisy MR image segmentation.*

# A Hierarchical Face Identification System Based on Facial Components

*Mehrtash T. Harandi, Majid Nili Ahmadabadi, and Babak N. Araabi*
Control and Intelligent Processing Center of Excellence
Department of Electrical and Computer Engineering, University of Tehran, Tehran, Iran
&
School of cognitive science (SCS)
Institute for studies in theoretical physics and mathematics (IPM), Tehran, Iran
m.harandi@ece.ut.ac.ir, mnili@ut.ac.ir & araabi@ut.ac.ir

## Abstract

*It is generally agreed that faces are not recognized only by utilizing some holistic search among all learned faces, but also through a feature analysis that aimed to specify more important features of each specific face. This paper addresses a novel decision strategy that efficiently uses both holistic and facial component (left eye, right eye, nose and mouth) feature analysis to recognize faces. The proposed algorithm uses the whole face features in the first step of recognition task. If the decision machine fails to assign a class (with high confidence) then the individual facial components are processed and the resulting information are combined with those obtained from the whole face to assign the output. Simulation studies justify the superior performance of the proposed method as compared to that of Eigenface method. Experimental results also show that the proposed system is robust against small errors in facial component extractor.*

# Robustness-Conserved Partially Host-Adaptive Watermarking Using a Baseband-Spread Spectrum Coding Technique

Ali E. Hameed
*Department of Computer Engineering,*
*University of Basrah, Basrah, Iraq*
*ali_essam_hameed@yahoo.com*

Majid A. Alwan
*Department of Computer Engineering,*
*University of Basrah, Basrah, Iraq*
*altimimee@yahoo.com*

## Abstract

*In order to reduce the impact of watermark embedding on the perceptual fidelity of the marked signal, watermarking systems process the generated watermark to match it to the local properties of the underlying host signal prior to embedding. However, this adaptation process could distort the watermark, affecting its robustness and information content. In this paper, a new watermark coding technique is proposed, that enables the application of some mark-nondistorting host-adaptation processing, where the intensity of the watermark could be redistributed according to the local properties of the underlying host without inducing any distortion into the watermark to be embedded. This completely eliminates the need to equalize adaptation distortions prior to decoding, and hence, to pass any side information about the adaptation processing to the decoder, too.*

# A novel algorithm to fast mode decision with consideration about video texture in H.264

Liquan Shen, Zhi Liu, Zhaoyang Zhang, Guozhong Wang
*Key Lab. of Advanced Display and System Application, Ministry of Education,*
*Shanghai Univ., Shanghai, 200072, China*
*jsslq@163.com, liuzhisjtu@163.com, zhyzhang@yc.shu.edu.cn*

## Abstract

*H.264 employs 7 different size block types for motion estimation that can significantly improve the coding performance compared with the previous video coding standards. However, H.264 requires extremely high computation with the R-D optimized decision since so many prediction modes are used. In this paper, a novel inter mode decision algorithm (NIMDA) is proposed that utilizes SADs of each $4 \times 4$ block and texture characteristic to reduce the candidate mode set after the $16 \times 16$ prediction mode is tested. The simulation results show that the proposed algorithm reduces the entire encoding time by 64.52% with only negligible coding loss.*

Keywords: H.264; mode decision; SAD; video texture

# A Novel Approach for Fingerprint Singular Points Detection Using 2D-Wavelet

Alireza Ahmadyfard
*Shahrood University of Technology*
*Shahrood,Iran*
*Ahmadyfard@shahroodut.ac.ir*

Masoud S. Nosrati
*Amirkabir University of Technology*
*(Tehran Polytechnic),Tehran,Iran*
*MasoudNosrati@cic.aut.ac.ir*

## Abstract

*The success of many methods in fingerprint identification strongly depends on the accurate detection of singular points on the fingerprints. In this paper we propose a new approach for detecting the singular points. The method is based on measuring the maximal disturbance for direction of ridges in fingerprint images. We do not use the directional field in neighborhood of points directly so our method is comparatively fast. For this purpose we used 2D wavelet to detect high frequency components in three directions: horizontal, vertical and diagonal.*

*The results of our experiments on different fingerprint databases confirm the ability of approach for rotation invariant, fast and accurate detection of singular points.*

# OCCLUSION HANDLING FOR OBJECT TRACKING IN CROWDED VIDEO SCENES BASED ON THE UNDECIMATED WAVELET FEATURES

M. Khansari[1], H. R. Rabiee[1,2], M. Asadi[1], M. Ghanbari[1,2,3]
[1]*Digital Media Lab, Department of Computer Engineering, Sharif University of Technology*
*Khansari@mehr.sharif.edu, rabiee@sharif.edu, m_asadi@ce.sharif.edu*
[2]*Iran Telecommunication Research Center*
[3]*Department of Electronic Systems Engineering, University of Essex, England*
*ghan@essex.ac.uk*

## Abstract

*In this paper, we propose a new algorithm for occlusion handling for object tracking in the crowded video scenes. The algorithm exploits the properties of undecimated wavelet packet transform (UWPT) coefficients and texture analysis to track arbitrary objects. The algorithm is initialized by the user through specifying a region around the object of interest at the reference frame. Then, coefficients of the UWPT of the region construct a Feature Vector (FV) for every pixel in that region. Optimal search for the best match is then performed by using the generated FVs inside an adaptive search window. Adaptation of the search window is achieved by inter-frame texture analysis to find the direction and speed of the object motion. This temporal texture analysis also assists in tracking of the object under partial or short-term full occlusion.*

