



# CIAO Newsletter

Centre for Informatics & Applied Optimization

School of Information Technology & Mathematical Sciences

Edition 13 – June 2006

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## From the Editors

The primary source of CIAO's success is research. With new research results, members of CIAO can provide consultancies, undertake commercial projects, publish

papers, present talks at conferences, and organise workshops. Because of this, the section "News from CIAO Research Groups" mainly consists of notes relating to current research.

CIAO research groups and clusters have many projects, so sometimes it's not possible to say something about each of them individually, in every newsletter.

This section contains information about the most interesting results and achievements obtained over the last three months. We also provide a detailed description of two CIAO projects on pages 12 and 13.

## News

### GANSO Library

CIAO is proud to announce the release of a new programming library GANSO (Global And Non-Smooth Optimization).

GANSO implements a number of modern optimization methods to tackle the most difficult nonlinear programming problems, in which the objective function is non-differentiable and has multiple extrema.

It also allows you to combine these methods in different ways (eg: to combine local and global searches).

The GANSO library provides interface for the following methods:

- o Derivative Free Bundle Method (DFBM) of non-smooth optimization.

This is a very efficient method to find deep local minima for problems with non-differentiable objective functions. It is a derivative free method, which uses finite difference approximation to the subgradient.

- o Extended Cutting Angle Method (ECAM) of global Lipschitz optimization

This is a deterministic global solver for finding a globally optimal solution to problems with multiple extrema of moderate size. It applies Branch-and-Bound strategy and computes tight lower bounds to Lipschitz-continuous objective functions.



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- Dynamical System-based Optimization (DSO)

This is a heuristic method for solving general global optimization problems.

- Random Start Local optimization.

Each of the above methods has a different field of application.

The full potential of the GANSO library is implemented through various combinations of these methods, to solve problems extremely efficiently.

GANSO provides class and procedural interface to all the algorithms, and can be linked to programs written in C/C++ and Fortran, and also called from other packages. An extensive user manual and examples are included in the package.

GANSO is royalty-free, it can be used by programs written in most common programming languages. It is distributed as a DLL (for MS Windows) or a statically linked library (for MinGW and linux) compiled for various platforms (i86, Opteron 64 bit, Power5).

GANSO is a system under constant development, including performance and usability improvements, implementation of new algorithms, and interface with other software packages. A trial version of GANSO is available from: <http://www.ganso.com.au>

We would appreciate users' feedback, and we can provide assistance with the installation and use of GANSO. Questions and feedback should be addressed to Dr Julien Ugon at [j.ugon@ballarat.edu.au](mailto:j.ugon@ballarat.edu.au).

## News from:

### *CIAO Research Groups*

#### **Combinatorics, Graphs & Network Topology (CGANT)**

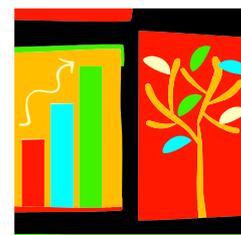
A CGANT Research Meeting was held on 24 March 2006.

The program included the following presentations:

- Labelings of Graphs: Professor Martin Baca, Technical University, Kosice, Slovakia.
- $\Delta$  - Optimum Exclusive Sum Labeling of Certain Graphs with Radius One: Moris Tuga, University of Newcastle.

- Modelling the capacity of a Wireless Telecommunications Network: Dr Julien Ugon, University of Ballarat.

- Open Problems and Discussion.



#### **Project Report:**

*Bounds on the Order of Graphs under Degree and Distance Constraints*

This is a project supported by an ARC discovery grant.

CIAO personnel involved in this project are:

- Professor Mirka Miller (CI)
- Dr Joe Ryan
- Mr Dafik, Mr Guillermo Pineda Villavicencio, Ms Kim Marshall, Mr Jakub Teska, Mr JianMin Tang (PhD students)

Aims:

The main aim of this project is to find the best possible general bounds on the number of nodes in a network, modelled as a graph, given constraints with respect to the maximum possible number of connections at any node, and given the maximum possible delay or distance (measured by the number of intermediate nodes along a shortest path between any two nodes).

The project includes many related sub-problems, such as:

- Construction of large graphs and digraphs.
- Voltage assignment technique.
- Repeats technique.
- Mixed graphs.

Progress made during the last three months has included:

1. We have proved that directed networks of maximum out-degree 3, diameter  $k > 2$  and defect 2 must necessarily be regular, that is, have out-degree and in-degree of every vertex in such a network equal to  $d$ . This new finding is being written up for a journal publication, with PhD student Dafik.
2. In collaboration with researchers from the Czech Republic, we are exploring the possibility of finding new divisibility conditions that might apply to directed networks of maximum out-degree  $d$ , diameter  $k > 2$  and defect 1. So far, it is known that such networks cannot exist for  $d = 2$  and 3. We are looking at the case  $d > 2$ .

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If we get strong enough conditions, we will be able to prove the nonexistence of some network structures or, alternatively, use the conditions to help in the construction of such networks, with PhD student Jakub Teska.

3. Together with researchers in Spain and Cuba, we have constructed some new largest undirected graphs for several values of maximum degree  $d$  and diameter  $6$ , by using the technique of compounding of graphs. The construction of these new largest known graphs will be described and published in a journal paper, and the new largest values will be displayed on the website [www-mat.upc.es/grup\\_de\\_grafs/grafs/](http://www-mat.upc.es/grup_de_grafs/grafs/), with PhD student Guillermo Pineda Villavicencio.
4. We are investigating the possibility of creating new large graphs from smaller ones, using the technique of voltage assignments, with PhD student Kim Marshall.
5. Using a new hybrid algorithm which combines good properties of Simulated Annealing and Genetic Algorithms, called HSAGA, we are creating new directed graphs that are in one sense “close” to the ideal of Moore digraphs, with PhD student JianMin Tang. This sub-project also involves close collaboration with Dr Yuqing Lin from the University of Newcastle.

## Data Mining & Informatics Research Group (DMIRG)

### AIBO Robots

DMIRG have purchased four Sony AIBO robots, and will be aiming to have Honours students become involved in robotics research. We currently have one Masters by Research student and one Honours student working in this area.

### Data Mining

The eResearch project co-ordinated by the Victorian Partnership for Advanced Computing (VPAC) and involving CIAO, LaTrobe University, Deakin University, the Royal Children's Hospital (RCH) and the Cystic Fibrosis Foundation has now been completed, and a presentation has been made to RCH.

The work has developed a database system for RCH, for recording clinical data on Cystic Fibrosis (CF) patients. With the limited data available to date, we have been able to develop a methodology for deriving a scale of CF severity, based on the case information in this database. This tool requires further development and testing.

An application for a research grant to undertake further development will be made to CF Australia.

The problem of developing a severity scale is important in monitoring patient health, but also in developing health economic policy. There are several avenues for further research, involving statistical and data mining techniques, as well as genomics and optimisation.

A paper has been prepared and will be submitted to the British Medical Informatics Journal. It was excellent to work with Dr Gaudi Hafen (RCH), Professor Phil Robinson (RCH), Dr. Phoebe Chen (Deakin) and Ms Julie Smith (RCH), as well as having input from Marianne Hibberd (CFV) and Bill Yeadon (VPAC).



