

Centre for Informatics and Applied Optimization

C I A O Newsletter

<http://www.ballarat.edu.au/itms/ciao.shtml>

December 2003

Edition 4

New Research Clusters

At a meeting of the leaders of CIAO on the 1st September 2003 it was decided that CIAO would acknowledge the status of two embryonic research "groups" by identifying them as Research Clusters.

The two Research Clusters are:

Intelligent Finance (IF) - led by Dr Heping Pan.

IF will primarily focus its research into the following five key areas.

- Financial market prediction
- Technical trading strategies
- Fundamental investing methodologies
- Quantitative portfolio management
- Complete trading systems

Emerging Communications Technologies (ECT)

- led (at present) by Professor Sid Morris.

The ECT cluster will cover such topics as mobile computing, wireless security, optimization in telecommunications, 3G, 4G, wireless grid for urban and rural communities, and smart computer caring systems.

It is anticipated that these Research Clusters will make a significant contribution to the research of CIAO.

CONGRATULATIONS to Dr Rana Ghosh on achieving an Academic Excellence Award for his PhD thesis from Griffith University.

CIAO Welcomes

Dr Eldar Hajilarov who has been appointed to take up a position of Lecturer in Mathematics. Eldar's research area of interest is mathematics.

Dr Alexander Kruger, Post Doctoral Fellow started on the 29 October 2004. His areas of specialisation are non-smooth analysis and non-smooth

optimisation. He will also be lecturing in mathematics and information technology.

Successful Grants/Tenders....

Associate Professor V Jeyakumar, University of New South Wales (Administering Institution) and **Professor AM Rubinov**, CIAO were successful in winning an ARC Discovery Grant totalling \$282,474 to be paid over three years. Their topic of research is "Necessary and sufficient conditions for global minimum in multi-extremal global continuous.

Professor KC Stacey, Dr GA Stillman, University of Melbourne (Administering Institution) and **Dr RU Pierce**, CIAO were successful in winning an ARC Linkage Grant totalling \$277,063. Their topic of research "Enhancing mathematics achievement and engagement by using technology to support real problem solving and lessons of high cognitive demand".

Cameron Hurst has been awarded a grant of \$9,246 for a study on "Explaining cross sectional and longitudinal variation in stock prices using Randomisation-based Canonical Ordination: an application to the Australian Stock Markets".

Dr Robyn Pierce has been awarded a grant of \$9,124 to work on "Investigating the impact of effectively used Computer Algebra Systems in addressing tertiary mathematics students' cognitive gaps and errors in algebra

Dr Christopher Turville has been awarded a grant of \$9,124 to work on a "Meta-model for Selecting the Optimal Forecasting Method"

Dignitaries visit CIAO....

A morning tea was held on 2nd September for staff to meet two of its Honorary Senior Research Fellows: **Dr Ken Harvey** from the School of Public Health, La Trobe University and **Dr Jack Harvey** School of ITMS, University of Ballarat and also the new Project

Leader of the Collaborative Centre for eHealth (CCeH) **Mr Chris Lynton-Moll.**

Dr Ken Harvey then met with some postgraduate students to discuss current and future projects. A further meeting was held between Mr Chris Lynton-Moll and Dr Ken Harvey.

CIAO Reports

Distributed Simulation Laboratory (DSL)

The DSL has been involved in major tender writing activities in the last quarter as well as moving towards the next batch of Honours student enrolments. Our Honours students have shown an excellent record of progressing towards research degrees so we pay a lot of attention to these initial contacts.

Short Course Offerings

The HLA Short Course will be delivered at Ballarat in February 2004. This will be an elective for Ballarat honours students, a component of the DSTO continuing education initiative (CEI), an elective for RMIT simulation students and a commercial short course! We are finding there are many different hats we can wear.

DSL Students - David Andrews, the first DSL PhD student, is a confirmed candidate and Tim Porkorny is scheduled to confirm in February 2004. James Miller and Michael Fraser, the two current honours students are working hard and both have expressed an interest in proceeding towards research degrees.

We are at the proposal writing stage with several prospective honours students, and they will be eligible for the SIAA (Simulation Industry Association of Australia) scholarship program which we are helping to establish.

ORTI The open RTI (Runtime Infrastructure) proposal is the subject of the internal research grant awarded to Dr David Stratton through the ECR (Early Career Researcher) program. Currently David Andrews, a doctoral student, is conducting the survey work associated with that grant. The RTI is the central "switchboard" of an HLA simulation and the project, which seeks to establish an RTI implementation that is to some extent or other free is gathering momentum internationally.

