

# CIAO Newsletter

Centre for Informatics & Applied Optimization  
School of Information Technology & Mathematical Sciences, University of Ballarat





# New Water Project Funding

## Grampians Wimmera Mallee Water

We are very pleased to announce that GWM Water has recently agreed to provide CIAO with funding for research into water optimization, for the next three years.

Some of this funding will be used to support an Australian Research Council Linkage Application, which is currently being prepared.

This follows on from our first project with GWM Water, optimizing power usage in the Northern Mallee Pipeline System, which is nearing completion.

## Footy, Flows, Fields and Families: Water Allocation and Community Resilience

CIAO is involved in a new and exciting project, which will focus on understanding the impact of changing water availability on community resilience in the Wimmera region of Western Victoria.

We will collaborate with the project's Lead Partner, the Water in Drylands Collaborative Research Program (WIDCORP) and Deakin University.

CIAO's role will be to design and assess the effectiveness of an online envisioning interactive tool, in understanding if trade-offs work in rural communities faced with difficult water allocation decisions.

This tool will be adaptable to any landscape, and will therefore be transferable to other regions and internationally.

The envisioning tool will attempt to educate the user by allowing them to:

- > make scenario decisions
- > see the local consequences of their choices in the allocation of water
- > see how these consequences might be balanced within their own wider community context.

The software will simulate community scenarios and the subsequent landscapes that result from unbalanced decision practices.

The project will also provide an indication of the communities' resilience to adapt to a range of future water allocation scenarios.

It will highlight and increase the awareness of the community-wide impact resulting from blinkered decision making, in relation to water allocation.

Overall, the project will have the capacity to help address one of the major problems facing water managers today: the issues of participatory decision making, transparency and equity, as water allocation decisions become more critical & the outcomes more uncertain.



**CIAO Director:**  
**Professor John Yearwood (above left)**  
**CIAO Deputy Director:**  
**Dr Andrew Stranieri (above right)**

# Rubinov Memorial Lecture 2008

The Inaugural Alexander Rubinov Memorial Lecture will take place at 5.30pm on Monday 10 November 2008 in Ballarat.

Professor Rubinov was the Founding Director of CIAO, and this event has been established to honour his memory and promote the mathematics and optimization work of CIAO.

It is a Public Lecture, and will be presented by Professor Barney Glover, a former colleague of ours, who was instrumental in facilitating Professor Rubinov's move to the University of Ballarat in 1996 from Europe.

Professor Glover (pictured below) is currently Deputy Vice-Chancellor, Research at the University of Newcastle, and was recently appointed Vice Chancellor Elect to Charles Darwin University.

More information about this event can be obtained from:

Elizabeth Matuschka on (03) 5327 9949 or e.matuschka@ballarat.edu.au



Dr Bagirov is a Senior Research Fellow and Leader of the Mathematical Analysis and Optimization Research Group (MAORG) within CIAO.

After gaining a Master of Science degree from Baku State University in Azerbaijan, he came to Australia in 1999 to study as a PhD student under the supervision of the late Professor Alex Rubinov, the Founding Director of CIAO.

Dr Bagirov's PhD topic was "Dual methods for the solution & analysis of structured optimization problems".

On completion of his PhD, Dr Bagirov (pictured right) was appointed to his current position within ITMS, where his specific research interests include mathematical programming, nonsmooth optimization, nonsmooth analysis, global optimization and data mining.

Dr Bagirov has enjoyed considerable success in obtaining research funding, with highlights including:

- Australian Research Council Discovery Grant in 2002: three year research project valued at \$193,000, titled "Approximate bundle methods in nonsmooth optimization and their applications in some complex systems".
- Woodside Energy Ltd in 2003: three year commercial research project valued at \$120,000, titled "Development of non-linear optimization techniques for production optimization", which applied optimization techniques to liquid natural gas operations and resulted in significant savings for the company.

## *Dr Adil Bagirov*

### Staff Member Profile



- Australian Research Council Discovery Grant in 2005: five year research project valued at \$554,000, titled "Derivative free algorithms for large scale nonsmooth and global optimization and their applications".