### Decision Support

The project with Ballarat Health Services (BHS) and the University of Ballarat's School of Nursing, to develop and test learning approaches based on modelling reasoning and the automatic generation of narrative learning scenarios from the reasoning, has been completed with positive outcomes. Learning approaches based on decision trees and a narrative tutoring system performed significantly better than conventional case study approaches.

Papers are being prepared for publication in nursing and IT journals, and future work with BHS is being considered.



### Text Categorization

A range of work is being carried out in this area – optimisation approaches to text classification, short featured datasets and multi-label classification, test stream mining and question answering systems based on frame semantics. The next DMIRG meeting will focus on this area, with presentations from ITMS PhD students Sol Hart, Bahador Ofoghi, Arun Banerjee, and Wei Xie.

### Health Informatics

The Joint Replacement pilot project with St John of God (SJOG) Hospital has been completed. This project identified areas of further study that would improve the health-related quality of life of total joint replacement patients.

A detailed description is provided on page 12.

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## **Distributed Simulation Laboratory (DSL)**

**Project Report:** *Australian Defence Force - eXtensible Modelling and Simulation Framework Testbed.*

This project is now complete.

**Project Report:** *Australian Defence Force - OpenRTI establishment and development.*

Work on this project is continuing, but for contractual reasons this is not occurring under the DSL. Depending on ADF responses to evaluations of CERTI, and on the open source RTIs, there could be future DSL activity in this area

**Project Report:** *Applying the Lessons of the Virtual Battlefield to Financial Modelling - Investigating Innovative use of Distributed Simulation.*

The largely automated generation of HLA-enabled programs from existing code-bases is well under way. The study is clarifying a series of challenging theoretical questions that may lead to further research.

A detailed description of a human modelling HLA federate project is provided on page 13.



## **Mathematical & Statistical Analysis Research Group (MASARG)**

**Project:** *The Structure of Pro-Lie groups and Locally Compact Groups*

Chief Investigator: Professor S Morris

This project is progressing very well. A 660-page book titled "The Lie Theory of Pro-Lie Groups" has been completed and accepted for publication by the European Mathematical Society Publishing House. It is due to appear in print later this year or in early 2007.

**Project:** *Operations research without convexity*

ARC Discovery grant DP0343998 (2003-2007)

Chief investigator: Professor A M Rubinov

The project is proceeding as planned. Some items of the research plan have been accomplished, and examination of other items has commenced. Two book chapters and nine papers related to this project were published in international journals during 2005.

**Project:** *Optimal Placement of Network Infrastructure in Wireless Networks*

Investigators: J. Ugon, S. Kouhbor, M. Mammadov, A. Rubinov, A. Kruger.

This is a non-funded project. Many results have been obtained by Ms Shahnaz Kouhbor for her PhD thesis during 2006, and the thesis is being written up during 2006.

**Project:** *Generalised Lagrange-type functions in non-convex optimization*

Investigators: A. Rubinov, J. Giri

This is non-funded project. A paper about special penalty functions has been accepted for publication.

**Project:** *Development of non-linear optimisation techniques for production optimisation.* Investigators: A. Bagirov, M. Ghosh.

This project was completed on 31 May 2006. PhD student Mrs Moumita Ghosh has successfully completed her PhD thesis, and will submit it for examination this month. As a result of this project, optimization software based on developed algorithms has been installed at Shell International.



## **Educational Research in Mathematics, IT and Statistics Cluster (CERMITS)**

**Project:** RITEMATHs (Real world problems and Information Technology Enhancing MATHeMatics)

Dr Robyn Pierce and Mrs Sandra Herbert

We are currently in the third year of this project.

In Ballarat, Term 2 data collection has involved testing and observing students' use of algebraic symbols in the context of linear functions.



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## New projects in 2006: data collection commenced

**Project:** *Student Perceptions in Problem Based Learning in Capstone Project Courses*

Mrs Kathleen Keogh and Mr Shamsheer Syed

An initial written survey has been conducted with students in the penultimate week in Semester 1 at Mt Helen.

Initial results suggest that students do indeed value and appreciate the need for structure and documentation in their project; we had expected that students in their initial stages of a project might not yet appreciate or value these concepts.

It also appears that, after just one semester of the project, students are already very confident in their ability to succeed in managing a real project in the workplace, and generally this confidence has increased since starting their project.

Students also like working with real clients rather than imagined projects. A thorough analysis of the initial survey results is yet to be completed.

**Project:** *Exploring the Value of Tutorials in Programming Courses*

Mr Sunam Pradhan

In CP514 Programming 1, we are evaluating the introduction of tutorials every week, where content materials relate to lecture and laboratory exercises.

Students are involved in two hours of lectures, followed by a one-hour tutorial and one hour of laboratory exercises.



## New projects for 2006: Data collection not yet commenced

*Supporting Teachers Adopting Relevant Technology for Mathematics (START-M):* Dr Robyn Pierce, Dr Jason Giri. The Victorian Department of Education and Training has approved our application to conduct research in Schools.

*Student Uptake of IT Educational Support*  
Dr Jason Giri, Kylie Winnell

*Culture Shock on Campus? Academic Staff Challenges from Increasing International Student Populations at Two Victorian Regional University Campuses*  
Dr Charlynn Miller

*e-learning and IT*  
Sally Firmin, Dr Robyn Pierce



## Information Security Cluster (INSECT)

On 6 June 2006, Dr Venkatesan Guruswami presented a seminar titled "Achieving Channel Capacity Against Malicious Errors" to ITMS staff and research students.

Dr Guruswami was visiting us from the USA, where he holds the position of Assistant Professor of Computer Science and Engineering, University of Washington, Seattle, USA.

The abstract for his presentation appears below:

*Suppose you want to communicate a message of  $k$  packets on a noisy communication channel. So you judiciously encode it as a redundant collection of  $n = ck$  packets and transmit these. What is the fewest number of correct packets one needs to receive in order to have any hope of recovering the message?*

*Well, clearly one needs at least  $k$  correct packets. In this talk, I will describe recent work that gives an encoding scheme that attains this information-theoretic limit: for any desired  $\epsilon > 0$ , it enables recovery of the message as long as at least  $k(1+\epsilon)$  packets are received intact. The location of the correct packets and the errors on the remaining packets can be picked adversarially by the channel.*

*This achieves the optimal trade-off (called "capacity") between redundancy and error-resilience for a malicious noise model where the channel can corrupt the transmitted symbols arbitrarily subject to a bound on the total number of errors. Previously, capacity-achieving error-correcting codes were only known for weaker, stochastic models of the channel noise.*

*These results are obtained in an error-recovery model called list decoding. The talk will introduce and motivate the problem of list decoding, and then give a peek into the algebraic ideas and constructions that lead to the above result. We will also describe some challenging questions that still remain open.*

## Intelligent Finance Cluster (IFC)

### Project 1: A Theoretical Framework of Intelligent Finance

After about three years of comprehensive study on both academic and professional financial literature and theoretical thinking, a theoretical framework of Intelligent Finance has finally been shaped, consisting of seven major components:

1. Financial Information Fusion
2. Multilevel Stochastic Dynamic Process Models
3. Active Portfolio Management and Total Risk Control
4. Financial Strategic Analysis and Intelligent Agent Modelling
5. Dynamic Optimization in Intelligent Finance
6. Objective Predicting and Intelligent Trading Systems
7. Macrowave Investing and Multifractal Trend Following.