Holden Linkage - The DSL has submitted an ARC linkage proposal entitled "Fitting the Virtual Tyre to the Virtual Car – Investigating the use of Distributed Simulation in the Automobile Industry" to the second ARC round. We have been developing and deepening the relationship with the engineering division of Holden.

Data Mining and Informatics Research Group (DMIRG)

Members of DMIRG are currently part of an application to the ARC for seed funding to establish a Data Mining Network. The application is led by Professor John Roddick of Flinders University

Research Clusters

Intelligent Finance (IF)

The 2003 Nobel Prize in Economics was awarded to Rober Engle and Clive Granger for their methods of analyzing economic time series with time-varying volatility (ARCH) and with common trends (cointegration). This is the third time financial econometricians have won the Nobel Prize in economics after the portfolio theory and the option pricing theory. There is a thread in these works - the notion of volatility, correlation and trends. Our current research is focused on multivariate financial time series, I believe there are still gold nuggets underneath this area to be discovered and we are heading in the right direction.

Project Initiatives: An initiative was started immediately after the Wollongang Workshop with the ANZ bank for testing our algorithms and systems for predicting foreign exchange rates and credits. The Intelligent Finance Cluster has now started experiments with three different approaches: neural networks, optimization, and statistical models.

A True Story from a Student of SITMS: He achieved 100% return of investment in about six months from ca \$10,000 in June to ca @20,000 in November 2003, using a fundamental investing methodology inspired by Buffettology. In fact, he mentioned this stock to Heping Pan, who didn't follow his recommendation because he considered it as too insignificant he was not familiar with it.

Joint Project

Dr David Yost will visit Peter Nickolas and Rod Nillsen at the University of Wollongong 24-28 November to discuss average distances in metric spaces and the theory of integration. David will present a seminar on integration and will continue research on average distances with Peter and Rod.

Grant/ Tender Applications...

Tender Applications

RAAF Anthropometry - A meeting was held between consortium partners on the 9 December in which negotiations continued on the Anthropometry tender with the RAAF. The consortium, led by UniSA is hoping that this will go to contract in January.

Parks Victoria - Cameron Hurst in collaboration with members of the Centre for Environmental Management (Professor Martin Westbrooke, Dr. Michael Wilson, Janet Laversha, Matthew Gibson and Jim O'May) have submitted a tender application to VicParks which will examine the effect of thinning in Box-Ironbark forests on the ecosystem as a whole, as well as the floristic, invertebrate and vertebrate assemblages. The project aims to examine the use of various thinning and felling techniques to attempt to return Box-Ironbark forests to a pre-European state.

AMOL - A consortium of CIAO, CeCC and Museum Planning Services Australia submitted a Proposal for the Hosting and Redevelopment of Australian Museums and Galleries On Line (AMOL) to The Department of Communications, Information Technology and the Arts (DCITA). There were approximately fifty submissions to DCITA for the tender in which the UB submission was shortlisted in the ten preferred tenderers. UB is expected to know early January if it has been selected as preferred tenderer.

Published Books, Chapters and Papers

The following books/papers have recently been published:

Book Chapters

Kendal, M.; Stacey, K.; and Pierce, R. (*in press*). *The influence of a computer algebra environment on teachers' practice*. In D. Guin, K. Ruthven, & L. Trouche, *The didactical challenge of symbolic calculators: Turning a computational device into a mathematical instrument*. Dordrecht, The Netherlands: Kluwer Academic Publishers

F. Cabello Sanchez, J.M.F. Castillo, N. J. Kalton and **D. Yost**, *Twisted sums with $C(K)$ spaces*, Transactions of the American Mathematical Society, 355 (2003), 4523-4541.

R. Ghosh, " *Finding optimal architecture and weights for ANN : A combined hierarchical approach*", Australian Conference on Artificial Intelligence, 2003: 857-865.

M. Ghosh and **R. Ghosh**, "*Offline Handwriting Recognition using Evolutionary Neural Learning Algorithm Based on Rule based Over Segmented Data Points*", 11th conference of the International Graphonomics society, Scottsdale, Arizona, USA, IGS 2003, pp. 192-195..

Accepted Books, Chapters and Papers

H. Pan, C. Tilakaratne and J Yearwood, *Predicting Australian Stock Market Index Using Neural Networks Exploiting Dynamical Swings and Intermarket Influences* has been accepted for oral presentation by the Australian Joint AI Conference in Perth. The AI'03 conference will continue publishing the proceedings as Lecture Notes in Artificial Intelligence (LNAI) by Springer.