- Grampians Wimmera Mallee Water in 2008: one-year commercial research project valued at \$84,000, titled "Northern Mallee Pipeline Optimization Project", which is applying optimization techniques to water delivery and water stakeholder applications.

As a result of his extensive optimization experience and expertise, Dr Bagirov has become an international research specialist in the area of Non Smooth Optimization.

Non Smooth and Non Convex Optimization are the most difficult types of optimization problem to solve.

This is because they normally have non-convex properties, meaning they may have multiple feasible regions and mul-

iple locally optimal points within each region, which are non-smooth or even discontinuous.

Accordingly, derivative or gradient information generally cannot be used to determine the direction in which the function is increasing or decreasing.

In simple terms, this means that when one possible solution is arrived at using non smooth optimization techniques, it will often provide very little information on where to look for a better solution.

Genetic or evolutionary algorithms offer one way to find reliable and superior solutions to nonsmooth optimization problems.

In a genetic algorithm, the problem is encoded in a series of bit strings that are manipulated by the algorithm. In an evolutionary algorithm, the decision variables and problem functions are used directly. Most commercially available products are based on evolutionary algorithms.

These methods successively generate better solutions, however there are no means for these methods to determine that a given solution is truly optimal.

Optimization techniques are being used to solve complex problems in an increasingly broad range of industry applications, nationally and internationally.

The cutting edge research of valuable researchers such as Dr Bagirov and his colleagues continues to propel CIAO's optimization expertise on to the international stage.

## **New Staff Member: Mr George Kadmapuzha**

Welcome to Mr George Kadmapuzha, who recently joined ITMS as a researcher and lecturer in Network Operating Systems and Management Information Systems. Mr Kadmapuzha's specific research interest is Network Security, and his other interests include Enterprise Resource Planning Systems, Knowledge Management and Distributed Networking.

He will become a member of CIAO's Internet Commerce Security Laboratory (ICSL), and collaborate on research projects with ICSL's members. Mr Kadmapuzha has a B.Commerce (Computing Stream), a Masters in Information Systems, and is a Certified Solution Consultant for SAP Human Resources. His work experience includes software development for InfoWorld Solutions Pty Ltd, course coordination at Stotts College for courses affiliated

with UB, and tutoring at Victoria University and the University of Ballarat.



# Research Group News

## MAORG: Mathematical Analysis & Optimization

Leader: Dr Adil Bagirov



MAORG is pursuing its main research directions: studies in nonlinear analysis including topology, development of new algorithms in global, nonsmooth and derivative free optimization, as well as in data mining & bioinformatics, and application of optimization algorithms.

The project "Pipeline Optimization" with GWM Water is progressing well. The first version of optimization software for minimizing pumping costs with proper interface is now ready. This software will be modified further after consultation meetings with experts from GWM Water.

Four research papers have recently been accepted for publication in the area of topology, while another four have been published or accepted for publication on the new global, nonsmooth and derivative free optimization algorithms.

All ARC Discovery Projects, involving Chief Investigators Dr Adil Bagirov, and Dr Musa Mammadov, are progressing well, and the ARC Discovery Grant "Operations Research without Convexity" has been successfully completed.

New algorithms have been developed for solving supervised data classification, data clustering and data approximation problems in large data sets. One paper has been published in this area, with three more in the pipeline.

During his study leave earlier this year, MAORG member Dr Prabhu Manyem spent eighteen weeks at the University of Durham (UK), working with Professor Iain Stewart on the descriptive complexity of optimization problems.

## DMIRG: Data Mining and Informatics

Leader: Dr Peter Vamplew (below)  
Deputy Leader: Dr Richard Dazeley



DMIRG continues to meet monthly for group meetings and seminars, as well as individual meetings with the Group Leader.

Possible industry partners in the text mining area are currently being sought.

Plans are also in place to develop closer links and collaboration with MAORG, as this synergy has been very beneficial in the past.