### Project 2: Multilevel Stochastic Dynamic Process (MSDP) Models

The theoretical foundations of MSDP models for financial market prices or indices have become clearer, including the heterogeneous market hypothesis in contrast with the homogeneous market assumption implied in the classical efficient market hypothesis, multifractality of financial prices, multiple time frames of different types of market participants such as producers, investors, traders and speculators.

The mathematical constructs of MSDP models have also resulted in much more clarity, including:

- Fractalization to convert a 4-element vector time series (open, high, low and close) to a single fractal time series only containing the significant fractal turning points;
- Singularization to label each fractal turning point with a fractal level, so the whole fractal time series can be structured into multilevel fractal processes;
- A set of multilevel stochastic differential equations are proposed, yet to be implemented and tested;
- A generic form of multilevel structural time series models is proposed, yet to be implemented and tested.

It has also been conceived that the Minority-Majority Game may provide an econophysical way to investigate the fundamental mechanisms of MSDP models.

### Project 3: Financial Information Fusion

A theory of financial information fusion has been shaped. Five perspectives to financial markets have been identified, corresponding to five parallel projections into the future:

1. economic long-term trend of growth and business cycles;
2. fundamental value and growth prospect;
3. technical market trend and cycles, sector rotations and money flows;
4. exogenous event impacts (news) and politico-economical event projection;
5. strategic intents of strategic investors (market makers).

Super Bayesian Influence Networks (SBIN), made up of many probabilistic ensembles of neural networks, provide a core framework for fusing these information sources into a coherent continuum of future scenarios.



## Collaborative Centre for e-Health (CCeH)

### New Staff Member

We are pleased to welcome Mr Michael Proctor to CCeH, as our Project Officer.

### Project: Schedule 4 & Schedule 8 Pharmacy Guild Project

This project is nearing completion, and the final report was presented to the Pharmacy Guild in April 2006.

The report has made recommendations regarding a best practice model for dispensing and monitoring of drugs of addiction (S4 & S8).

It also made recommendations on appropriate remuneration to pharmacies for carrying out this process. CCeH is now waiting for the final report to be accepted by the Pharmacy Guild of Australia.



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## **Project: Service Coordination Tools Template (SCTT) 2006**

This project has now been completed. The final HL7 implementation specification for the SCTT 2006 was delivered to the Department of Human Services Victoria in May 2006.

## **Project: Barwon Division of General Practice D\_Info Project.**

This project commenced in January 2006, with the aim of implementing the transmission of Diabetes Management Plans (DMP) from general practice desktop software to divisional databases in the northern general practice divisions of New South Wales. This project has completed the scoping phase, and has now moved into the development phase.

This phase will produce an electronic Diabetes Management Plan that will be sent securely from a GP's desktop to the divisional Microsoft Access database, where it will be automatically incorporated into the database.

The database will generate automatic reminders for continual assessment, and automatically generate the appropriate pathology requests for the next patient examination. The development phase is due for completion by the end of June 2006, when the system will be installed in two trial sites in northern New South Wales.

## **Project: New South Wales Health and DHS Victoria HL7 Messaging Handbook**

CCeH are preparing two HL7 messaging handbooks for New South Wales Health and Department of Human Services Victoria.

The first handbook will detail HL7 version 2.4 messaging specifications for patient administration processes. The second handbook will detail HL7 version 2.4 messaging specifications for pathology and diagnostic imaging orders, and results and adverse drug reactions. The first handbook is near completion.



## **Project: Queensland Health eONI Project**

CCeH have been contracted by Queensland Health to carry out work on their Ongoing Needs Investigation (ONI) forms.

CCeH will:

- Produce AHML profiles to reflect the detailed eONI specification.
- Produce XML schema to reflect the detailed eONI HL7 specification.

- Develop transformation technology to change between HL7 vertical bar and HL7 XML.
- A schema that uses the same tags as the eONI HL7 schema, but which reflects HACC MDS data.
- Produce a schema of the Interactive Free Text PDF ONI that interfaces with Electronic ONI HL7 schema
- Provide helpdesk support and access to the AHML testing facility.

Contracts are being negotiated and work will commence soon.



## **Project: ITOL (Information Technology on Line) Program**

A consortium of six stakeholders, including the University of Ballarat's Collaborative Centre for eHealth (CCeH), has received funding of \$350,000, for the development of a new electronic prescription management system.

The system will streamline the current time-consuming process of prescription management for the elderly in residential care facilities, as well as within the community.

The project is supported by the Federal Government with funding of \$175,182 through Round 14 of the Information Technology Online (ITOL) Program of the Department of Communications, Information Technology and the Arts.

The consortium members include Bendigo and District Division of General Practice, Ballarat and District Division of General Practice, Ballarat District Nursing and Healthcare, Collaborative Centre for eHealth (CCeH), Grampians Rural Health Alliance Network and The Pharmacy Guild of Australia.

CCeH is part of the University of Ballarat's School of Information Technology and Mathematical Sciences (ITMS). It will be responsible for the design, development, testing and implementation of the system.

Current practices of medication management processes rely

heavily on labour-intensive technologies - the telephone and the fax. The new web based electronic prescription management system will enable better patient health outcomes, lead to reduced costs and significantly improve information flow between all participants of the process

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including nursing staff, the prescribing doctor and the pharmacy.

The project is unique to Australia and it is anticipated that, once implemented, it will readily roll out to other health areas such as radiology and pathology requests.

The electronic notification process will improve the flow of information between residential aged care facilities, community based health care providers, community pharmacies and general practitioners. All participants will be able to check the status of a prescription at any time via the internet.

The project will build on existing broadband infrastructure being rolled out by the Federal and State Governments for all health care facilities.

The proposed software solution will be a user-friendly system, readily managed by staff with limited time and often minimal computing skills.

## Conferences & Seminars

- To ITMS Staff:  
A list of recommended international conferences has been prepared and will soon appear on the Staff Information page, of the ITMS internet site.

Staff members will not normally be supported to attend an international conference from the research initiatives account unless that conference is on this list.

Staff with sufficient funds in their publication or other consultancy accounts will be able to support travel to other conferences from those accounts.

- Mr Peter Martin will be attending the 7th International Conference on Teaching Statistics in Salvador, Brazil in July 2006, on behalf of ITMS.

This conference is held every four years, and is the premier statistics education conference worldwide.

The conference organisers have promoted the paper "Achieving Success in Industrial Training" that Peter will present.



- The CIAO research team was well represented at the ANZIAM Meeting, held on 5-9 February 2006, in Mansfield, Victoria, to the east of Melbourne.

Dr Adil Bagirov, Dr Fusheng Bai, Dr Musa Mammadov, Dr Nadezda Sukhorukova, Dr Julien Ugon, Dr David Yost and Dr Zhiyou Wu gave talks and assisted during the first two days of the meeting.

It was a very fruitful meeting, attended by researchers from many Australian and overseas Universities. Interesting discussions and talks were out of the meetings, with the possibility of new collaboration partnerships for CIAO.

- Ms Shahnaz Kouhbor attended the IEEE 63rd International Vehicular Technology Conference held in Melbourne, Victoria from 7-10 May 2006.

More than 600 papers and posters were presented. Shahnaz presented the paper "Coverage in WLAN with Minimum Number of Access Points", and many people showed interest and asked for a copy of the paper.

A number of participants requested information about our software. Most of the plenary discussions were on Mobile broadband, fourth generation mobile, and the future of cellular technology.