D. Lierkamp, *Following-distance on a high flow freeway* has been accepted for publication in the November/December issue of the ITS International journal in the UK.

D. Lierkamp, *Treating inadequate headways on a high flow freeway* has been accepted by the Cooperative Transport Dynamics Journal in Germany.

Dr Robyn Pierce, has recently submitted two book chapters Computer Algebra Systems and Algebra: Curriculum, Assessment, Teaching and Learning coauthored with Mike Thomas (University of Auckland) and John Monaghan (University of Leeds) and Review of Research in Teaching and Learning Algebra: 2000-2003 coauthored with Elizabeth Warren (Australian Catholic University, Qld).

In addition a further book to which Robyn contributed a chapter (*L'influence des environnements de calcul formel sur les modes de travail des enseignants.*) co authored with Margaret Kendal and Kaye Stacey (University of Melbourne) is currently being translated into English for publication by Kluwer.

Heping Pan "*A Swingtum Theory of Intelligent Finance Integrating Technical, Quantitative and Fundamental Analysis of the Financial Markets*" by Heping Pan, Abstract invited and accepted by the 24th International Symposium on Forecasting, 4-7 July 2004, Sydney. <http://www.isf2004.org>. Full paper in preparation.

Visitors to CIAO

Juan Enrique Martinez Legaz from Spain
Rafail Gasimov from Turkey - 4/9 to 7/9

Dr Thomas Mason from Woodside - 25/9 to 2/10
Dr Iradj Oveysi & Dr Bruce Radcliff, from Telstra Research Laboratories - 16/9
Professor Bingsheng He from Nanjing University 3 to 7/11/03
Dr Regina Burachik & Dr Yalcin Kaya from UniSA - October

Seminars and Workshops....

Recent Seminars

Mr Stan Jeffery, Director, Ballarat Technology Park presented a talk to all ITMS students '*New Business Creation*' on the 17th September 2003.

Dr Thomas Mason from Woodside Energy Ltd, who is on Secondment to Shell Research Laboratory - Rijswijk, The Netherlands) gave a talk on the application of Global Optimization techniques for the maximization production of LNG (Liquified Natural Gas), LPG (Liquid Petroleum Gas) and other valuable by-products on Wednesday 1st October 2003.

Professor Bingsheng He from Nanjing University presented a talk on '*Solving the constrained minimax-norms problems by linear variational inequality approach*' on Thursday 6th November 2003.

Jane Darby and Chris Lynton-Moll from Collaborative Centre for eHealth, University of Ballarat presented a talk '*Electronic Transfer of Radiology Requests and Reports with Decision Support*' on Thursday 13th November, 2003.

A. Bagirov, A. Kruger, M. Mammedov, A. Rubinov and D. Yost presented a talk on *Current research in the area of optimization in CIAO* on Thursday 20th November 2003-12-11

Dr Hou Duo from the University of New South Wales presented a talk '*Symmetric-Matrix-Valued Functions*' on the 11th December 2003.

Dr Regina Burachik from the University of South Australia presented a talk '*Enlargements of Maximal Monotone Operators and Applications*' on the 4th December 2003.

Dr Yalcin Kaya from the University of South Australia presented a talk on '*Computations for Finding Bang-Bang Pontryagin Trajectories*' also on the 4th December 2003.

Professor Miguel Goberna from the University of Alicante, Spain presented a talk '*Existence theorems for linear inequality systems*' on the 11th December 2003.

Professor Xiaoling Sun from Shanghai University presented a talk '*Convexification and Monotone Optimization*' on the 11th December 2003.

Professor Qi Hou Duo from the University of New South Wales presented a talk '*Symmetric-Matrix-Valued Functions*' on Thursday 11 December 2003.

Professor Panos M. Pardalos, Center for Applied Optimization Industrial and Systems Engineering Department, University of Florida presented a talk '*Network-Based Models and Algorithms in Data Mining and Knowledge Discovery*' on the 18th December, 2003.

Gary Saunders presented a paper at the APAC'03 conference at the Royal Pines Resort, Gold Coast, Queensland, 29 Sept - 2 October 2003.

Gary Saunders Attended BioInfoSummer 2003 "Mathematical, Statistical and Computational Challenges in BioInformatics" 1 - 5 December at the Australian National University, and also presented a poster there.

Gary Saunders Presented a paper at the Second Australasian Data Mining Workshop at Rydges Lakeside, Canberra, 8 December.

Conferences.....