*Experimental results show a good performance for occlusion handling for object tracking in crowded scenes, in particular crowds on stairs in airports or train stations.*

**Keywords:** *Occlusion Handling, Object Tracking, Crowded Scene, Undecimated Wavelet Packet Transform, Texture Analysis*

# An effective model of stressing in an Arabic Text To Speech System

Zouhir ZEMIRLI, Salima KHABET, M'hamed MOSTEGHANEM
*LCSI Laboratory, SCALA Team*
*National Computer Science Institute, BP 68M Oued-smar Algiers ALGERIA*
*z_zemirli@ini.dz, s_khabet@yahoo.fr, m_mosta@ini.dz*

## Abstract

*The improvement of the naturalness a TTS synthesis system implies the development of a prosodic model which is able to reproduce, from a text, the acoustic phenomena implied in the production of the natural word. This requires formalism which interpret the prosody of a written text and a phonetic model which allows the quantification of prosody so that it is exploitable by the synthesis system. The object of this article consists in treating the intonation under the aspect of the lexical stressing with the level of the words, the simple sentences and the texts. A model is proposed and a first evaluation in the ARAVOICE system is presented.*

## Video nature considerations for multi-frame selection algorithm in H.264

Liquan Shen, Zhi Liu, Zhaoyang Zhang, Guozhong Wang
*Key Lab. of Advanced Display and System Application, Ministry of Education,*
*Shanghai Univ., Shanghai, 200072, China;*
*jsslq@163.com, liuzhisjtu@163.com, zhyzhang@yc.shu.edu.cn*

## Abstract

*H.264 allows motion estimation performing on multiple reference frames. This new feature improves the prediction accuracy of inter-coding blocks significantly. However, the coding gain comes at the cost of a much higher computational complexity. The reference software JM adopts full search scheme, and the computational complexity of motion estimation increases linearly with the number of allowed reference frames. In fact, the reduction of prediction residues is highly dependent on the nature of sequences, not on the number of searched frames. In this paper, with consideration of video nature and the available information from previous searched reference frames, an adaptive multi-frame selection algorithm (AMFSA) is proposed to speed up the matching process for multiple reference frames in the H.264 video coding system. The proposed algorithm can effectively reduce 63.6% on average.*

# License Processing: Recognizing Characters in License Plates

Hasan R. Obeid, Rached N. Zantout

Department of Computer and Communication Engineering
Hariri Canadian University
Lebanon

obeidhr@hariricanadian.net, zantoutrn@hariricanadian.net

*Abstract*—This paper describes an approach to character recognition which is designed to recognize Lebanese license plate characters by extracting lines of information from vehicle photographs. The algorithm is designed to extract signatures at strategic positions on the character, then studies the information taken from the hotspots and identifies the different characters. The algorithm is simple and fast however its simplicity does not compromise the integrity of license plate recognition systems.

*Index Terms*—ALPR, line processing, peak, recognition tree

# Multiple Sclerosis Diagnosis Based on Analysis of Subbands of 2-D Wavelet Transform Applied on MR-images

Meysam Torabi
*IEEE Student Member*
*mtorabi@ieee.org*
*School of Electrical Engineering*
*Sharif University of Technology*

Hassan Moradzadeh
*hmoradzadeh@iust.ac.ir*
*School of Electrical Engineering*
*Iran Science & Technology University*

Reza Vaziri
*reza_vaziri@ee.sharif.edu*
*School of Electrical Engineering*
*Sharif University of Technology*

Reza Dehestani Ardekani
*IEEE Student Member*
*rdehestani@ee.sharif.edu*
*School of Electrical Engineering*
*Sharif University of Technology*

Emad Fatemizadeh
*IEEE Member*
*fatemizadeh@sharif.edu*
*School of Electrical Engineering*
*Sharif University of Technology*

## Abstract

*In this study, we have proposed a novel approach to investigate the features of four subbands of 2-D wavelet transform in magnetic resonance images (MRIs) for normal and abnormal brains which defected by Multiple Sclerosis (MS). Concurrently, another method extracts different kinds of features in spatial domain. Totally, 116 features have been extracted. Before applying the algorithm, we have to use a registration method because of variety in size of brain images. All extracted features have been passed over the Principal Component Analysis (PCA) and have been pushed to an Artificial Neural Network (ANN) that is a feed-forward type. According to changing in position of defected parts of brain, we have analyzed four different MRI datasets in different stages of MS progression, including 101 MRIs of normal and abnormal brain images. In all cases, certain diagnosis is gained. Meantime, 40 percent of the datasets have been reserved as the "test data".*

# Artificial Visual Cortical Responding Model in Image Semantic Processing

Zhiping. XU, *Member, IEEE*, Shiyong ZHANG, Yiping ZHONG
Department of Computing and Information Technology
Fudan University, Shanghai, China, 200433
dr.bennix@gmail.com

*Abstract*—**This paper used the time sequence response feature, which generated from a novel visual information process model named Artificial Visual Cortical Responding Model (AVCRM), to clustered the sub-images into the initially manually assigned concept categories to attain the semantic distribution map of the image. According to the result of semantic distribution map, the semantic descriptor was generated for further semantic based Content Based Image Retrieval system. This mechanism was proved to be effective through the experiments and made a good semantic foundation of the future content based image retrieval research work.**