There were also a number of seminars before and after the conference, all on the topic of mobile technology.



- Professor Mirka Miller gave a seminar at Deakin University on 3 March 2006 on the topic "Security of Statistical Databases".
- Professor Mirka Miller and Dr Joe Ryan attended an eSecurity Victoria Event in Melbourne on 9 March 2006.
- Dr Xinwen Wu attended a US Homeland Security Opportunities Seminar in Melbourne on 28 March 2006.

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## Conferences & Workshops: Organised by CIAO and CIAO members

### ➤ Australian Computer Science Week (ACSW) 2007

ACSW 2007 will be hosted by the School of ITMS, at the University of Ballarat. ACSW 2007 will include eight conferences and workshops.

ACSW 2007 Organizing Committee Members:

- Prof. Sid Morris (Chair)
- Mr Greg Simmonds (Deputy Chair)
- Dr Prabhu Manyem
- Dr Ranadhir Ghosh
- Dr Liping Ma
- Dr David Yost
- Ms Rosemary Hay
- Ms Kathleen Keogh
- Ms Belinda Wallesz

ACSW 2007 is also organising a Doctoral Consortium, which will provide an ideal opportunity for doctoral students to explore their research interests in an interdisciplinary workshop, under the guidance of a panel of distinguished research faculty.

This consortium is dedicated to giving young researchers an opportunity to showcase their research to the Australian Computer Science community as a whole. Submissions are being invited from current graduate students pursuing a PhD project, who would benefit from detailed discussions of their doctoral research by a panel of established researchers.

The consortium will operate in workshop format, providing feedback on participants' current research and guidance for future progress. Selected applicants will receive complimentary conference registration, and accommodation and subsistence expenses. Two awards will be presented, to the first and second best student participants.

Doctoral Consortium Committee Members

Dr Ranadhir Ghosh (Chair)  
Dr Prabhu Manyem  
Dr Liping Ma  
Dr Xinwen Wu



### ➤ 5th Ballarat Workshop on Global and Non-Smooth Optimization: Theory, Methods and Applications, Ballarat, Victoria, Australia, 28-30 November 2006

This workshop aims at bringing together experts from Australia, the Pacific region and around the world in the area of optimization theory, methods and applications to meet and exchange their recent research findings and to discuss possible joint projects.

The topics of the workshop include all areas of optimization, optimal control and their applications, however the emphasis of this workshop is on theory, numerical methods and applications of global and non-smooth optimization.

The workshop will incorporate a one day "Focussed Meeting on Global and Nonsmooth Optimisation Problems in Data Analysis and Engineering".

The workshop will be held at the University of Ballarat.

Workshop organisers are Dr Adil Bagirov and Professor Alexander Rubinov.

Plenary lectures will be given by Prof. Terry Rockafellar (University of Washington, USA) for the workshop and Prof. Bulent Karasozen (Middle East Technical University) for the focussed meeting. More than twenty-five experts from Australia and overseas will give invited lectures.

The Australian Mathematical Sciences Institute (AMSI) will sponsor Australian postgraduate students and early career researchers expenses for travel and accommodation, via the allowance that has been given to Heads of mathematics/statistics departments to manage.

More information about the workshop can be found on the website: <http://www.ballarat.edu.au/BWO>

### ➤ AWOCA 2006

Preparations are well under way for the 17<sup>th</sup> Conference of the Australasian Workshop on Combinatorial Algorithms, to be held in Uluru, Central Australia, 13-19 July 2006, following the 31<sup>st</sup> ACCMCC meeting at Alice Springs, Central Australia.

AWOCA 2006 is jointly hosted by CIAO and the School of ITMS, the University of Ballarat and the School of Engineering and Logistics, Charles Darwin University. The Invited Speakers for AWOCA 2006 are

- Amihoud Amir, Bar-Ilan University, Israel
- Pino Caballero, University of La Laguna, Spain

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- Charlie Colbourn, Arizona State University, USA
- Derek Corneil, University of Toronto, Canada
- Diane Donovan, University of Queensland, Australia
- Martin Grützmüller, Universität Rostock, Germany
- Kunsoo Park, Seoul National University, Korea

The Program Committee includes Dr Prabhu Manyem, Dr Joe Ryan and Professor Mirka Miller from ITMS. Mirka Miller is Co-Chair (with Professor Bill Smyth, McMaster University).

There will be refereed Conference Proceedings edited by Dr Joe Ryan, and a Special Issue of Fundamenta Informatica, edited by Professors Costas Iliopoulos from Kings College, and Mirka Miller and Bill Smyth.

For more information:

[www.ballarat.edu.au/conferences/awoca2006/index.html](http://www.ballarat.edu.au/conferences/awoca2006/index.html)

## ➤ International Workshop on Biometric systems (IWBS)

In conjunction with:

The 19th Australian Joint Conference on Artificial Intelligence, University of Tasmania, Hobart, Australia 4-8 December 2006, <http://www.comp.utas.edu.au/ai06/>

A biometric system is a computer system that can recognise the identity of or verify the claimed identity of an individual, using a measurable physical characteristic or personal behavioural trait. Biometric techniques are a more secure form of authentication than the traditional login system, based on user name and a password or smart card which can be stolen.

The organising committee consists of Professor Gopal Gupta, Dr Ranadhir Ghosh (CIAO), Dr Bailing Zhang, Dr Moumita Ghosh (CIAO).

## ➤ International Workshop on Pattern Recognition (IWPR)

In conjunction with:

The 19th Australian Joint Conference on Artificial Intelligence, University of Tasmania, Hobart, Australia, 4-8 December 2006, <http://www.comp.utas.edu.au/ai06/>

Organizing Committee consists of Dr Ranadhir Ghosh (CIAO), Dr Ajith Abraham, A/Prof. Tuan Pham.



## ➤ Sixth International Conference on Intelligent System Design and Applications 16-18 Oct 2006, Jinan, Shandong, China <http://isda2006.ujn.edu.cn/>

Special session on:

Artificial Intelligence in Information Assurance and Security

Session Chairs

Ranadhir Ghosh (University of Ballarat, Ballarat, Australia)

Ajith Abraham (Chung Ang University, Seoul, South Korea)

Xinwen Wu (University of Ballarat, Ballarat, Australia)

## ➤ The Second International Workshop on Intelligent Finance, July 2007, Finance Research Centre of China, Southwest University of Finance and Economics, Chengdu, China

Chair of the workshop is Dr Heping Pan.

## ➤ Beijing Workshop on Financial Computational and Risk Management, the Centre for Forecasting Science, Chinese Academy of Sciences, 2-3 July 2006

A co-chair and principal speaker is Dr Heping Pan.

## ➤ Australia-China Workshop on Finance and Economics, 25-29 September 2006, Gold Coast, Queensland

Chair: Professor Tom Nguyen, Griffith University, with Dr Heping Pan as a Co-Chair and leader of a team from the University of Ballarat and IIFP.

## Commercial Projects

### Virtual Reality facility at UB

CIAO has received funding to establish a Virtual Reality (VR) facility at the University of Ballarat (UB). This VR capability is a new initiative and will involve the purchase of new technology.

UB has a great research strength in areas such as optimization, data mining and simulation. However it is not always easy to explain this capability to potential research consultancy clients.

It is our intention to build a VR capability which allows us to better describe and demonstrate these capabilities.