Current projects are being undertaken in the areas of:

- > Reasoning Communities.
- > Sleep Apnoea.
- > Development of a Chinese Traditional Medicine Expert System in collaboration with the Health Informatics Laboratory.
- > Text-Mining Surveys.

Dr Peter Vamplew's PhD Student Ms Armita Zarnegar recently attended the Winter School in Mathematics and Computational Biology at the University of Newcastle New South Wales.

Five papers have been accepted to AI-2008, the 21st Australasian Joint Conference on Artificial Intelligence, to be held in Auckland, New Zealand in December 2008.

DMIRG members have also recently submitted a wide range of papers to journals and other conferences.

Details of all recent submissions are listed in the Publications section of this newsletter.

# Visitors from Turkey

CIAO recently hosted a visit from three Turkey academics:

> Associate Professor Dr Refail Kasimbeyli, Izmir University of Economics, Faculty of Computer Sciences.

His research interests include convex and nonconvex optimization: theory, methods and applications, vector optimization, data mining and classification, and portfolio optimization.

Dr Kasimbeyli is working on the project "Applications of MSG algorithm to solving non-smooth constrained equations" with Dr. Musa Mammadov, as part of an ARC Discovery Grant.

> Mrs Zehra Kamisli Ozturk, Research Assistant and PhD student, Open Education Faculty, Anadolu University, Eskisheir, Turkey.

Her research interests include mathematical programming, decision support systems, meta-heuristics, educational timetabling problems and discrete event system simulation.

> Dr Gurkan Ozturk, Assistant Professor, Engineering and Architecture Faculty, Industrial Engineering Department, Anadolu University, Eskisheir, Turkey.

His research interests include mathematical programming, data mining, discrete event system simulation, and decision support systems.

Dr Ozturk and Mrs Ozturk visited CIAO while on sabbatical study leave, and were here to collaborate with Dr Adil Bagirov and Dr Musa Mammadov.

Below (L to R): Mrs Zehra Ozturk, Dr Gurkan Ozturk and Dr Refail Kasimbeyli.



# Research Laboratory News

## ICSL: Internet Commerce Security

Leader: A/Prof Paul Watters



ICSL has recently been involved in initial engagement with the Australian Federal Police, with a view to onboarding them as a formal research partner.

Discussions are also continuing with other banks and law enforcement agencies to grow the partnership.

All components of our IT infrastructure from IBM have been delivered to Ballarat, with laptops being delivered to staff and UNIX servers coming online.

The Research Advisory Committee (RAC) met formally for the first time in July, and all partners are satisfied with the progress of work.

ICSL's primary goal remains scaling up our existing code and algorithms to handle large phishing data sets, and investigating the correlation structure between variables of interest with a view to improving performance.

On the malware front, Mr Glenn Stevens' project on modeling malware is proceeding with a view to tackling Storm, which is at the "cutting edge" of internet worms in terms of offensive capability and countermeasures against law enforcement.

Semester 2 has seen the enrolment of five new research students for ICSL:

- > Ms Amber Stabek (ICSL scholarship)
- > Mr Robert Layton (ICSL scholarship)
- > Mr Jai Gupta
- > Mr Mamoun Al Azab
- > Mr Glenn Stevens, ITMS Lecturer

ICSL was also profiled in the latest edition of the Ballarat Enterprise magazine.

## HIL: Health Informatics

Leader: Dr Andrew Stranieri



Providing adequate health care for all is a significant global issue that is stretching every nation's resources.

HIL researchers believe we must adopt new ways of thinking about health care. This involves new ways to apply information technologies that result in quality care and empower people to manage their health.

One 'new world' tenant involves the integration of Western medicine with other forms.

HIL researchers, Dr Long Jia, Dr Richard Dazeley and Dr Andrew Stranieri are working with universities in China to develop an interactive simulation system that trainee Traditional Chinese Medicine practitioners can use to hone their diagnostic skills.

Along a similar vein, HIL's Dr Chris Turville, is working with a global team of researchers on one of the largest trials of homeopathy remedies for prevention of the flu.