# A Superior Low Complexity Rate Control Algorithm

Alireza Aminlou, Maryam Homayouni, M.H Neishaburi, Siamak Mohammadi

*Faculty of Electrical and Computer Engineering, University of Tehran, Tehran – Iran*
*aminlou@cad.ece.ut.ac.ir, marnameh@yahoo.com, mhnisha@cad.ece.ut.ac.ir, s.mohammadi@ece.ut.ac.ir*

## Abstract

*In this paper, a new low complexity Rate-Distortion optimization algorithm has been proposed. The proposed method can be employed with non-convex curves as well as convex curves. The new technique has been used in a hardware implementation of a JPEG2000 encoder. Simulation results indicate that the proposed algorithm is less sensitive to the shape of R-D curves in comparison with current algorithms. Compared to the exact method, our performance degradation is less than 0.43 dB. The low complexity of this algorithm makes it suitable for real time applications and in applications like Digital Cinema that have to process a large number of input data.*

# Content-based Image Retrieval using Multiple Shape Descriptors

M. Sarfraz and A. Ridha
*Information and Computer Science Department*
*King Fahd University of Petroleum and Minerals*
*KFUPM # 1510, Dhahran 31261, Saudi Arabia.*
Email: sarfraz@kfupm.edu.sa

## Abstract

*In this paper we investigate content-based image retrieval using various shape descriptors. The descriptors include 11 moment invariants, area ratios (3-concentric ring based and 8-sector based) and simple shape descriptors (eccentricity, compactness, convexity, rectangularity, and solidity). The similarity measures used are Euclidean distance and Cosine correlation coefficient. For testing, 220 binary images from SQUID categorized into 12 image groups are used. Simple Shape Descriptors with Euclidean distance achieve the best average precision (0.593). Combining simple shape descriptors and area ratios, also using Euclidean distance as similarity measure, results in 3.29% improvement.*

# Off-Line Signature Verification of Bank Cheque Having Different Background Colors

Javed Ahmed Mahar
Department of Computer Science
Shah Abdul Latif University
Khairpur, Pakistan.
mahar.javed@gmail.com

Mohammad Khalid Khan,
PAF-Karachi Institute of
Economic & Technology,
Karachi, Pakistan.
khalid.khan@pafkiet.edu.pk

Prof. Dr. Mumtaz Hussain Mahar,
Department of Computer Science
Shah Abdul Latif University,
Khairpur, Pakistan.
mumtazmahar@hotmail.com

## Abstract

*Most of the banks issue the chequebooks to their customers having different background colors where as the original specimen signature is always taken on the white paper at the time of the opening of the account. When these signatures are verified digitally the results are not accurate. In this paper, we have proposed a mechanism that automates the offline signature verification for bank cheques even with different background colors. Work present in this paper is focused, to examine whether an input signature of colored bank cheque is a genuine signature or a forged. This task is performed by comparing the collected signature samples (white background) with input signatures (colored background). The Signature Verification of Colored Cheques (SVCC) system of verifying the signatures having different background colors in spite of white paper specimens through variation of color intensity is discussed and presented.*

# Incorporating Knowledge into Unsupervised Model-Based Clustering for Satellite Images

Bilal Al Momani, Sally McClean and Philip Morrow
*School of Computing and Information Engineering*
*Faculty of Engineering, University of Ulster, Cromore Rd, Coleraine*
*Co. Londonderry, BT52 1SA, Northern Ireland*
*{al_momani-b, si.mcclean, pj.morrow}@ ulster.ac.uk*

## Abstract

*The identification and classification of landcover types from remotely sensed data is traditionally based on the assumption that pixels with similar spatial distribution patterns belong to the same spectral class. However, spectral data on its own has proven to be insufficient for classification. In addition, it is difficult to obtain enough accurate labelled samples from such data. Contextual data can be incorporated or 'fused' with spectral data to improve the estimation of class labels and therefore enhance the accuracy of the classification process as a whole when labelled data is not available. In this paper we use Dempster-Shafer theory of evidence to fuse the output of an unsupervised model-based clustering (MBC) technique and contextual data in the form of a digital elevation model. The final classification accuracy is shown to improve when using this approach.*

# A DCT-Based Watermarking Technique for Image Authentication

Mohamed Al Baloshi and Mohammed E. Al-Mualla
*Multimedia Communication and Signal Processing Research Group,*
*Etisalat University College,*
*P.O.Box: 573, Sharjah, United Arab Emirates*
*Tel: +971 6 5611333, Fax: +971 6 5611789,*
*email: almualla@euc.ac.ae*

## Abstract

*This paper presents a novel DCT-based watermarking method for image authentication. In this method a watermark in the form of a visually meaningful binary pattern is embedded for the purpose of tamper detection. The method embeds one watermark bit in each DCT block by shifting a randomly selected coefficient to have a mapped value, in a coefficient-binary-mapping function, that is identical to the watermark bit. The method was tested under different attacks and was found to provide good detection performance while maintaining the quality of the watermarked image*

# Segmentation of Printed Farsi/Arabic Words

A. Broumandnia [1], J. Shanbehzadeh [2], M. Nourani [3]
[1]Islamic Azad University-Tehran South Branch, [2] Tarbiat Moalem University, [3]Tehran University
I. R. Iran

*Abstract*—Characters connectivity is a problem in automated printed Farsi/Arabic script recognition. This paper introduces a novel scheme based on wavelet transform to solve segmentation of printed Farsi/Arabic words into characters. Our novel algorithm employs a new wavelet transform by which the extracted wavelet coefficients are exploited, in detecting, underlying horizontal edges and base line. Projection of horizontal edges and their location on base line provide the segmentation points. A classification method distinguishes true segmenting points. New algorithm is robust against noise, gray level, font and size of characters. Simulation results provide a comparison between new algorithm and three schemes, closed contour, structural and holistic, in terms of precision, speed and robustness against Gaussian noise. Experimental Results indicate superiority of our scheme in terms of precision and show that new algorithm improves recognition speed by a factor of at least 2.5 times.

