



Research Newsletter

JUNE 1998

Edition 1.

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

This is the first issue of the newsletter. The impetus for the newsletter came from the desire to have brief informal project reports within the Research Centre for Intelligent Tele-imaging (RCITI). The scope was broadened to include all research and consultancy activity within the School. This issue captures activity for the first half of the year, but there will be ample opportunity for new projects and updates on ongoing projects. It is hoped that the newsletter will be a stimulus for further discussion and possibly involvement from all staff and research students.

Projects in Progress.....

Professor Binh Pham and John Yearwood together with two German students, will be working on an internet based collaborative system for medical image work. The German students will arrive in Australia in October and will be staying for six months.

Three overseas final year students will arrive in the second semester under the Practical Training Program to assist with two research projects. Milou de Vries (the Netherlands) who has a Medical Engineering background, will work on a project involving the modelling of articulated human movement. Gesine Schoeter and Matthias Kraft (Germany) who have experience in internet computing and multimedia, will be involved with the project on the construction of a cooperative multimedia environment to support telemedicine applications using the internet.

David Stratton is currently working with the DSTC on a Meta Object Facility. David went to Brisbane in the second week of the Easter break to study with members of the Distributed Systems Technology Centre at the University of Queensland. The DSTC is a very active member of the Object Management Group (OMG) the worldwide consortium that oversees CORBA. David will take part in the work on a new proposal that the DSTC is preparing - the Meta Object Facility. The objective of the MOF is to provide a distributed type library so that distributed

application components can share common type information.

Jack Harvey has been invited to join a multidisciplinary team in a research project funded by Worksafe Australia to investigate the potential for reduction in back injuries and energy expenditure in shearers through modifications to shearing shed design. The research team is led by Assoc Prof Warren Payne and includes staff from HMSS, VIOSH, other tertiary institutions, and industry representatives. The current phase of the research involves the design of a laboratory experiment in which measurements on a computer-linked force plate will be used to model spinal stresses in shearers when lifting and dragging sheep on different floor surfaces and inclinations. Being an early bird, Jack has enjoyed keeping "farmer's time" with regular 7.30 and 8.00 am telephone conferences.

During the period January-May 1998, the ITMS Statistical Consulting Centre, in the persons of **Greg Simmons, Robyn Pierce and Jack Harvey**, have provided consultancy services relating to 35 different projects. The clients included 12 UB postgraduate students, 11 UB staff or sections and 8 external individuals or organisations. Three of the consultancies with UB staff have evolved into collaborative research activities which are outlined in separate notes.

Robyn Pierce has assisted with data analysis for a survey of patrons of the National Gallery of Victoria's Rembrandt exhibition and Student Services' survey of student response to O-week.

Scott Hebbard has recently been writing a research proposal for the ACARP organisation. The goal of the proposed system is the development of a tailored learning environment that can implement a contractor based training schedule to enhance workplace safety at Australian underground mine sites. The system described in the proposal will have various functions. Firstly, it will determine if a contractor possesses the necessary occupational health and safety skills to work safely in a particular mining environment. Secondly the project will provide a competency based training program. There is no shortage of occupational, health and safety information available to help train these

contractors. The information is however, distributed over a variety of Internet sources, company Intranets, fatality, injury and compensation databases. The final stage of this project would be to utilise various searching and data mining techniques in conjunction with the user profile to develop a lesson plan tailored to the individual needs of a contractor.

Robyn Pierce meets fortnightly at the University of Melbourne with a group of researchers looking at teaching and learning mathematics using computer algebra systems. In particular they have been considering implications for assessment in Calculus. Robyn has been collecting data on the experience of students studying MA511 during a period of change in the way CAS has been incorporated in the teaching and assessment of this course.

Jack Harvey, in collaboration with David Borys of VIOSH and Derek Viner, a Risk Management consultant and VIOSH associate, has recently submitted an application for retrospective Ethics Committee approval in order to publish some interesting results from what began as a class exercise. Students of the Grad Dip in Occupational Hazard Management, many of whom are practicing OH&S professionals, were given two tasks. One task involved assessing the risk for a hypothetical scenario, using a range of widely available nomograms, matrices and other tools. The other task involved coding the various aspects of a hypothetical accident scenario (nature of injury, agency of injury etc.), using the relevant Australian Standard. In both cases the range of many of the responses was very broad, which calls into question the efficacy and utility of the procedures and specifications. Because much of the data is unordered categorical, the analysis involves the comparison of profiles of responses using measures of entropy and indices of similarity.

Jack Harvey is currently preparing a report for St John of God Hospital management on the results of a survey of medical staff satisfaction. Details are confidential (and unless the trained eye of a pharmacist can be enlisted, some of the doctors' written comments will remain an undeciphered secret!).