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The VR capability itself will build on our multimedia and simulation expertise. It will allow research findings to be presented to participating organisations in an interactive and visual way, which will enhance UB's engagement within the community, by being able to offer a facility where design and/or research outcomes can be visually represented.

Areas of UB application include optimization scenarios, virtual design applications, data mining visualisation, virtual walk-through of localities, and in the area of health informatics, graphic representation of drug interactions and design.

## Commercialisation of Adverse Drug Reaction Intellectual Property (IP)

CIAO has received notification from Information City Australia (ICA) that it has been successful in gaining \$50,000 in funding, to develop a Business Plan for the Adverse Drug Reaction (ADRAC) project. It will be incorporated as a company, with a further \$150,000 reserved for follow-on funding.

UB Legal along with ICA have registered a company Datascreen Pty Ltd, ACN 119 510 682, as a commercial vehicle for commercialising the IP.

This project will commercialise CIAO knowledge, which has been developed over the past three years, in the application of optimization and data mining techniques to determining suspected adverse drug reactions. CIAO personnel involved are John Yearwood, Musa Mammadov, Sasha Ivkovic and Wayne Hurst

## Natural Text Recognition

CIAO has entered into an agreement with Outback Designers, a Melbourne based software developer and retailer, for the development of enhanced algorithms. We will build software which will more accurately recognise natural handwriting and convert it to text.

This software will be used in extracting text from any handwritten note, form or survey, and convert it into a variety of outputs, such as Word, Notepad, XLS, XML and CSV.

Key features will include accuracy of recognition and speed of conversion. Rana Ghosh and Moumita Ghosh are the principle researchers involved on this project.

An abstract of this project appears on page 12.



## Recently submitted proposals

### Solar Cities

The Central Victorian Greenhouse Alliance has requested the University of Ballarat to provide assistance and support, to develop the evaluation component of their Solar Cities submission to the Commonwealth Department of Environment and Heritage – Australian Greenhouse Office.

This is a seven-year, \$3.1million project with CIAO and UB's Centre for Regional Innovation and Competitiveness (CRIC) undertaking to survey and monitor household energy use.

An extensive database will be developed to collate survey data, meteorological data and energy usage data from power companies, and to undertake statistical analysis of the collated data.

The Central Victorian Greenhouse Alliance (CVGA) is an organisation made of thirteen local governments and representatives from eleven other organisations, including businesses, government and community organisations.

The CVGA has set a target to reduce regional greenhouse emissions by 30% below the levels set in 2000, and wants to achieve this target by 2010. It has set a further target of zero net emissions by 2020.

The Solar Cities project is a complex one, with the recruitment of 5000 households and 100 businesses across the Loddon Mallee and Grampians regions.

It will monitor the changes to their energy consumption, utilising five energy conservation methods, over a period of seven years. CIAO researchers include Dr Jack Harvey and A/Prof John Yearwood.



### NHMRC – Joint Replacement Continuum of Care

An Expression of Interest has been submitted to the National Health and Medical Research Council (NHMRC), for funding further research into Measuring Health Related Quality of Life (HRQOL) for Ongoing Improvement in the Continuum of Care for Joint Replacement Patients.

This submission follows on from the recently completed research carried out by Michelle O'Brien, in conjunction with the St John of God Hospital, Ballarat (SJOGB).

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The research will use an augmented HRQOL scale to identify and quantify the factors that influence HRQOL outcomes, and determine the relationship between these and HRQOL outcomes at identified decision points along the continuum of care.

The study will be across a number of hospitals and surgeons, in both rural and metropolitan areas. This will provide the basis for informing practice and policy in the health services provided to patients involved in Total Joint Replacement (TJR) surgery.

The ability to link each decision point along the continuum of care to expected HRQOL outcomes will provide a means of rapidly assimilating best evidence based practice, for the most efficient and effective delivery of TJR patient care.

Health entities involved in the application include St John of God Hospital, Ballarat Health Services and the Mercy Campus of St Vincent and Mercy Private Hospital, Melbourne.



## CIAO Projects

### Handwritten Signature Verification using Signature Extrema Points and Shingles

Project team members:

Mrs Moumita Ghosh (University of Ballarat)

Dr Ranadhir Ghosh (University of Ballarat)

Dr Gopal Gupta (Monash University)

In modern society, there has been a vast increase in the number of documents that are being transmitted and stored electronically.

Just like paper documents, and perhaps even more so, electronic documents are subject to forgery. This increasing dependence on electronic storage and transmission of documents has created a need for electronically verifying the identity of the sender.

Handwritten signatures have a high level of social and legal acceptance, because they have been the normal and customary method of identity verification that has worked well over many years. There is therefore an obvious need for computer verification of handwritten signatures.

There is increasing interest in authentication based on biometric characteristics. A handwritten signature is a

biometric characteristic that through long-standing tradition has been used in many common authentication tasks. Handwritten signature verification (HSV) may be considered superior to many other biometric authentication techniques, for example fingerprints or retinal patterns, which are more reliable but are also more intrusive.

This paper presents results of a study in which extrema points of an on-line signature's  $x$  and  $y$  profiles are used to develop a compact representation of the signature. To compare two signatures, the representation of one signature is compared with the similar representation of the other signature, using shingles which have been successful in document fingerprinting. The technique has been shown to be very promising.

Comparing signatures automatically is a challenging problem, because it is well known that no two genuine signatures of one person are precisely the same, and some signature experts note that if two signatures written on paper were the same, they could be considered forgery by tracing.

Successive signatures by the same person often differ, both globally and locally, and may also differ in scale and orientation.

Osborn notes that the variations in signatures of a person are themselves habitual, and are clearly shown in any collection of genuine signatures produced at different times and under a great variety of conditions.

Hilton notes that once a person is used to signing his/her signature, the nerve impulses are controlled by the brain without any particular attention to detail. This is in contrast to normal handwriting, which relies on position and visual feedback during the writing.

Signature writing is considered a *ballistic motion*, which is a rapid practised motion that is not driven by feedback, but is predetermined by the brain and which cannot be done slowly.

In this research, our aim is to develop a novel HSV system based on the approach by Gupta and Joyce (1997). It is based on a technique that uses  $x$  and  $y$  profile extrema values to capture the essence of signature steps. We also include approximate string matching, using shingles and velocity and acceleration information for our signature features.



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## CIAO Projects

### A human modelling HLA federate

Project team members:

Dr Philip Smith

Dr David Stratton

Sina Pezshek

Mr Lance Burns

Just how can Australia do better in the Winter Olympics?

One-legged skiers and speed skating accidents aside, the Australian Sports Commission is paying a lot of attention to wind resistance.

Currently potential bob-sled athletes are placed, at great expense, in a wind tunnel to assess their suitability. Wouldn't it be great if body scans of many contenders could be tested, on a computer, for their sleekness?

Why not when, in the Australian Defence Anthropometry Personnel Testing (ADAPT) project, we test body-scanned recruits for their ability to fly aircraft?

There's a critical difference. ADAPT is concerned with the physical size and shape of people and the human modelling program, JACK, is designed to do just that.

The wind-resistance problem involves a large amount of extra analysis – albeit of the same scanned human. This is the tip of a large iceberg – additional computations that one might want to perform on a human, which was being modelled physically by a specialised human-modelling application.