# Handwritten Farsi/Arabic Word Recognition

A. Broumandnia [1], J. Shanbehzadeh [2], M. Nourani [3]
[1]Islamic Azad University-Tehran South Branch, [2] Tarbiat Moalem University, [3]Tehran University
I. R. Iran

*Abstract*— This paper presents a novel holistic Handwritten Farsi /Arabic Word Recognition scheme in situation where we face with word rotation and scale change. Image words features are extracted by exploiting rotation and scale invariance characteristics of M-Band packet wavelet transform performed on polar transform version of images of handwritten Farsi/Arabic words. The extracted features construct a feature vector for each word image. This vector is employed in recognition phase by finding the similar words based on the least Mahalanobis distance of feature vectors. This scheme is robust against rotation and scaling. Experimental results, obtained from testing different handwritten texts with various orientations and scales, show that proposed scheme outperforms Fourier-wavelet and Zernike moments algorithms. The robustness of new scheme has been tested with images corrupted by Gaussian noise and compared with similar schemes. Experimental results show that the accuracy of our algorithm reaches 95.8 percents.

## Security Enhancement for Watermarking Technique Using Content based Image Segmentation

*M. A. Suhail, Member, IEE, and M. S. Obaidat, Fellow, IEEE*
Monmouth University and University of Bradford
Corresponding Address: Prof. M. S. Obaidat
Department of Computer Science
Monmouth University, W. Long Branch, NJ 07764, USA
E-mail: Obaidat@monmouth.edu, http://www.monmouth.edu/mobaidat

### Abstract
Devising new methods for watermarking with high robustness capabilities is still a challenging research problem. Most of the already proposed schemes suffer from some drawbacks. These proposed algorithms are robust for some range of attacks, but not most of them. As an example, they can not sustain in front of rotation or cropping. This work is a continuation of our works reported in [1-2]. The paper combines both techniques in [1] and [2] to propose a novel watermarking method for data hiding in media signal operating in the frequency domain using content based image segmentation with security enhancing technique. Such watermarking methods present additional advantages over the published watermarking schemes in terms of detection and recovery from geometric attacks, and with better security characteristics.

# Neural Network Examination on Seismic Design Values in the Building Code of Taiwan

Tienfuan Kerh[1,2], J.S. Lai[1], D. Gunaratnam[2] and R. Saunders[2]
[1] *Department of Civil Engineering*
*National Pingtung University of Science and Technology*
*Pingtung 91207, Taiwan*
*E-mail: tfkerh@mail.npust.edu.tw*
[2] *Key Centre of Design Computing and Cognition*
*Faculty of Architecture*
*University of Sydney*
*NSW 2006, Australia*
*E-mail: kerh@arch.usyd.edu.au*

## Abstract

*The purpose of this study is to check the suitability of seismic design values in the current Taiwan building code by using the neural network (NN) method. The neural network model input parameters are magnitude, epicenter distance,, and focal depth for each of the records in the checking stations, and the output is peak ground acceleration (PGA). The neural network model estimations showed that for 5 out of the 24 locations considered in the region, the design value recommended in the building code would be exceeded. Additionally, a curve fitting model, $PGA = 8.96 / D_f$ , is developed for the relationship between horizontal PGA and focal distance $(D_f)$, and reflecting the essential characteristics of strong motion in the region investigated. The present neural network model and the mathematical equation can provide useful information for both the relevant government agencies and practicing engineering designers.*

# A Study of ECG Characteristics by Using Wavelet and Neural Networks

*Man Sun Kim, HyungJeong Yang*
*Department of Computer Science, Chonnam National University*
*300 Yongbong-Dong, Buk-gu, Gwangju 500-757, Korea*
*mansun@kongju.ac.kr hjyang@chonnam.ac.kr*

## Abstract:

*ECG consists of various waveforms of electric signals of heat. Machine Learning methods such as the MLP classification have proven to perform well in ECG classification. In this study, preprocessing was performed through wavelet transform, and in classification several characteristics were evaluated using BP algorithm that applied generalized delta rules to MLP. In order to decide wavelet generating function that can remove baseline by minimizing the distortion of raw signals, this study removed baseline by applying various wavelet generating functions. To evaluate the results above according to the learning method, learning iteration and learning rate of neural networks, various experiments were conducted.*

## Keywords:

ECG, data mining, wavelet, BP

# Diesel Engine Indicated Torque Estimation Based on Artificial Neural Networks

Yahya H. Zweiri and Lakmal* D. Seneviratne
Department of Mechanical Engineering, Mu'tah University,
Karak, Jordan.
*Department of Mechanical Engineering, King's College London,
Strand, London WC2R 2LS, UK.
email: yahya.zweiri@kcl.ac.uk