Jack Harvey has been collaborating with Rapson Gomez of BSS&H, in research into diagnostic criteria for Attention Deficit / Hyperactivity Disorder (AD/HD) in children. The analysis involves the use of confirmatory factor analysis to evaluate proposed models of the structural relationships underlying the assessments of a set of symptoms made by parents and teachers. A joint paper on the work has recently been accepted for publication by the *Journal of Child Psychology and Psychiatry*.

Jack Harvey's final report on the "Ergonomics of Sheep Shearing" project, commissioned by Worksafe Australia, has been completed, and a number of papers dealing with particular aspects of the research are in preparation. The report, co-authored by a multidisciplinary UB research team including statistician (and backup sheepdog owner) Jack Harvey, outlined the methodologies used in the team's 1997 research and identified a number of key issues in shearing shed design aimed at reduction in back injuries and energy expenditure in shearers. Technically, some large but fairly straightforward multi-factorial experimental designs became unbalanced and hence more "interesting" to analyse after equipment malfunctions and logistical glitches resulted in the loss of some experimental data.

Grants News.....

Andrew Stranieri, together with colleagues from La Trobe University and Griffith University, has submitted three Spirit applications for future research on family law.

The Refugee Review Tribunal agreed to support a Spirit APAI application made by **Andrew Stranieri and John Yearwood**. Andrew and John would like to thank Binh Pham for her invaluable comments on the draft application. Their last draft was frantically worked on just before deadline while removalists moved furniture into the new building.

A Law Book Company flew **Andrew Stranieri** and his PhD supervisor from Latrobe University (John Zeleznikow) to Sydney to demonstrate Andrew's Family Law Property Prediction System (Split Up). Discussion also took place regarding an industry collaboration on a Spirit grant.

Seminars and Workshops.....

Professor Binh Pham and Professor Anthony Maeder (Engineering) will be conducting a two day National Medical Imaging Workshop during 31st July and the 1st August 1998 in Sydney. Registration will be \$100 per day. The first day will cover technical aspects and the second day will cover medical applications. Both Australian and Overseas guests will be speaking.

Conferences.....

John Yearwood attended the 7th International World Wide Web conference. The Conference had large sections devoted to information retrieval and modelling. There was significant emphasis on the W3C recommendation XML which will become the document standard for the Web. The associated areas of RDF (Resource Description Framework) the Document Object Model (DOM) and SMILE, the new

emerging standard for multimedia were the topic of many paper sessions and tutorials. Java and CORBA also played a major part. Highlights were the addresses by Tim Berners Lee and Ted Nelson.

Andrew Stranieri and Raouf Veliev attended the Pacific Asia Knowledge Discovery from Databases (PAKDD) conference. Andrew presented a paper that discussed obstacles inherent in data mining of legal domains. Both Andrew and Raouf attended tutorials taken by Prof. Han from Simon Fraser University, Canada and Prof. Wallace from Monash University. Prof. Wallace referred at some length, to the work of Binh Pham, John Yearwood and Mikhail Andramonov in his keynote address at the conference.

John Culvenor of VIOSH presented a paper co-authored by a multidisciplinary UB research team including statistician **Jack Harvey**, on "The Ergonomics of Sheep Shearing" at the International Workplace Health & Safety Forum and 33rd Ergonomics Society of Australia Conference, Gold Coast, November 1997. The paper outlined the methodologies used in the team's current research aimed at reduction in back injuries and energy expenditure in shearers through modifications to shearing shed design. The final report on the project, commissioned by Worksafe Australia, is in preparation, as are a number of papers dealing with particular aspects of the research.

Visitors to the School.....

Dr Zbigniew R. Struzik, from the Centre from the Centre for Mathematics and Computer Science, Amsterdam visited the School of Information Technology and Mathematical Sciences. The Centre for Mathematics and Computer Science is one of the foremost research institutes in The Netherlands. It is affiliated with a network of Technical Colleges (somewhere between a Tafe and a University here). Students from IT courses in these Colleges need to perform work experience in order to graduate. In the past students from German and Dutch Colleges, Marc, Uva and Silka have chosen to do their work experience with the School on research projects run by Binh Pham, John Yearwood, and Andrew Stranieri, with excellent results. Zbigniew has offered to approach the Colleges he is affiliated with to advertise for students to do projects if anyone has a project and they are willing to supervise an exchange student Andrwe. During his time at the University of Ballarat, Zbigniew presented a seminar entitled 'Wavelet transformation for Time Series Data' on Thursday 23 April. He has emailed **Andrew Stranieri** to thank the School for our hospitality and a most memorable visit to Sovereign Hill (The School provided him with a ticket, and Andrew Stranieri took him out for dinner).

Post Graduate News.....

Heather Mays has begun to investigate the purchase of data mining software. Software such as Clementine can be used to discover patterns from health, economic, legal and geographical data.