In another project, we make extensive use of the JACK program – to test the effect of heat or radiation on metabolic calculations. Most large software packages allow for the “import” or “export” of their data in standard formats, but this software captures a static picture at that instant. How could JACK provide real time information about the human it was modelling to another program, the one that was computing wind resistance, for example?

The answer is the High Level Architecture (HLA). HLA provides a standardised format for information that is exchanged between the co-operating parts of a simulation model. JACK, if it “spoke” HLA, could provide a second program (“federate”) with live information about the posture and movements of a sample figure. JACK would stick to what it is good at, and the second federate would compute the wind resistance.

The key to making an established program HLA-aware is to provide a means for changes inside the program to result in HLA messages – moving the hand being signalled in HLA, for example.

Sophisticated software usually includes a programming language in which such customer changes can be implemented, but exactly which programming language depends on the software – JACK uses the language *tcl*, AutoCad uses the language *lisp*, Rhino (a 3D modelling package) uses the language *Visual Basic*.

The problem of programs using HLA becomes the problem of programming languages using HLA and, at present, only a few widely-used languages have this available.

A recent DSL paper, presented by Dr Philip Smith at a Simulation Conference in Alabama USA, describes a technique for linking arbitrary programming languages to the HLA. The only requirement – easily fulfilled - is that the language can send and receive messages on the Internet.

As a result of this have demonstrated a Jack manipulated figure moving around in a Java federate, at the SimTecT Simulation Conference in Melbourne. This proof-of-concept is a profound step towards the Australian Sports Commission's vision that we started out with.



## Tenders/Consultancies/Grants

### Applications for ARC Discovery Grants

The following applications for ARC discovery grants were submitted in March 2006.

#### 1. Global Optimization based on a direction of global descent: theoretical and numerical aspects.

A.Rubinov and M. Mammadov.

The mathematical formulation of many problems in different fields, including bio-informatics, computational chemistry, economics and finance, leads to complicated multi-extremal optimization problems with thousands of variables that cannot be handled by existing methods.

In this project, we will develop and investigate a new approach to global optimization.

This approach will lead to the development of new fast

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numerical algorithms that can be applied to a broad class of complex high dimensional optimization problems.

This is five-year project.

## **2. Polynomial splines through nonsmooth optimisation: modelling and applications.** N Sukhorukova.

The goal of this project is to develop techniques for spline approximation, focusing on nonsmooth polynomial splines with free knots, and applications.

The applications include, but are not limited to, the following:

1. Data and function approximation;
2. Data segmentation (forecasting);
3. Data clustering (classification).

Data approximation allows substitution of a massive array of data by values – calculated for a very simple function – whose values are close enough to the values of the original data.

It allows simplification of complicated processes by modelling them on a computer, and helps in running them more efficiently. The main outcome of this research is the development of specific approaches for solving optimization problems, appearing in applications.

This is three-year project.

## **3. Solving Location problems with continuous geographical search space.** J Ugon

Location problems involve determining the location of facilities in the most satisfactory way, usually to deliver service, and considering factors such as cost or customer demand.

Location problems occupy a large part of applied optimisation. The usual approach, based on the discretisation of the search area, has many disadvantages, and research has started to focus on the continuous case.

The aim of this project is to develop a practical framework for continuous location problems, using the structure of such problems. After examination of these structures, several considerations will be investigated, leading to the design of new, adapted methods. Real world applications will be studied to exhibit and compare the practicality of our methods.

This is three-year project.

## **4. Filled function methods for global optimization and their applications.** Z. Wu

Global optimization problems are ubiquitous in science, industry and commerce and are extremely difficult to solve.

The filled function method is one of the most computationally efficient methods for solving global optimization problems. Most of the existing filled function methods aim to solve only unconstrained global optimization problems, and have some drawbacks.

This project will develop new filled function methods for unconstrained global optimization problems, as well as develop filled function methods for constrained global optimization problems. In particular, it will develop efficient filled function methods for quadratic global optimization problems.

This is three-year project.

## **Seeding Grant**

Researchers involved: N. Sukhorukova, J.Ugon, B. Ofoghi, D. Webb

This seeding grant will be used to work on two separate projects. A research assistant has been hired for each of these projects, to conduct numerical experiments.

The first project focuses on the use of optimisation to construct an accurate feature recombination and selection algorithm. For this purpose, a model has been constructed to find the linear combinations of the features which best fit the data.

Numerical experiments are currently being conducted to assess the efficiency of this method, and compare it with other existing techniques.

The goal of the second project is to apply several optimisation methods from GANSO (an optimisation library developed at CIAO) to data classification and data clustering problems.

In this project we will construct special algorithms for classification of curves and families of curves into several classes. The proposed algorithms are based on polynomial spline approximation through nonsmooth optimisation. The purpose is to compare different optimisation methods from GANSO and the corresponding classification results.

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## ITMS Colloquia & Seminars

### ITMS Colloquia Series 2006

The 2006 Colloquia Series continues to attract diverse speakers and a high level of professional expertise.

Recent visiting speakers have included:

- Dr Paul Davis, Executive Director, GrangeNet, Next Generation Networks and the Research of the Future.
- Mr Con Zymaris, CEO, Cybersource Pty Ltd, Using the Open Source Methodology to Boost the Software Industry in Regional Victoria.
- Professor John Fulcher, University of Wollongong, Research into Intelligent Systems.
- Dr Rajkumar Buyya, University of Melbourne, Grid Computing and Gridbus Technologies: Making the Global Cyberinfrastructure for eScience and eBusiness a Reality.



### ITMS Seminar Series 2006

Recent visiting speakers have included:

- Professor Andrew Paplinski, Monash University, Active Appearance Model Analysis using a 3D Morphable Model.

## Staff News

- Dr Jack Harvey's re-appointment as Senior Research Fellow has been approved.
- Dr Adil Bagirov has been appointed as a co-chief investigator for the discovery grant "Operations research without convexity". Now there are two Chief investigators for this grant: Alex Rubinov and Adil Bagirov.
- A new book "Computational Intelligence Modeling Techniques and Applications", is being prepared and edited by Ranadhir Ghosh, Moumita Ghosh, John Yearwood and Sidhivinayak Kulkarni. The book is scheduled to be published by Idea Group Inc.

## Post-Graduate News

### Welcome to New Arrivals

We welcome the following new students to ITMS:

- ✓ Ms Armita Zarnegar  
Degree: PhD  
Topic: Intelligent WWW Ranking  
Principal Supervisor: A/Prof John Yearwood  
Associate Supervisor: TBA
- ✓ Mr Subhasis Mukherjee  
Degree: Master of Computing  
Topic: A Neuro-Fuzzy System for Combating Co-Channel Interference in Mobile Radio Systems  
Principal Supervisor: A/Prof John Yearwood  
Associate Supervisor: Dr Andrew Stranieri

### Congratulations

- Dr Jason Giri has successfully completed his PhD, and graduated in May 2006. Jason studied part-time while teaching full-time, and in fact completed his PhD earlier than scheduled. Congratulations Jason!
- Dr Kiki Sugeng's PhD thesis entitled 'Magic and Antimagic Labeling of Graphs' was recently passed by her examiners. Congratulations Kiki!