A key feature of the new world of health care involves collecting and learning from huge amounts of data.

Over 300 gigabytes of data is recorded from one patient in an overnight sleep clinic yet methods to process this data are still largely manual.

HIL researchers Dr Julien Ugon and Dr Nadezda Sukhorukova are working closely with data mining researchers CIAO and the Tenon Hospital in Paris, to automatically identify a patient's sleep stage, diabetes and cardio-vascular disease.

## VRSL: Virtual Reality and Simulation

Leader: Dr David Stratton (below R)  
Dep Leader: Dr Phil Smith (below L)



VRSL is following up a number of ideas to maximise use of the VRSL facilities.

ITMS Staff Member and current PhD student Mr William Harvey's research deals with improving pilot competencies and skills in gaining a private pilot licence, using personal computer flight simulation software.

This project offers an ideal opportunity to utilise the lab's facilities, and funding sources are currently being investigated for flight simulation equipment.



The following projects have recently been completed.

- > HL7 training courses delivered in Perth, Western Australia.
- > Service Coordination Tools Template 2008 update for Department of Human Services, Victoria.
- > Victorian Statewide Referral Form HL7 message specification and AHML implementation.

Current continuing projects include:

- ~ Queensland Health eONI
- ~ Intelligent decision support system for general practitioners in home based sleep disorder diagnosis.
- ~ Structured Reports for Radiology Reporting.
- ~ 2008 IHE Connectathon Project.

## Commercial Projects

### Business Development Manager:

Mr Con Nikakis



### Department of Human Services Tender

CCeH has recently been successful in its tender to provide the Department of Human Services with specifications for their online forms.

The work is valued at \$43,000, and will be completed by early 2009.

### Road Transport Authority NSW Tender

> Tender application submitted in conjunction with Transfield Services for Road Transport Authority NSW.

> Will use new statistical techniques to predict grouped road asset deterioration, with the view to minimizing the cost of multiple road asset maintenance.

> Excel Plug-In software to be developed using Recurrent Markov Chain approach to provide group asset condition prediction.

> Outcome of tender expected shortly.

> Value: \$30,000

> Personnel involved: Professor John Yearwood, Dr Ahmed Bani-Mustafa, Mr Peter Martin, Mr Con Nikakis.

## Grant Applications Submitted

### Australia-Japan Foundation Grant

Project Title: Forensic Analysis of Japanese Phishing Attacks

Chief Investigator: A/Professor Paul Watters

Partners:

> Dr Shimo-Malmberg, School of Languages, Cultures and Linguistics, Monash University

> Professor Takato Natsui, Meiji University, Japan (former judge and practising lawyer at Hayabusa Asuka Law Office in Tokyo. Professor Natsui is Japan's foremost legal expert on cybercrime)

Funding source: Australian Government

Funding requested: \$10,000

### USA Cystic Fibrosis Foundation

Project title: A new clinical scoring system for Cystic Fibrosis

Investigators: Professor John Yearwood, Dr Zari Dzalilov, Dr Phil Robinson, Dr Gaudi Hafen, Professor Panos Pardolas, Dr Musa Mammadov

Funding sought: \$89,461

### Grants Awarded

CIAO Seed Funding Grant

Topic: Data Mining Explorations into Sleep Disorders

Background: This grant will fund research assistants to mine Tenon Hospital, France data using optimization, neural networks, forecasting and Hidden Markov Model.

Comparative results will aid development of partnership with Sleep Apnoea Research Centre at the Austin Hospital, with a view to applying for a CASS Seeding Grant and later a 2009 ARC Linkage Grant.

Funding: \$10,000

Personnel involved: Dr Andrew Stranieri, Dr Julien Ugon, Dr Nadia Sukhorukova, Dr Peter Vamplew, Mr Marcello Bertoli, Dr Ahmed Bani-Mustafa, Dr Liping Ma.