## Abstract

*This paper presents an artificial neural networks approach to estimate the indicated torque of a single-cylinder diesel engine from crank shaft angular position and velocity measurements. Since these variables can be measured using low-cost sensors, the estimator may be useful in the implementation of the control or diagnostics strategies that require cylinder indicated torque, a variables that are not easily measured and need expensive sensors. The approach is to design indicated torque estimators using feedback and an artificial neural networks model as feedforward. Such an approach can offer the advantage of being amenable to real-time implementation. The estimated results of the engine indicated torque are presented, which compared with experimental data indicate a good agreement.*

# Seamless Secure Development of Systems:
# From Modeling to Enforcement of Access Control Policies

Saeed Parsa, Morteza Damanafshan
*Department of Computer Engineering*
*Iran University of Science and Technology, Tehran, Iran*
*parsa@iust.ac.ir, morteza_damanafshan@comp.iust.ac.ir*

## Abstract

*Despite the emphasis on removing gap between software models and implementation code, there has been made little effort to apply software tools to enforce access control models directly into program code. In this paper the design and implementation of an access control policy enforcement environment is described. Within this environment, View-Based Access Control policies defined in XML Metadata Interchange format are translated into View Policy Language. The View Policy Language primitives are then easily translated into Java primitives. At last, these primitives are enforced into Java program code to be secured. Two major benefits of applying the proposed approach for modeling and enforcement of access control policies are rapid development of view-based customized applications and secure enforcement of ordered chain of methods' executions.*

# Trust-Based User-Role Assignment in Role-Based Access Control

Hassan Takabi          Morteza Amini          Rasool Jalili
Computer Engineering Department
Sharif University of Technology
Tehran, Iran.*
{takabi@ce., m_amini@ce., jalili@ }sharif.edu

## Abstract

Role Based Access Control (RBAC) model is naturally suitable to organizations where users are assigned organizational roles with well-defined privileges. Nowadays, many organizations and enterprises such as banks, insurance industry and utility companies, provide online services to their very large number of users. This shows that assigning users to roles is a intolerable task and maintaining user-role assignment up-to-date is costly and error-prone. Also, with the increasing number of users, RBAC may have problems in prohibiting cheat and changing roles of users. To overcome these problems, user-role assignment decision can be made based on how much we trust him/her. In this paper, we propose a model to assign users to roles based on trustworthiness which is fuzzy in nature. The proposed model uses fuzzy relation equations to compute trust values.

# How to Counter Control Flow Tampering Attacks

Mohsen Sharifi, Mohammad Zoroufi, Alireza Saberi
msharifi@iust.ac.ir,{m_Zoroufi, a_Saberi}@comp.iust.ac.ir
Computer Engineering Faculty
Iran University of Science & Technology

## Abstract

Nowadays more and more business activities are operated through web and the web plays a vital role in the interests of both businesses and their shareholders. However, the very good features of web such as its popularity, accessibility and openness, has provided more opportunities for security breaches by malicious users. That is why the rate of successful attacks on web and web applications are increasing. Many approaches have been introduced so far to reduce the rate of successful attacks of many kinds. Any technique that can detect these vulnerabilities and mitigate the security problems of web applications is useful to organizations seeking for more reliability from the security viewpoint. In this paper we first introduce the control flow tampering attack, which is one of the notable attacks against web applications, and present our approach for countering this attack using web application firewall.

# On Optimal Firewall Rule Ordering

El-Sayed M. El-Alfy and Shokri Z. Selim
*College of Computer Sciences and Engineering*
*King Fahd University of Petroleum and Minerals*
*Dhahran 31261, Saudi Arabia*
*{alfy, selim}@kfupm.edu.sa*

## Abstract

*In today's online connected world, almost all corporate networks use some form of perimeter firewalls to manage Internet connections and enforce a security policy at the corporate gateway. Although it can considerably enhance network security and protect business-critical information, a firewall with thousands of rules can become a bottleneck for network performance. The primary goal of this paper is to present a new rule order optimizer based on simulated annealing to find optimal configurations that minimize the average number of rule comparisons while preserving precedence relationships among disjoint rules. The proposed approach is evaluated and its effectiveness is compared with another approximate solution under several firewall configurations and policy profiles.*

# Structuring a Multi-violation Detectors Database for an Efficient Intrusion Detection

Amel Meddeb-Makhlouf, Mohamed Hamdi, and Noureddine Boudriga
Communication Networks and Security Research Lab.
Engineering School of Communications (SupĆom), Tunisia

## Abstract

*This paper proposes to manage data structures manipulated by the proposed correlation function based on a new concept called Multi-violation Detectors (MvD). The MvD-based correlation function manipulates events based on metrics that evaluate them. The detection and the correlation processes are managed using a MLP(Muli-Layer Perceptron)-like network architecture. The manipulated data structures in the MLP-like network mainly include attacks, metrics and MvD values. To add more efficiency to the implemented processes, these values are managed through a structured database where an SQL-like language for MvD retrieval is introduced. The proposed approach is based on a relational calculus. Therefore, its completeness is mathematically proved.*

# SmartSSL: Efficient Policy-Based Web Security

Camille Gaspard    Batoul Haidar    Ayman Kayssi    Ali Chehab
Department of Electrical and Computer Engineering
American University of Beirut
Lebanon
*{cgg04,brh02,ayman,chehab}@aub.edu.lb*

## Abstract

*In this paper we present SmartSSL as a policy-based solution for assuring the security of Web servers and that employs SSL in an efficient way. SmartSSL is content-based and applies SSL dynamically on parts of the Web traffic, as configured by a security policy. SmartSSL does not require any modifications on the client and is designed in a platform-independent manner. SmartSSL can be seamlessly integrated into existing server platforms. Implementation results show substantial performance improvement for SmartSSL as compared to bulk SSL.*