### Confirmation of Candidature

We extend our congratulations to the following students, who recently successfully completed their Confirmation of PhD Candidature:

- **Ms Sandra Herbert**

PhD Topic: Variation in pre-calculus students' understanding of the concept of rate of change

Principal Supervisor: Dr Robyn Pierce, University of Ballarat

Associate Supervisor: Dr Kaye Stacey, University of Melbourne

Date: Thursday 4 May 2006

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### ▪ Mr Bahadorreza Ofoghi

PhD Topic: Question Answering Enhancement via Encapsulated Frame Semantics

Principal Supervisor: Associate Professor John Yearwood, University of Ballarat

Associate Supervisor: Dr Ranadhir Ghosh, University of Ballarat

Date: Thursday 11 May 2006

### ▪ Mr Shamsul Huda

PhD Topic: A Switching Dynamical Acoustic Model for Automatic Speech Recognition

Principal Supervisor: Associate Professor John Yearwood, University of Ballarat

Associate Supervisor: Dr Rana Ghosh, University of Ballarat

Date: Thursday 18 May 2006

### ▪ Mr Guillermo Pineda Villavicencio

PhD Topic: Improving Upper and Lower Bounds on the Order of Large Undirected Graphs under Degree and Distance Constraints

Principal Supervisor: Professor Mirka Miller, School of ITMS

Associate Supervisor: Dr Joe Ryan, School of ITMS

External Expert: Dr Roman Kuzel, University of West Bohemia, Czech Republic

Date: Wednesday 24 May 2006

### ▪ Mr Arun Banerjee

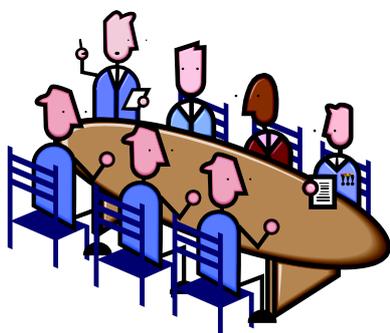
PhD Topic: Multi-label Classification of Shorter Featured Datasets using Optimization Techniques

Principal Supervisor: Dr Musa Mammadov, School of ITMS

Associate Supervisor: Associate Professor John Yearwood, School of ITMS

External Expert: Associate Professor Leonid Churilov, Monash University, Melbourne

Date: Wednesday 7 June 2006



## Visits

Dr. Adil Bagirov and Dr. Musa Mammadov visited the University of Newcastle on 22-24 May 2006, to discuss possible co-operation between CIAO and Engineering Department of the University of Newcastle.

In particular, they discussed the application of optimization in mechanics.

There are many problems in mechanics which can be formulated as optimization problems. These optimization problems are, as a rule, large scale ones. Algorithms for large scale nonsmooth optimization developed in CIAO will be applied to solve these types of problems, in co-operation with the University of Newcastle.

Dr. A. Bagirov and Dr. M. Mammadov gave a joint seminar in the Engineering Department of the University of Newcastle during their visit.

## Visitors to CIAO

✓ Professor Martin Baca

Professor Baca is from the Technical University, Kosice, Slovakia, and visited CGANT and CIAO during March-April 2006.

As a result of his collaboration with Prof Mirka Miller, Dr Joe Ryan and PhD student Dafik, there will be at least two publications.

✓ Associate Professor Diane Donovan

Associate Professor Donovan is from the Centre for Discrete Mathematics and Computing, Department of Mathematics, University of Queensland. She visited the INSECT Cluster recently, and presented a seminar.

✓ Dr Venkatesan Guruswami

Dr Guruswami is from the University of Washington, Seattle, USA, and visited CIAO from 4-17 June 2006.

He is a graduate of MIT, his thesis received the ACM award for the best doctoral dissertation in Computer Science, and he is a recipient of the Packard Fellowship in 2005.

For more information:

<http://www.cs.washington.edu/homes/venkat/>

<http://www.cs.washington.edu/homes/venkat/cv05/CV.pdf>

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During his visit Dr Guruswami mainly worked with Dr Xinwen Wu and Dr Prabhu Manyem. The visit was supported by a CIAO Seeding Grant.

✓ Professor Bernd Kummer

Professor Kummer is from Humboldt University Berlin, and visited UB for about ten days in February 2006.

He is a world renowned specialist in optimization, variational analysis and games theory, the author of three books and co-editor of several mathematical journals.

The goal of the visit by Professor Kummer was to continue his collaboration with Dr Alex Kruger in the field of optimization theory. The visit was supported by a CIAO Seeding Grant. During Professor Kummer's stay in Ballarat he presented two seminars and undertook intensive work with Alex Kruger. They are currently preparing a joint paper.

✓ Dr Roman Kuzel

Dr Roman Kuzel is from the University of West Bohemia, Plzen, Czech Republic, and visited CGANT and CIAO during April-June 2006.

As a result of his collaboration with Prof Mirka Miller and PhD student Jakub Teska, there will be at least two publications.



## Publications

### Books, Chapters & Papers: Published

1. A.M. Bagirov and J. Yearwood, A new nonsmooth optimisation algorithm for minimum sum-of-squares clustering problems, *European Journal of Operational Research*, Volume 170, Issue 2, 2006, pp. 578-596.
2. R. Baratov and A. Rubinov, Conical decomposition and vector lattices with respect to several preorders,

Taiwanese Journal of Mathematics, Vol.10 pp 265-298, 2006.

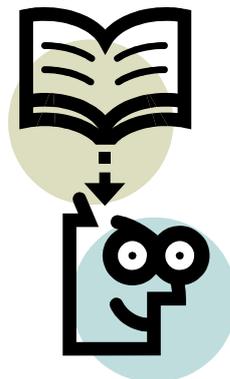
3. R.S. Burachik, V. Jeyakumar, and Z.Y.Wu, Necessary and sufficient conditions for stable conjugate duality, *Nonlinear Analysis Series A: Theory, Methods & Applications*, 64, 1998-2006, 2006.
4. M. Bača, E.T. Baskoro, M. Miller, J. Ryan, R. Simanjuntak, and K. A. Sugeng, Survey of edge antimagic labelings of graphs, *Journal of Indonesian Math. Society (MIHMI)*, Vol.12, No.1, pp. 113-130, 2006.
5. M. Bača, Y. Lin, M. Miller, and J. Ryan, Antimagic labelings of Möbius grids, *Ars Combin.* 78, pp.3-13, 2006.
6. E.T. Baskoro, Y.M. Cholily, M. Miller, Structure of selfrepeat cycles in almost Moore digraphs with selfrepeats and diameter 3, *Bulletin of ICA*, Vol.46, pp.99-109, 2006.
7. J. Gimbert, N. Lopez, M. Miller, J. Ryan, Characterization of eccentric digraphs, *Discrete Mathematics*, Vol.306, Issue 2, pp.210-219, 2006.
8. Y. H. Gu and Z.Y. Wu, A new filled function method for nonlinear integer programming problem, *Applied Mathematics and Computation*, 173(2), 938-950, 2006.
9. A.J. Kruger. About Regularity of Collections of Sets, *Set-Valued Analysis*, appeared on-line and can be accessed at: <http://dx.doi.org/10.1007/s11228-006-0014-8>.
10. H. Mohebi and A.M. Rubinov, Metric projection onto a closed set: necessary and sufficient conditions for the global minimum, *Mathematics of Operation Research*, vol. 31, 124-132, 2006.
11. Z.Y. Wu and F.S. Bai, A new method for global optimality conditions, *Journal of Chongqing Normal University*, 23(1), 1-5, 2006.