Keyur Patel won the award for the Best Presenter at the 2003 Water Jet Technology America (WJTA) Conference held in Houston from 17-20 August 2003

Heping Pan attended the 16th Australian Joint Conference on Artificial Intelligence, 2-6 December, Perth, and presented a paper coauthored with Chandima and John Yearwood, entitled "Predicting Australian Stock Index using Neural Networks exploiting Dynamic Swings and Intermarket Influences", published in the Springer's Lecture Notes on AI, volume LNAI 2903, edited by T. D. Gedeon and L.C.C. Fung.

Heping Pan will chair a session called "Financial Market Prediction" in the 24th International Symposium on Forecasting (<http://www.isf2004.org>), July 4-7, 2004, Sydney. One of the two new Nobel Laureates Prof Clive Granger from US will speak there, right in the area of this session. Heping is calling for paper submissions to his session.

Ewan Barker, Chris Turville, Cameron Hurst, Neroli Sawyer, Sandra Herbert, Jason Giri and Robyn Pierce attended the Mathematical Association of Victoria's Annual Conference held at Monash University and presented workshops, seminars and lectures for primary and secondary school mathematics teachers. In particular Sandra

presented a session based on her Master's research work on the use of strategy games in promoting higher order thinking. Her paper *Strategy games for gifted students* was published in the proceedings of the conference.

Robyn Pierce and **Chris Turville** presented a paper at Remarkable Delta:03 Fourth Southern Hemisphere Symposium on Undergraduate Mathematics and Statistic Teaching and Learning held in the very beautiful Queenstown New Zealand. Pierce, R., Turville, C. & Giri, J. (2003). Undergraduate mathematics curricula - a new angle. New Zealand Journal of Mathematics Vol 32 November 2003.

Workshops....

AMSI Workshop

AMSI sponsored a workshop 15-16 December 2003 '**Continuous Optimization and Optimal Control**'. The workshop was organised by Professor Alex Rubinov, University of Ballarat and Associate Professor V. Jeyakumar, University of New South Wales

The workshop aims were to bring together eminent researchers and graduate students working in optimization and optimal control and their applications for presenting their recent work, exchanging information and ideas on the latest developments and discussing applications of optimization techniques to emerging fields such as bio-informatics and data mining.



Workshop organizers: A. Rubinov, V. Jeyakumar.

There were two keynote speakers:

Professor Panos Pardalos, University of Florida, USA

'Recent Advances and Trends in Cooperative Control and Global Optimization',
and

Professor Miguel Goberna, University of Alicante, Spain

'Linear Semi-Infinite Optimization: Recent Advances'.

Additional talks were presented by:

Dr Hounduo Qi, University of New South Wales
Duality Theory: A Bridge from Infinite-dimensional Convex Programming to Finite-dimensional Programming

Professor Louis Caccetta, Curtin University
Positive Linear Dynamic Model of Mobile Source Air Pollution and Problems of Control

Professor Xiaoling Sun, Shanghai University
A Convexification Method for Monotone Optimization

Dr Musa Mammadov, University of Ballarat
Statistical Convergence and Stability of Optimal Trajectories

Professor Charles Pearce, University of Adelaide
Impulsive Control of Rumours

Professor Phil Howlett, University of South Australia

Applications of Optimal Control

Dr Bruce Craven, University of Melbourne

Optimal Control on an Infinite Domain

Dr Gleb Beliakov, Deakin University

On Extensions of the Cutting Angle Method and its Applications

Associate Professor Robert Womersley, University of New South Wales

Optimization problems on spheres and tori

Associate Professor V. Jeyakumar, University of New South Wales

Liberating the Subgradient Optimality Conditions from Constraint Qualifications

Dr Regina S. Burachik, Universidade Federal do Rio de Janeiro

An Outer Approximation Method for the Variational Inequality Problem

Dr Yalcin Kaya, University of South Australia

A Modified Subgradient Algorithm and its Implementation

Dr Adil Bagirov, Professor Alex Rubinov and Mr Jiapu Zhang, University of Ballarat

Local Optimization Method with Global Search

Dr David Yost, University of Ballarat

Differentiability of Convex Functions

Associate Professor Andrew Eberhard, RMIT

Some Observation Regarding Optimality Conditions in Nonsmooth Analysis

Dr Alexander Kruger, University of Ballarat

About Weak Stationarity

Professor Alex Rubinov, University of Ballarat

Monotonic Analysis

Numbers attended:

A total of 32 delegates attended the workshop which consisted of six students and 26 academics. The Workshop was very successful. Selected papers presented at the workshop will be published either as a book or as a special issue of Journal of Global Optimization.