**Keywords:** Security, SSL, Web Security, Policy-Driven Security, Content-Based Security, Customizable Security.

# Sensor Activity Scheduling for Efficient WSN-based Tracking

Nejla Essaddi, Mohamed Hamdi, Noureddine Boudriga
Communication Networks and Security (CN&S) Research Lab.
Engineering School of Communications (Sup'Com), Tunisia
mmh@suppcom.rnu.tn

## Abstract

*With the advance of sensing technologies and its applications, sophisticated (i.e., mobile, wireless) sensor networks are gaining increasing interest. Although such networks allow to implement interesting tracking functionalities, their performance is severely affected by energy limitations. This paper introduces an activity scheduling protocol that extends the network lifetime while the area coverage is kept unchanged. A cost-benefit analysis is conducted in order to assess the cost of the additional number of sensors that should be deployed to implement our protocol. Simulation results show that the proposed approach outperforms the existing scheduling techniques.*

# WordNet based Cross-Language Text Categorization

Bentaallah Mohamed Amine
Department of computer sciences
EEDIS Laboratory
Sidi Bel Abbes, 22000. ALGERIA
mabentaallah@univ-sba.dz

Malki Mimoun
Department of computer sciences
EEDIS Laboratory
Sidi Bel Abbes, 22000. ALGERIA
malki-m@yahoo.fr

## Abstract

This article is essentially dedicated to the problem of Cross-Language Text Categorization, that consists in classifying documents in different languages according to the same classification tree. The proposed approach is based on the idea to spread the utilization of WordNet in Text Categorization towards Cross-Language Text Categorization. Experimental results of the bi-lingual classification of the ILO corpus (with the documents in English and Spanish) show that the idea we describe are promising and deserve further investigation.

## An Educational Asynchronous Learning Environment

Amar Balla
National Institute of Computer Science
BP 68M, Oued-Smar, Algiers, Algeria
a_balla@ini.dz

## Abstract

In this paper we propose an educational asynchronous learning environment which makes students more interactive in learning process. Our system lets students collaborate among them in order to construct their knowledge as much as possible and to find solutions of many problems that occur during learning. In this paper, we focus on question and answer (Adaptive Evaluation: AE) as a collaboration tool for students based on Web technology, because AE has the characteristics that ensures and checks students' comprehension of material without any restriction of time and place. In our system students can act as questioners who ask some questions collaboratively to acquire additional knowledge, or act as respondents who answer questions from other students. Using this environment, the interactive learning of students can be achieved, and also the teacher's load can be decreased.

Keywords: Asynchronous learning environment; Adaptive Evaluation; Collaboration;

# Exploiting Model of Personality and Emotion of Learning Companion Agent

Taihua Li
*School of Electronic and Information Engineering,
Southwest University, Chongqing, China*
catalyst@swu.edu.cn

Peng Yue
Intelligent Software and Software Engineering Laboratory
Southwest University, Chongqing, China
yappy555@swu.edu.cn

Yuhui Qiu
Intelligent Software and Software Engineering Laboratory
Southwest University, Chongqing, China
yhqiu@swu.edu.cn

Guoxiang Zhong
*Chongqing Education College,
Chongqing, China*
xsc@cqec.edu.cn

## Abstract

*In the development and application of intelligent learning environments, an important trend is to integrate characteristics proper of human, such as personality and emotion, into the intelligent interface agents, with the aim of providing the student with a more personalized and friendly environment. The learning companion is a kind of very useful intelligent interface agent in the learning environment. Therefore, exploring the model of personality and emotion of learning companion agent is the crucial problem to make it more hominine and believable. In this paper, the related works on personality and emotions in psychology and artificial intelligence are reviewed briefly, and a framework of learning companion agent with Personality and Emotions is proposed. Based on the OCEAN model and the OCC model, the model of personality and emotion of learning companion agent is defined and formalized. Moreover, the computation and the coming implementation of the model are described in detail.*

# HELP: A Recommender System to Locate Expertise in Organizational Memories

Esma Aïmeur, Flavien Serge Mani Onana, and Anita Saleman
*University of Montreal, Department of Computer Science
{aimeur, manionaf, salemana}@iro.umontreal.ca*

## Abstract

*The rapid evolution of our world means that learning and knowledge sharing are fast becoming a key challenge for individuals and organizations. In this paper, we present a system called HELP, whose aim is to locate information and recommend experts in organizations. Each user is being viewed simultaneously as an expert and a learner. We use two approaches: The first one consists of making the system retrieve one or several requests similar to the seeking-learner's request using a textual case-based reasoning technique. The second approach aims at locating experts in specific areas in order to recommend them to the users who request this expertise. For this purpose, we use a hybrid recommendation technique based on Collaborative Filtering (CF) and Case-Based Reasoning (CBR). In contrast to existing approaches in expertise location, we believe that CBR combined to CF enables HELP to better recommend expertise, taking into account the user's feedback concerning the technical and pedagogical skills of the experts.*

# Developing Quality Games-based e-Learning Systems

School of Computer Science and Engineering
Cyprus College
6 Diogenes Str. Engomi, 1516, Nicosia
CYPRUS
*apapanik, mstefanos@cycollege.ac.cy*

## Abstract

*In this paper, we define the factors of game-based learning and quality and how they can be incorporated into e-Learning systems development. First, we identify the advantages of games-based learning in correlation to the basic learning theories, next we define the quality and socio-cultural factors as published in previous work and lastly we formulate the essential factors combining the two aforementioned principles.*