### Books: Accepted

1. The second edition of the book "The Structure of Compact Groups" by K. Hofmann and S. Morris will be published by Walter DeGruyter. The current version is 875 page typed manuscript.
2. The book "The Lie Theory of Pro-Lie Groups" by the same authors will be published by the European Mathematical Society Publishing House. The book contains 660 pages.

## Papers: Accepted

1. G. Adilov and A.M. Rubinov, B-convex sets and functions, *Numerical Functional Analysis and Optimization*.
2. A.M. Bagirov, M. Ghosh and D. Webb, A derivative-free method for linearly constrained nonsmooth optimization, *Journal of Industrial and Management Optimization*.
3. A.M. Bagirov and J. Ugon, Piecewise partially separable functions and a derivative-free method for large-scale nonsmooth optimization, *Journal of Global Optimization*.
4. F.S. Bai, Z.Y. Wu, and D.L. Zhu, Lower order calmness and exact penalty function, *Optimization Method and Software*.
5. G. Beliakov and A.M. Bagirov, Nonsmooth optimization methods for computation of conditional values-at-risk and portfolio optimization, *Optimization*.
6. G. P. Crespi, I. Ginchev, M. Rocco, and A.M. Rubinov, Convex along lines functions and abstract convexity, *Journal of Convex Analysis*.
7. K.H. Hofmann and S.A. Morris, Open mapping theorem for pro-Lie groups, *J.Austral. Math. Soc.*
8. V. Jeyakumar, A. M. Rubinov and Z.Y. Wu, Generalized Fenchel's Conjugation Formula and Duality for Abstract Convex Functions, *Journal of Optimization Theory and Applications*.
9. V. Jeyakumar, Z. Y. Wu, G. M. Lee, and N. Dinh, Liberating the subgradient optimality conditions from constraint qualifications, *Journal of Global Optimization*.
10. V. Jeyakumar, A.M. Rubinov and Z. Y. Wu, Non-convex, Quadratic Minimization Problems with Quadratic Constraints: Global Optimality Conditions, *Mathematical Programming*.
11. V. Jeyakumar, A.M. Rubinov and Z. Y. Wu, Sufficient Global Optimality Conditions for Non-convex Quadratic Minimization Problems with Box Constraints, to appear, *Journal of Global Optimization*.
12. Kruger, Stationarity and regularity of real-valued functions, *Applied and Computational Mathematics*.
13. K. Kortanek, H. Pan, and D. Sornette, Intelligent Finance – An Emerging Direction, *Quantitative Finance*.
14. T.L. Mason, A.M. Bagirov and M. Ghosh, Application of derivative-free methods for production optimization, *Applied and Computational Mathematics*.
15. Charlynn Miller, Retaining Mature-Age Students at University: A Student Services Perspective, a fully refereed conference paper accepted at HERDSA in July 2006.
16. D. Morales, Properties of Strongly Star Shaped Cones, *Pacific Journal of Optimization*.
17. R. Pierce and K. Stacey, Enhancing the image of mathematics by association with simple pleasures from real world contexts. *Zentralblatt für Didaktik der Mathematik*.
18. R. Pierce and V. Steinle, Incomplete or Incorrect Understanding of Decimals: An Important Deficit for Student Nurses, a fully refereed paper accepted for PME30 in July 2006.
19. K. Przeslawski and D. Yost, Decomposability of polytopes, *Discrete and Computational Geometry*.
20. A.M. Rubinov and Z.Y. Wu, Optimality conditions in global optimization and their applications, *Mathematical Programming, Series B*.
21. A.M. Rubinov, X.Q. Yang and Y. Zhou, A Lagrange penalty reformulation method for constrained optimization, *Optimization Letters*.
22. A.M. Rubinov, Methods for global optimization of nonsmooth functions with applications, *Applied and Computational Mathematics*.
23. P. Vamplew and A. Berry, An Efficient Data Structure for Unbounded Bi-Objective Archives - Introducing the Mak\_Tree, accepted for GECCO-2006: The Genetic and Evolutionary Computation Conference.
24. Z. Y. Wu, V. Jeyakumar and A. M. Rubinov, Sufficient Conditions for Globally Optimality of Bivalent Nonconvex Quadratic Programs with inequality constraints, *Journal of Optimization Theory and Applications*
25. Z.Y. Wu and F. S. Bai, A Novel Monotonization for Some Classes of Global Optimization Problems, *Asia-Pacific Journal of Operational Research*.
26. Z.Y. Wu and F.S. Bai, Convexification and Concavification for a Class of Non-monotone Optimization Problems, *Pacific Journal Optimization*.



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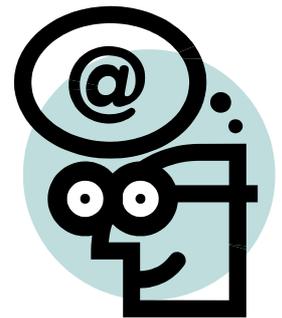
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## Research Reports : 2006

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|---------|--|---------|---|
| 2006/01 | Optimization solvers and problem formulations for solving data clustering problems, Julien Ugon, January 2006  | 2006/11 | Non-convex Quadratic Minimization Problems with Quadratic Constraints: Global Optimality Conditions, V. Jeyakumar, A. M. Rubinov and Z. Y. Wu. April 2006 |
| 2006/02 | Constrained Nonlinear and Semismooth Equations and Global Optimization, Musa Mammadov, Liqin Qi and Fusheng Bai, January 2006                                    | 2006/12 | Subdifferentials of convex-along-rays functions, A. M. Rubinov and E.V. Sharikov, April 2006  |
| 2006/03 | Coverage in WLAN: Optimization Model and Algorithm, S. Kouhbor, J. Ugon, M. Mammadov, A. Rubinov and A. Kruger, February 2006                                    | 2006/13 | On the use of Abstract Convexity in set valued analysis, Regina Sandra Burachik and Alex Rubinov, April 2006  |
| 2006/04 | Coverage in WLAN with Minimum Number of Access Points, S. Kouhbor, J. Ugon, A. Rubinov, A. Kruger and M. Mammadov, February 2006                                 | 2006/14 | Sufficient Global Optimality Conditions for Weakly Convex Minimization Problems, Z Y Wu, April 2006   |
| 2006/05 | Nonsmooth Optimization for the Placement of Access Points to Enhance Security in WLAN, S. Kouhbor, J. Ugon, M. Mammadov, A. Rubinov and A. Kruger, February 2006 |         |   |
| 2006/06 | Methods for global optimization of nonsmooth functions with applications, A M Rubinov, April 2006  |         |   |
| 2006/07 | Abstract Convexity and Augmented Lagrangians, Regina Sandra Burachik and Alex Rubinov, April 2006  |         |   |
| 2006/08 | Necessary Global Optimality Conditions for Quadratic Optimization Problems, A. M. Rubinov and Z. Y. Wu, April 2006   |         |   |
| 2006/09 | Optimality conditions in global optimization and their applications, A. M. Rubinov and Z. Y. Wu, April 2006  |         |   |
| 2006/10 | Best Approximation in a Class of Normed Spaces with Star-Shaped Cones, H. Mohebi, A. M. Rubinov and H. Sadeghi, April 2006                                       |         |   |



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Examples of newsletter items are: projects in progress, papers accepted, research in process, publications, grants, seminars, visitors to ITMS, visits, scholarships, reports from school research groups / centres, events, conferences, new discoveries, and general items of interest

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