itms School of Information Technology and Mathematical Sciences

Research Newsletter

A Few Words from the School Research Coordinator .....

If you have not seen the green paper on research and Research Training then it is probably worth reading at least the summary. It is time again to consider applying for UB competitive and ARC Small Grants.

The School welcomes:

Achin Klein and **Sascha Warschkow** who arrived at the University on the 16th August 1999. They will be staying with the School for five months to complete practical training under the supervision of Binh Pham.

They are currently working in the IVRIF-Lab to develop an application to process medical X-Ray images using operators from SGI's Image Vision library and their own algorithms. As a second part of their project they will extend a distributed collaborative multimedia environment for telemedicine applications using the internt.

Philip Cameron who has been employed as a programmer for IVRIF.

Conference Reports ....

Optimization Day

An **Optimization Day Miniconference** was held at the Greenhill Enterprise Centre on Friday 16 July 1999. The first of the Optimization miniconferences took place in Ballarat in 1994 and was followed by Optimization Days at UNSW, Melbourne University, RMIT and UWA. This year the Optimisation Day was an adjunct to the International Mathematics Meeting, which

was a joint meeting of the Australian Mathematical Society and the American Mathematical Society at the University of Melbourne.

There were 32 participants and 18 talks were presented. Six participants from USA and Canada, one from Hong Kong and two from New Zealand. Six of them are prominent experts in the field and presented very interesting talks. We had four participants from Ballarat, some participants from the University of Melbourne, RMIT, Monash University, Victoria University of Technology, Newcastle University, University of South Australia, The University of Adelaide, Central Queensland University and Curtin University of Technology.

Kluwer Academic Publishers Company had agreed to publish the Proceedings of the miniconference as the volume *Progress in Optimization: Contribution from Australasia III.*

This conference was a significant event for the optimization community of Australia and particularly for our small group here in SITMS, which is engaged in optimisation. It enabled awareness of many new approaches and results in the area, and extended our contacts with many researches from Australia and oversees.

Professors Panos Pardalos (USA), Jonathan Borwein (Canada), Kok Lay Teo (Hong Kong) and Charles Pearce (Adelaide) spent a couple of days in Ballarat after the Optimization Day. Alex had very fruitful discussions with them.

The miniconference was organised by Alex Rubinov, and Andrew Stranieri. Many thanks to Maxine Kingston, Verna Barry, Julie Howes and Zary Dzalilov for their help.

KES'99 - Third International Conference on Knowledge-based Intelligent Information Engineering Systems, 29 August 1999 Binh Pham

The focus of the KES'99 Conference was on the integration of many technologies such as machine learning, fuzzy logic, neural networks, data mining and evolutionary computing to provide intelligent solutions to important applications. The range of applications is diverse: air traffic controllers, robotics, medical diagnosis, design, economics, smart cards, etc. Nearly 80 per cent of the participants came from overseas, mainly Europe and Asia. Researchers from Japan and Korea seemed to have access to extensive infrastructure facilities that allow rapid prototyping of products that result from their research. We were shown a variety of futuristic household and office products: mind mouses (which can be controlled without touching), electronic paper, IC-tags (shirt button storing personal information), sensor device to ensure safe and tasty food, etc. One definite trend that has emerged are the efforts to create not only intelligent, but humanised technologies. Thus, many systems (software, hardware, engineering) use human interactions and responses to optimise, evaluate and perform iterative improvement of their design. This approach has been taken quite seriously by some institutions and organisations. For example, the Kyushu Institute of Design in Japan requires their engineering and computing students to study some basic units in arts, psychology and humanity, with the hope that they will have a more holistic approach towards their designs. My paper on "Fuzzy shape specification for design" also attempts to bring human requirements and preferences into the area of computer-aided geometric design.

Visiting Fellows....

Two applications for funding visiting fellows for the year 2000 have gone forward to the Central Committee.

Green Paper....

The Green paper on Higher Education Research and Research Training "New Knowledge, New Opportunities" has been the cause of much debate within the University sector. The paper proposes that the ARC take over the management of Research Funding.

1.   Changes to ARC Management

- Full-time CEO, PT chair and a series of program managers
- Visiting researchers to oversee the peer review process
- Readers to rank applications
- A move away from general assessment toward more discipline specific expert review
- ARC will be set up under its own act & will be responsible for research grant decision making as well as program administration
- More than one round of grant applications per year
- This structure will rationalise 4 committees & 9 panels to 6 program committees each with a programme manager (Social Sci & Humanities share)
- Each programme has a manager (visiting researcher with experience in research management)
- Two of the 10 people on each committee will be research users. A committee will comprise
– Part-time members (researchers & users)
– Discipline specific research readers -> ranked assessments
– Funding recommendation made to council on the basis of these three (manager, members & readers)

2.   Changes to ARC Grant schemes

- Most ARC grant schemes will fold into a single national competitive grants programme (NCGP)
- There is a stronger emphasis on:
– International standard and excellence
– Collaboration (national, international and industry)
– Users of research
- The new scheme comprises 2 elements:
– discovery (fundamental research)
– linkage (collaborative ventures & infrastructure)
- Grant duration will be 5 years (max of $500,000)
- The main components will be NCGP, Institutional Grants Scheme (IGS) and the Australian Postgraduate Research Student Scheme (APRSS)