Damien Jolley from Melbourne University has agreed to be the Associate Supervisor for **Dora Pearce**, who is currently doing a PhD project to investigate the correlation between respiratory illness and air pollution. Damien Jolley is also willing to be nominated as an external Research Associate.

Scott Hebbard is currently studying for his PhD with a focus on artificial intelligence, on-line and flexible learning systems.

Raouf Veliev's confirmation of candidature is due in July 1998.

David Stratton's confirmation of candidature is scheduled for October 1998.

Research & Professional Development Group News.....

The Research and Professional Development Group has recently been mainly concerned with issues of streamlining and documenting research and consultancy activity within the school. Most staff and research students are now aware of the need to formally apply for conference funding and leave, report on conferences and submit their publications data and grant applications. Publications data for 1998 should be submitted to Kirsty as it becomes available so that the data collection can be carried out progressively and automatically. The group has made recommendations on research load allocations and looks forward to hearing reports on the research projects being undertaken. It is important that successes as well as difficulties be drawn to the attention of the group and that it starts to play a more personal role in supporting and mentoring research. The group is also intended to be a forum for ideas and strategies for improving and developing research activity and output from the school.

The Research students are running a fortnightly lunchtime colloquium which is also a mechanism for staff to interact with the emerging research culture of the school. Research work could be reported here as a further means of involving and supporting staff and students. A schedule of post graduate seminars can be obtained from the following web address: <http://www.ballarat.edu.au/itms/research/pglc.htm>

The group is planning to hold a half day devoted to facilitating research activity of those in the school with research interests. It is envisaged that this could be a starting point for initiating a research

project involvement. Future sessions would build on this and complement the mentoring support program coming from the RPDG. There will also be an opportunity to develop a framework for scholarly activity within the school. The event will be held at the Greenhill Enterprise Centre.

Research Centre for Intelligent Tele-Imaging Report.....

The IT&MS Monthly Newsletter will include a report from the RCITI Chair (**Professor Binh Pham**) after she returns from her two month stay in Germany. Binh will be in Germany from the 21st of May to the 23rd of July 1998, to work on a collaborative research project with Prof. Dan Ulmet of the Hochschule of Technik Esslingen and two stylists / designers of Daimler-Benz in Stuttgart. The project investigates techniques for automatic correction of relection lines for aesthetic purposes in car design.

Economic Modelling and Optimization Group.....

The Optimisation and Economic Modelling Group conducts both basic and applied research into aspects of optimisation theory, computation and economic modelling. The group comprises **Dr. Alex Rubinov** and three PhD students: **Huifu Xu**, **Mikhail Andramonov** and **Rauf Veliev**.

One of the main directions of research of the Group is the study of global optimisation problems. In general, they are very difficult to solve due to multi-extremality and combinatorial nature. We use the idea of abstract convexity which was developed by Semen Kutateladze and Dr. Alex Rubinov in the 1970s. This idea has recently led to several methods for solving complicated structured global optimisation problems. In particular the cutting angle method was developed by Mikhail Andramonov, Dr. Alex Rubinov and Dr. B. Glover. Another approach is the level functions method developed by Huifu Xu. Numerical experiments using the facilities provided by the School and commercial software CPLEX MIP and MINOS, have shown very promising performance of the algorithms. This leads to the possibility of solving important problems of optimal transportation, optimal distribution of resources etc. more efficiently. The theoretical and numerical results were presented and some of them have already been published in international journals.

The second major part of the research activity of the Group is the research in the field of Mathematical Economics. Each econometric model is based on some kind of economic theory and on statistical data. Thus if the statistical data is not sufficient we should strengthen the theoretical part. The approach can be used for economic forecasting in the countries "in

transition" since there is not any reliable statistical data for such countries. Raouf Veliev has begun to construct an econometric model of this kind. In this context some connections with genetic algorithms, neural networks and data mining can be established. Andrew Stranieri is helping to investigate these connections

The main directions of future research of the Group are the further development of efficient algorithms of global optimisation, based on Lagrangian duality and penalisation, and their application to some engineering and economic problems. The econometric model will be completed and tested in practice.

Learning Technologies Research Group.....

The Learning Technologies Research Group has been formed to set targets and produce ideas in the area of learning technologies and their future use within the School. Members of the group include Paul Kelly (Chair), Lyn Roberts, Greg Simmons, Scott Hebbard, Tony Greening, and Sneha Kirubakaran.



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All IT&MS staff members and post graduate 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, research in process, publications, grants, seminars, visitors, visits by ITMS staff and Post graduates, scholarships, reports from school research groups, events, conferences, new discoveries, general items of interest, etc. All items should be received by Kirsty Broadbent no later than Friday the 26th June 1998.