## Defining OCL constraints for the Proxy Design Pattern Profile

N. C. Debnath

*Winona State University*
*Department of Computer Science*
*Winona, MN 55987 USA*
*ndebnath@winona.edu*

A. Garis, D. Riesco, G. Montejano
*Universidad Nacional de San Luis*
*Ejército de los Andes 950*
*(5700) San Luis-Argentina*
*{agaris, driesco, gmonte}@unsl.edu.ar*

## Abstract

*Profiles allow extend UML vocabulary and the design patterns define a common vocabulary for software designers, therefore it is possible to use profile to define a pattern vocabulary in UML. If profiles are used to represent patterns then it is not required to define a special notation neither a particular CASE tool for patterns (UML tool is used).*

*Three mechanisms are in the profiles: stereotypes, tag values and constraints. Stereotypes extend the UML vocabulary and it is possible to associate to it tag values and constraints. When these elements are introduced in models; patterns can be clearly visualized, software developers improve communication and establish a common vocabulary. Also profiles allow add information to the model to transform it to other models.*

*OCL (Object Constraint Language) constraints are semantic restrictions added to UML elements. This work shows a way in which OCL constraints are used to define semantic restrictions over stereotypes included in a profile of pattern. The definition of OCL constraints for proxy design pattern is shown as an example of our proposal. An interaction between users and UML tool is proposed for solving the loss generality when OCL constrains are imposed.*

**Keywords:** UML Profiles, OCL, Design Patterns

# E-government Services Offerings Evaluation Using Continuous Logic

Narayan Debnath[*], Aristides Dasso[†], Ana Funes[†], Roberto Uzal[†], José Paganini[‡]

[*]NDebnath@winona.edu
Winona State University
Winona, MN 55987, U.S.A.

[†]{arisdas, afunes, ruzal}@unsl.edu.ar
Universidad Nacional de San Luis
D5700HHW San Luis
Argentina

[‡]Universidad Nacional de Jujuy
Jujuy
Argentina

## Abstract

*Electronic Government although it has many areas is more commonly associated with the possibility of the general public to obtain through the web not only information about the government itself but also being able to access online public services. We present here an evaluation model for online public service offerings that is based on one hand on the use of the benchmarking of online public services created by the European Commission and on the other hand by the use of one particular method of Continuous Logic called Logic Scoring of Preference.*

# HAODV: a New Routing Protocol to Support Interoperability in Heterogeneous MANET

Haidar Safa[1], Hassan Artail[2], Marcel Karam[1], Hala Ollaic[1], and Rasha Abdallah[1]

[1]Department of Computer Science
[2]Department of Electrical and Computer Engineering
American University of Beirut, Beirut, Lebanon
{hs33, hartail, mk62, hao04, rma47}@aub.edu.lb

## Abstract

*In today's MANET, nodes can be equipped with one or more wireless communications interfaces that support different wireless technologies such as WIFI IEEE 802.11 and Bluetooth. Each technology implements distinct hardware and logical specifications. Current AODV routing protocol becomes inefficient when used in a network formed of heterogeneous devices. Indeed AODV in its nature search the paths between homogeneous devices and ignore the ones between heterogeneous devices. In this paper, we propose a heterogeneous AODV protocol that interoperates between WIFI and Bluetooth technologies in a single MANET. The extended algorithm takes into consideration several factors when building the routes such as network stability, traffic, conversion rate; in addition to the shortest path.*

# An Abstract Workflow-Based Framework for Testing Composed Web Services

Marcel Karam*[1], Haidar Safa[1], Hassan Artail[2]
[1] Department of Computer Science
[2] Department of Electrical and Computer Engineering
American University of Beirut
P.O.Box: 11-0236 Riad El-Solh, Beirut 1107-2020, Lebanon
Phone: +961 1 350000, ext. 3520
Fax: +961 1 744461
E-mails: { mk62, hs33, hartail}@aub.edu.lb

## Abstract

*Testing web services impose many challenges to existing testing methods, techniques, and tools; especially those available to traditional applications. Composed web services increase these challenges by requiring additional validation and verification efforts. Structural-based testing approaches have been thoroughly researched for traditional applications; however, they have not yet been examined, as a methodology, for testing composed web services. In this work, we introduce a formal model for an abstract-based workflow framework that can be used to capture a composed web service under test. We then define a set of applicable structural-based testing criteria to the framework. Finally we outline a promising line of testing criteria that can be applied to this framework.*

# Formal Design of a Parameterized Synchronization Component for Asynchronous Communication Streams

Walter Dosch

Institute of Software Technology and Programming Languages
University of Lübeck, Lübeck, Germany

http://www.isp.uni-luebeck.de

**Abstract.** The paper presents the top-down design of a synchronization component refining the communication-oriented input/output behaviour into a state-based implementation. The component constrains the flow of messages on two parallel communication channels to stay within a specified tolerance. The formal derivation uses transformations which are of general importance for the design of interactive components. The differentiation of the stream function localizes the effect of a single input with respect to previous input histories. The history abstraction extracts the component's state from the input histories. The design safely bridges different views of the synchronization component ranging from the stream based specification to the state based implementation.