## Conferences & Seminars

### Health Informatics Conference, HIC 2008, Melbourne Convention Centre, Victoria

Mr Gary Saunders attended this conference on 31 August to 2 September 2008, hosted by the Health Informatics Society of Australia.

He presented a paper titled "Applying drug and critical term ontologies to Australian drug safety data for Adverse Event Signalling (AES) and comparison with its Bayesian AES method MGPS".



### CATS 2009: Computing - The Australasian Theory Symposium

Dr Prabhu Manyem is a program committee Co-Chair of this Symposium, to be held in the Victoria University of Wellington, New Zealand in January 2009.

## Colloquia at ITMS

Recent colloquia presentations have been made by the following visitors:

> *Dr John Wharington*

Senior Research Scientist, Maritime Platforms Division, Defence Science Technology Organisation

Topic: "Building an Environmental Weather Server at DSTO"

> *Professor Song-Ping Zhu*

Director, School of Mathematics and Applied Statistics, University of Wollongong

Topic: "Various Quantitative Approaches for Pricing American Options"

## Seminars at ITMS

Recent seminars have been presented by:

> *Professor Josef Pieprzyk*

Director, Centre for Advanced Computing, Algorithms and Cryptography (ACAC), Macquarie University

Topic: "The Current Status of Hash Functions Biography"

> *Dr Heping Pan*

CIAO Researcher and ITMS Lecturer

Topic: "A Basic Theory of Financial Information Fusion in Stock Markets"

## Staff News

### Another new baby

Congratulations to Mr Sunam Pradhan and his wife Prajwala, who recently welcomed their new son into the world.

### Farewell to Staff

We recently said farewell to the following staff members:

*Mr Scott Hebbard:* Scott has moved to Mason Brown IT in Ballarat, and his new role involves managing relationships and selling corporate ICT systems. Scott is a former ITMS student and spent ten years here as an academic staff member.

*Dr Allison Plant:* Allison has accepted a two-year contract position in China, lecturing first year students who are expecting to attend Cambridge University, UK, in 2009.

*Mr Chris Lynton-Moll:* Chris has left his role as Manager of CCeH and plans to relocate to Melbourne for work.

We wish them the very best for the future, and thank them for their valuable contribution.

# Research Student Profile:

## *Mr Md. Shamsul Huda*



Mr Md. Shamsul Huda (pictured above) is a PhD student in the School of ITMS, and came to Ballarat from his native home of Bangladesh in March 2005 to commence a research degree at UB.

He is on study leave from the Khulna University of Engineering and Technology (KUET) in Bangladesh, where he is a faculty member in the Computer Science Department.

Mr Huda is supervised by Professor John Yearwood (Principal Supervisor), and Dr Eldar Hajilarov and Dr Adil Bagirov (Associate Supervisors). He also works closely with his External Co-Supervisor, Dr Roberto Togneri from the University of Western Australia.

Mr Huda's research thesis topic is "Hybrid training approaches to Hidden Markov Model based acoustic model for automatic speech recognition".

Automatic Speech Recognition (ASR) systems are used extensively in a variety of real life applications.

Here are some examples:

- > the transcription of broadcast news
- > voice control systems
- > car navigation systems
- > the automation of complex operator-based applications, such as customer helpline services
- > any service which requires speech-to-text transformation tasks.

Despite substantial progress over the past decade, even the best ASR systems still experience significant performance degradation.

The main causes of the recognition performance degradation in the ASR systems are the huge variability in the speech signals, and the modeling para-

digms that has been employed to capture the complex variability of the speech signal.

Hidden Markov Models (HMM) are the most popular and successful stochastic approach to speech recognition modeling, due to the existence of efficient algorithms for both the training and recognition processes. HMMs are used by most current generation ASR systems.

However, the standard training method of HMM faces a local convergence problem. This gives a non-optimized estimation of the parameters of HMM and consequently a lowering of the recognition accuracy.

Mr Huda's research addresses the shortcomings in the training of HMM based acoustic models, and proposes several hybrids of standard metaheuristic approaches for the training of HMM.