National Competitive Grants Program (NCGP)

- Discovery
– To replace Large grants, Fellowships, IRDP, SRCs, some of RIBG
- Linkage
– To replace SPIRT, IREX, RIEF,SRI, Key Centres, some of RIBG
- Infrastructure overhead (RIBG) moves to the NCGP
– RIBG had been awarded on the basis of institutional success in obtaining competitive research funding
– now, infrastructure costs must be built in as a component in each NCGP grant (7.23)

Institutional Grant Scheme (IGS)

- RQ, Small Grants & a share of the Research Training Component of Operating Grants are now under the

Institutional Grant Scheme

– It is conditional on institutions having research management plans (RMPs)

- Formula based allocation (0.6*Share of Res. Stud + 0.4*Share of ResIncome)
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- Composite Index has been abolished
- Less focus on number of publications
- Only quality publications will contribute through NGCP to research income
- Research Consultancy is yet to be defined but research consultancy will be included in research income

Australian Postgraduate Research Student Scheme (APRSS)

- Formula based allocation of scholarships to institutions. Formula based on
  - Share of scholarships in previous years
  - Share of total research income
  - Share of HDR completions
- Once awarded scholarships are portable (after 1 eftsu)
- Institutions must have Research Training Management Plans

New Grants
- Postdoctoral and senior fellowships
- PM's Scholarships Stipends for exceptional research students

Joint meeting of the Australian Mathematical Society and American Mathematical Society.

The joint meeting was held at the Melbourne University from 12.07.99 till 16.07.99 The session "Nonlinear Dynamics and Optimisation" of this meeting was organised by the Ballarat team : Alex Rubinov (optimisation) and Anatoly Ivanov (dynamics). 23 talks were presented at this session (5 on dynamics and 18 on optimisation) by many researchers from Australia, USA, Canada, New Zealand and Hong Kong. Alex Rubinov and Adil Bagirov gave talks at this session.

Special Visits….

June 1999 - Binh Pham
Last year, the School of Engineering and School of ITMS, in collaboration with the University of Technology, Sydney, organised A National Research Workshop in Automated Medical Image Analysis which was sponsored by the ARC Special Research Initiatives Program. Two good outcomes have resulted from the Workshop. A book titled " New Approaches in Medical Image Analysis" (Eds. Pham B., Braun M., Maeder A.J. and Eckert M.) has been published by SPIE (the International Society for Optical Engineering) for July 1999. A collaborative research project on the development of a medical diagnosis support system for cervical spine trauma (Pham / Yearwood / Stranieri) with the Western Hospital has started and a NHMRC grant application has also been submitted.

As a follow-up activity, I recently visited two research groups to discuss recent progress and strategic development in areas related to medical imaging in UK. The Computational Imaging Sciences Group at Guys's Hospital, led by David Hawkes, Professor of Computational Imaging, School of Radiological Sciences, Kings College in London, is organising an annual UK forum for medical image understanding and analysis. This forum aims to encourage dialogue between professionals from technical and clinical disciplines, and to attract funding to support research from both government and industry. The group which currently has 6 postdoctoral fellows, 5 postgraduate students (and 5 postdoctoral vacancies!), has a number of interesting projects on image registration, image deformation, image guided interventions, MR image restoration, tele-surgery and brain morphometry. Binh Pham gave a seminar on the current status of medical imaging research in Australia, and also the project we currently have with the Western Hospital.

The Institute of Behavioural Sciences at the University of Derby, was led by Alastair Gale, a Professor of Applied Vision Sciences. One of their major projects which is in collaboration with the National Breast Scanning Program, investigates the behaviour and performance of radiologists while reading mammograms in order to improve the level of accuracy. It was rather surprising to find out that radiologists in UK have not been reluctant to volunteer to participate in such research.

While at the University of Derby, I also caught up with a long lost contact, Lindsay MacDonald, who is now the Professor in Multimedia Imaging in the Colour & Imaging Institute. This Institute was a special initiative of the University, which has evolved from a Design Research Centre with an ambitious aim to be the leading European Institute for the science and application of colour and imaging. Judging from the extensive research and teaching programs, as well as the support given by industry during the last five years, the Institute must have achieved its aim.

Binh also visited an ex-colleague from ANU, Prof. Richard Brent, at the Oxford University Computing Laboratory. Their research programs (carried out by the Programming Research Group and the Numerical Analysis Group) which seem to be very theoretical at a cursory glance, have produced many significant applied outcomes and collaborations with industry. In particular, the Laboratory provides the home to the Rolls-Royce Technological Centre, and the Programming Research Group has won two Queen's Technological Achievement Awards for their collaborative projects with INMOS Ltd and IBM UK. The undergraduate program at Oxford is rather unusual, placing a much stronger emphasis on affiliations with Colleges, than with particular Departments. As a consequence, any curriculum changes need to be approved by all Colleges and require College tutors to be re-trained, hence a very long delay may result.