*Keywords* Synchronization component, communication history, stream function, state transition machine, differentiation, history abstraction, synchronization tolerance

# Benchmarking XML-Schema Matching Algorithms for Improving Automated Tuning

*Mohamed Boukhebouze\*, Rami Rifaieh\*\*, Nabila Benharkat\*, Youssef Amghar\**
*\* LIRIS, National Institute of Applied Sciences of Lyon, Lyon, France*
*\*\*San Diego Supercomputer Center, University of California San Diego, USA*
*{mohamed.boukhebouze, nabila.benharkat, youssef.amghar}@insa-lyon.fr*
*rrifaieh@sdsc.edu*

## Abstract

Several matching algorithms were recently developed in order to automate or semi-automate the process of correspondences discovery between XML schemas. These algorithms use a wide range of approaches and matching techniques covering linguistic similarity, structural similarity, constraints, etc. The final matching combines arithmetically different results stemmed from these techniques. The aggregation of the results uses often many parameters and weights to be adjusted manually. Generally, this task is achieved by human experts and requires a perfect understanding of the matching algorithm. In order to reduce the human intervention and improve matching quality, we suggest automating the tuning of the various structural parameters used within XML-Schema matching algorithms. In this work, we offer a benchmark, for three tools, that seeks mathematical relations between parameters values and schema topology. In consequent, we propose an algorithm for the tuning of these parameters for studied tools.

**Keywords**: Matching, XML Schemas, Benchmark, Automatic Tuning.

# A Performance Comparison of Contiguous Allocation Placement Schemes for 2D Mesh-connected Multicomputers

Ismail M. Ababneh
*Computer Science Department, Al al-Bayt University, Mafraq, Jordan*
*ismail@aabu.edu.jo*

## Abstract

Several contiguous processor allocation policies for two-dimensional mesh-connected multicomputers have been proposed over the past fifteen years. These policies typically consist of a detection phase and a placement phase. The detection phase finds submeshes that can accommodate the current allocation request, and the placement phase chooses a free submesh where allocation will take place and a position for the allocated submesh within this submesh. The performance of allocation policies depends on their ability to detect free submeshes, and on the placement policy used. Several placement schemes have been considered in previous research works, but no realistic performance comparison between them is available. In previous comparisons, the placement and detection schemes were lumped together. This paper presents the results of detailed simulations that were carried out to evaluate and compare several placement schemes that cover a wide range of choices. In these simulations, a single complete-recognition free submesh

and on the placement policy used. Several placement schemes have been considered in previous research works, but no realistic performance comparison between them is available. In previous comparisons, the placement and detection schemes were lumped together. This paper presents the results of detailed simulations that were carried out to evaluate and compare several placement schemes that cover a wide range of choices. In these simulations, a single complete-recognition free submesh detection algorithm is used with all placement schemes considered.

# An Efficient Processor Allocation Strategy that Maintains a High Degree of Contiguity among Processors in 2D Mesh Connected Multicomputers

S. Bani-Mohammad
*Glasgow University, Computing Science, Glasgow G12 8RZ, UK.*
saad@dcs.gla.ac.uk

M. Ould-Khaoua
*Glasgow University, Computing Science, Glasgow G12 8RZ, UK.*
mohamed@dcs.gla.ac.uk

I. Ababneh
*Al al-Bayt University, Computing Science, Mafraq 25113, Jordan.*
ismail@aabu.edu.jo

Lewis M. Mackenzie
*Glasgow University, Computing Science, Glasgow G12 8RZ, UK.*
lewis@dcs.gla.ac.uk

## Abstract

Two strategies are used for the allocation of jobs to processors connected by mesh topologies: contiguous allocation and non-contiguous allocation. In non-contiguous allocation, a job request can be split into smaller parts that are allocated to non-adjacent free sub-meshes rather than always waiting until a single sub-mesh of the requested size and shape is available. Lifting the contiguity condition is expected to reduce processor fragmentation and increase system utilization. However, the distances traversed by messages can be long, and as a result the communication overhead, especially contention, is increased. The extra communication overhead depends on how the allocation request is partitioned and assigned to free sub-meshes. This paper presents a new Non-contiguous allocation algorithm, referred to as Greedy-Available-Busy-List (GABL for short), which can decrease the communication overhead among processors allocated to a given job. The simulation results show that the new strategy can reduce the communication overhead and substantially improve performance in terms of parameters such as job turnaround time and system utilization. Moreover, the results reveal that the Shortest-Service-Demand-First (SSD) scheduling strategy is much better than the First-Come-First-Served (FCFS) scheduling strategy.

# Applications of Heterogeneous Computing in Hardware/Software Co-Scheduling

Proshanta Saha, Tarek El-Ghazawi
The George Washington University
{sahap, tarek}@gwu.edu

## ABSTRACT

Current work on automatic task partitioning and scheduling for reconfigurable computing (RC) systems strictly addresses the field programmable gate array (FPGA) hardware, and does not take advantage of the synergy between the microprocessor and the FPGA. Efforts on partitioning between the microprocessor and the FPGA are often times a manual and laborious effort as a formal methodology for automatic hardware-software partitioning for RC systems has not yet been established. Related fields such as heterogeneous computing (HC) and embedded computing (EC) have an extensive body of work for scheduling for heterogeneous processors. In this work, we adapt HC scheduling algorithms for RC systems, and show how simply adapting the algorithms alone is not sufficient to take advantage of the reconfigurable hardware. In many cases, the HC heuristics algorithms do not generate efficient schedules necessary to take advantage of the synergy between the microprocessor and the FPGA. We introduce new heuristic algorithms based on HC scheduling algorithms and show that they provide up to an order of magnitude improvement in execution time.