Data Mining Workshop

Sasa Ivkovic and **Dr Andrew Stranieri** attended the Data Mining Workshop at Monash University 16-18th July 2003. The objective of this workshop was to present the mechanisms and techniques underlying data mining with emphasis on KDD's potential as an alternative to current data analysis and expert system building techniques in real-world applications. Sasa and Andrew met Dr Usama Fayyad, a world's leading researcher in this area. During the discussions Usama was briefed on Sasa's and Andrew's research and gave positive feedback.



From left: Dr Andrew Stranieri, Dr Usama Fayyad and Mr Sasa Ivkovic chat at the Data Mining Workshop, Monash University 16-18 July 2003.

Workshop on Mathematics in Finance - Dr Heping Pan and Dr Musa Mammadov

attended the Workshop on Mathematics in Finance organized by the University of Wollongang, 4 Nov 2003. Heping presented a talk entitled: "A Unified Science of Intelligent Finance Integrating Technical, Quantitative and Fundamental Analysis of the Financial Markets", which received genuine interests from both academics and professionals.

Melbourne Agent Systems School (MASS) - Kylie Pegg

recently attended the MASS (and AAMAS03 (The Second International Joint Conference on Autonomous Agents and Multi Agent Systems) held in Melbourne. The school was an introduction to the area of agents; the highlight of the school was the general introductory session conducted by Michael Woolridge. At the conference a number of contacts were made and a number of potential areas of further research were identified.

Post Graduate News....

Congratulations to **Mr David Stratton** who has been awarded the first University of Ballarat Doctor of Information Technology degree. Dr Philip Smith was his Principal Supervisor and Associate Professor John Yearwood and Dr John Wharington were his Associate Supervisors.

Mr Rishat Baratov transferred from Probationary Candidature to Full PhD Candidature. The title of Rishat's paper was Conical decompositions and conical projections. Professor Alex Rubinov is Rishat's Principal Supervisor and Professor Sidney Morris is his Associate Supervisor.

Mr Siarhei Dymkou transferred from his PhD Candidature to a Master of Information Technology. He plans to complete his PhD in Germany.

Honours Students

Honours Talks were held on the 24th October 2003. Presentation were given by:

K. Pegg – Prior programming experience and the influence it has on students' performance in an introductory programming unit.

J Redfern – Distance Education for Tertiary Level Computing Students.

A Rayner – Robotics in Education

P. Feely – Measuring the economic climate of Regional Victorian Small and Medium sized Enterprises.

A Botting – Job Scheduling in High Performance Computers.

T. Hazlewood – A Study of Learning Styles and Adapted Presentation of Web-based Educational Material.

E. Jackman – User profile development and learning styles.

University of Ballarat Annual Research Conference 2003

ITMS was well represented at the University of Ballarat Annual Research Conference 2003 with 15 Post Graduates and two staff members presenting.

Ms Faezah Ashfar was awarded the prize for best presentation by a representative of CIAO and **Ms Michelle O'Brien's** paper was selected for the award of 'Best Written Paper' for the conference.

NZ visit by UB Team

Glenn Stevens, Shannon Bell, Belinda Kent, Ian Lee visited the New Zealand International Campus on the 7 December to meet the administrative staff of the Campus and to familiarise themselves with the facilities and services offered, and to gain an understanding of its student demographic and location.

Research Reports

03/19	Quantitative Study of Abrasive Containment in a Ductile Material during Abrasive Aqua Jet Machining (AAJM)	K. Patel and F. Chen	August 2003
03/20	Services for Third and Forth Generations: Technologies and Implications	K.J. Patel and V. Singh	August 2003
03/21	Increasing cut surface quality with various cutting nozzle head oscillations for abrasive aqua jet machining (AAJM)	K.J. Patel and F.L. Chen	August 2003
03/22	Optimization approach for clustering datasets with weights	R. Ghosh, A. Rubinov and J. Zhang	October 2003
03/23	σ -Porosity in monotonic analysis with application to optimization	A Rubinov	November 2003
03/24	An algorithm for computation of piecewise linear function separating two sets	Adil M. Bagirov and Julien Ugon	November 2003

All IT&MS staff members and postgraduate students are encouraged to contribute to the next edition of the monthly CIAO Research Newsletter. Examples of newsletter items staff should consider are: projects in process, papers accepted, research in process, publications, grants, seminars, visitors, visits by ITMS staff and Post graduates, scholarships, reports from school research groups / centres, events, conferences, new discoveries, general items of interest, etc. All items should be received by Maxine Kingston no later than the 20th May 2003.



School of Information Technology & Mathematical Sciences,
University of Ballarat.