It justifies the effectiveness of the proposed hybrids of metaheuristic approaches for HMM training in the ASR systems.

Mr Huda is currently finalising his thesis, which contains significant results that will benefit the ASR System industry and its many applications – such as sequential pattern recognition, signal classification and recognition, bioinformatics – within our daily lives.

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## New Research Students

We welcome the following new ITMS research students:

### > *Mr Robert Layton*

Degree: PhD on "Phishing profiling using cluster ensembles"

P/Supervisor: Assoc Prof Paul Watters  
A/Supervisor: Dr Richard Dazeley

### > *Ms Amber Stabek*

Degree: Master of Mathematical Sciences on "Minimising guess ability and maximising memorisation in password generation"

P/Supervisor: Assoc Prof Paul Watters  
A/Supervisor: Dr Alison Plant

### > *Mr Lei Zhao*

Degree: PhD on "Global optimization methods for solving non-linear equations"

P/Supervisor: Dr Musa Mammadov  
A/Supervisor: Dr Zhiyou Wu

### > *Mr Alia Mari Al Nuaimat*

Degree: PhD on "Meta-model for selecting the optimal forecasting method"

P/Supervisor: Dr Chris Turville  
A/Supervisor: Dr A Bani-Mustafa

We also warmly welcome the first recipient of the Alex Rubinov PhD Scholarship, who comes to us from Harbin Engineering University in China:

### > *Ms Liping Jin*

Degree: PhD on "Algorithm optimization in field reconstruction"

P/Supervisor: Dr Adil Bagirov  
A/Supervisor: Dr Musa Mammadov

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## UB Open Day 2008

UB's annual Open Day was held on 31 August 2008 and CIAO participated by:

> Projecting a continuous large screen display of information about CIAO's structure, research groups, commercial projects and grant activity.

> Demonstrating three current research projects using Powerpoint, project models and detailed information posters.

> Publicising the diverse range of research topics of our forty current PhD and Masters by Research students.

Pictured below (L to R): "Win an iPod" competition winner Mr Matt Brehaut and Mr Con Nikakis, CIAO's Business Development Manager.



# Kazakhstan Visitors

Recent visitors to CIAO were Professor Zoya Tuiebakhova, Vice-Rector and Dr Fuad Hajiyevev Dean, Faculty of Information Technology, from Kazakh British Technical University, Kazakhstan.

Their visit was used to discuss building a co-operative relationship with UB in the areas of teaching and research, and to sign a Memorandum of Understanding with UB to cement the relationship.

## Publications

### *Books Published*

Boslaugh, S. & Watters, P. (2008) Statistics in a Nutshell: A Desktop Quick Reference, O'Reilly & Associates, 476 pages.



### *Journal Papers: Submitted/Accepted*

**Dazeley, R. & Kang, B.** (2008) Prudence Analysis: Knowing the Limit of Knowledge, IEEE Transactions on Knowledge and Data Engineering, IEEE Computer Society (submitted).

Dmitruk, A.V. & Kruger, A.Y. (2008) Extensions of metric regularity, Optimization (accepted).

**Herbert, S.** (2008) Where is the Rate in the Rule?, Australian Senior Mathematics Journal (submitted).

**Huda, S., Yearwood, J. & Togneri, R.** (2008) A Constraint-Based Evolutionary Learning Approach to the Expectation Maximization for Optimal Estimation of the Hidden Markov Model for Speech Signal Modelling, IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics, Vol.38, Issue 6 (accepted).

**Kelarev, A.V., Ryan, J. & Yearwood, J.L.** (2008) Cayley graphs as classifiers for data mining: the influence of asymmetries, Discrete Mathematics (accepted).

**Morris, S.** (2008) Varieties of Abelian topological groups and scattered spaces, Bulletin of the Australian Mathematical Society (accepted).

**Morris, S. & Hofmann, K.** (2008) Contri-

butions to the Structure Theory of Connected Pro-Lie Groups, Summer Topology Proceedings (accepted).