Seminars and Workshops

Alex Rubinov presented a paper titled "P-functions and Hadamard type inequalites" on the 20th August, 1999. The paper was written jointly with Prof. Charles Pearce. at Victoria University Melbourne.

School Seminars
Glenn Auld gave a seminar on 11/8/99 "Researching computer assisted language learning in Arnhem Land – problems and solutions".

Professor Binh Pam gave a seminar on 25/8/99 on "Distributed and Collaborative Environments for Interactive 3D Graphics Applications".

Published Papers….

The book "Progress in Optimization: Contributions from Australasia" was published by Kluwer Academic Publishers as the volume 30 in the series "Applied Optimization". This book contains 14 chapters, the authhours or co-authors of 6 of them are members of Ballarat team. Here is the list of these chapters:

1. **A. M. Rubinov** and **A. Zaffaroni**, Continuous approximation of nonsmooth mappings;

2. **M. Andramonov** and **A. Ellero**, Generalised convexity properties of marginal functions;

3. **A.M. Rubinov**, Supremal generators of spaces of homogeneous functions.

4. **A. M. Bagirov**, Minimization methods for one class of nonsmoooth functions and calculation of semi-equilibrium prices;
5. **H. Xu**, **A. M. Rubinov** and **B.M. Glover**, Approximations to Clarke generalized Jacobians and non-smooth lest-squares minimization;

6. **M. Andramonov**, A parametric approach to global optimization problems of a special kind.

Accepted Papers:

The paper "Abstract Convexity: Examples and Applications" by **A. Rubinov** has been accepted for publication in the international journal "Optimization" This paper is an extended version of a lecture given by Alex at CODE workshop on Generalized Convexity and Monotonicity in Economic Modelling (Barcelona, June 1998). Let us quote an extract from Introduction to the paper:

"The first book on abstract convexity and some of its applications was published by Kutateladze and Rubinov in 1976 in Russian. Excellent books by D. Pallaschke and S. Rolewicz and by I. Singer on abstract convexity were published in 1997. The intersection of these large books is almost empty. ...The paper presents a survey of some results from and application of abstract convexity. Almost all results are given without proof but we provide references where these proofs can be found. The paper contains very many examples, which are its essential part. The intersection of this paper with both books by Pallaschke and Rolewicz and by Singer is very small."

P Smith has had a paper accepted for the Journal of Educational Computing Research. The article is entitled "The Efficacy of a Low-Level Program Visualisation Tool for Teaching Programming Concepts to Novice C Programmers".

P Smith has also had a paper accepted for publication in the proceedings of the International Conference on Computers in Education (ICCE99) in Chiba, Japan. The paper is entitle "Evaluation of a Low-Level Program Visualisation Tool".

D Stratton has had a paper accepted for publication in the proceedings of the International Conference on Computers in Education (ICCE99) in Chiba, Japan. The paper is entitled "Towards a Location and Language Independent Novice Programming Environment" in November.

Paul Kelly and **Lyn Roberts** have had a paper accepted 'Challenges for university administrators in the on-line world' sub theme -Innovations in delivery of learning and teaching for presentation at the 12th International Meeting of University Administrators. Paul is travelling to Edinburgh to present the paper.

Post Graduate News ....

Tunde Meikle presented a paper at the Australasian Legal Information Institute conference (AustLII 99), 'Law via the internet', in Sydney 21 - 23 July. Her presentation discussed a number of models of consistency as a concept applied to legal decision making. It was well received and the opportunity to gain feedback on ideas early in her thesis has been extremely valuable. she would like to thank the School of ITMS for providing funding assistance to make this possible, and also her supervisors Drs John Yearwood and Andrew Stranieri for their encouragement.

First PhD Completion
The School of ITMS had its first PHD completion. **Dr Huifu Xu** completed his PhD in under minimum time. His principal supervisor was Professor Alex Rubinov with associate supervisors Dr Barney Glover and Dr Bruce Craven.

Raouf Veliev has left to go to Esslangen, Germany to do a MBA. He hopes to finish his PhD by December 1999.

Research Reports

99/31	Student Modelling to Identify Gaps in Conceptual Knowledge	Heather Mays, Binh Pham and Andrew Stranieri	July 1999
99/32	Best Approximation by Normal and Conormal Sets	Alex Rubinov and I. Singer	July 1999
99/33	A fuzzy-neural hybrid approach in economic modelling	Raouf Veliev, Alex Rubinov and Andrew Stranieri	July 1999
99/34	Properties of D-continuous convex-valued mappings*	Alexander Vladimirov	July 1999
99/35	Radiant sets and their gauges[1]	A.M. Rubinov	July 1999
99/36	Data Exploration using the Clustering Algorithm in MineSet	Chaula Anjaria	August 1999
99/37	Global Minimization Of Increasing Positively Homogeneous Functions Over The Unit Simplex	A.M. Bagirov and A.M. Rubinov	August 1999

All IT&MS staff members and postgraduate students are encouraged to contribute to the next edition of the monthly ITMS 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 April 1999.

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