**Plant, A.** (2008) A new recipe for the spin characters of the symmetric group, Journal of Physics A: Mathematical and Theoretical (accepted).

**Yearwood, J. & Stranieri, A.** (2008) A study of the use of structured reasoning frameworks for improving students' reasoning qualities, Learning & Teaching (accepted).

**Zarnegar, A., Vamplew, P. & Stranieri, A.** (2008) Application of gene expression programming to discovery of gene expression networks, Simulated Evolution and Learning (submitted).

### *Journal Papers: Published*

**Bagirov, A.M.** (2008) Modified global k-means algorithm for sum-of-squares clustering problems, Pattern Recognition, Volume 41, Issue 10, pp. 3192-3199.

Cooke, T., Lingard, H., Blismas, N. & **Stranieri, A.** (2008) ToolSHed: The development and evaluation of a decision support tool for health and safety in construction design, Engineering, Construction and Architectural Management, Vol.15, No.4, 2008, pp.336-351.

**Hajilarov, E.** (2008) Degrees of Maximums of Linear Mappings, Optimization, Vol.57, Issue 4, Jan 2008, pp.505-514.

**Kelarev, A.V.** (2008) An Algorithm for BCH Codes Extended with Finite State Automata, Fundamenta Informaticae, Vol.84, No.1, pp.51-60.

**Kelarev, A.V. & Passman, D.S.** (2008) A Description of Incidence Rings of Group Automata, Contemporary Mathematics: Noncommutative Rings, Group Rings, Diagram Algebras and Their Applications, Vol.456, pp.27-33.

### *Conference Papers: Submitted/Accepted*

**Dazeley, R. & Kang, B.** (2008) An Approach for Generalising Symbolic Knowledge, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).

**Dazeley, R.** (2008) An Expert System Methodology for SMEs and NPOs, The Eleventh Annual Australian Conference on Knowledge Management and Intelligent Decision Support, ACKMIDS 2008 (submitted).

**Dazeley, R. & Kang, B.** (2008) Detecting the Knowledge Boundary with Prudence Analysis, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).

**Haidar, I., Pan, H. & Kulkarni, S.** (2008) Analysis of the Relation between Crude Oil Futures Prices and Spot Price Using Nonlinear Artificial Neural Networks, Australian Conference of Economists, Gold Coast, Australia, 30 Sep to 3 Oct 2008 (submitted).

**Haidar, I., Kulkarni, S. & Pan, H.** (2008) Forecasting Model for Crude Oil Price Using Artificial Neural Networks and Commodity Future Price, The Eleventh Annual Australian Conference on Knowledge Management and Intelligent Decision Support, ACKMIDS 2008 (accepted).

**Kulkarni S. & Venkatraman, S.** (2008) The Impact of Biometric Systems on Communities: Perceptive and Challenges, The Eleventh Annual Australian Conference on Knowledge Management and Intelligent Decision Support, ACKMIDS 2008 (accepted).

**Layton, R., Vamplew, P. & Turville, C.** (2008) Using stereotypes to improve early-match play in poker, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).

**Ofoghi, B., Yearwood, J. & Ma, L.** (2008) FrameNet-Based Fact-Seeking Answer Processing: A Study of Semantic Alignment Techniques and Lexical Coverage, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).

**Quinn, A., Stranieri, A., Yearwood, J.L. & Hafen, G.** (2008) A classification algorithm that derives weighted sum scores for insight into disease, Health Informatics and Knowledge Management Workshop HIKM 2009 (submitted).

Tilakarathne, C., **Morris, S. & Mammadov, M.** (2008) Predicting Trading Signals of Stock Market Indices Using Neural Networks, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).

**Vamplew, P., Yearwood, J., Dazeley, R. & Berry** (2008) On the limitations of scalarisation for multi-objective reinforcement learning, 21st Australasian Joint Conference on Artificial Intelligence, AI 2008, Auckland, New Zealand (accepted).



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Photograph: a burst of Spring - golden wattle flowering along University Drive, Mt Helen Campus