



Research Newsletter

SEPTEMBER 1998

Edition 4.

Inside this Edition:

<u>New projects:</u>	Cervical spine x-ray - medical imaging project (Binh Pham, Andrew Stranieri, John Yearwood)
<u>Projects in Progress Reports:</u>	Open day display of post graduate & research work in progress
<u>Special feature:</u>	research proposal development and grant application writing (by prof. Binh Pham)
<u>Research Profile:</u>	Scott Hebbard (part-time lecturer and post graduate student)
<u>Accepted papers:</u>	Increasing Convex-along rays functions with application to global optimization (by Alex Rubinov & Barney Glover)
<u>Published papers:</u>	Quasiconvexity via two step functions (by Alex Rubinov & Barney Glover)
<u>Seminars and Workshop Reports:</u>	The German connection: opportunities and limitations presented by Binh Pham Workshop on computation-intensive machine learning techniques the second Asia-Pacific conference on simulated evolution and learning (SEAL98) International joint meeting of American Mathematical Society (AMS) and Australian Mathematical Society (AUMS)
<u>Conferences:</u>	Milou de Vries
<u>School Visitor:</u>	Scott Hebbard's post graduate research - tailored learning environment for workplace safety at Australian underground mine sites.
<u>Post Graduate News:</u>	

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

John Yearwood will be on long service leave from July 13th 1998 until October 18th 1998. Andrew Stranieri will be acting as Research, Higher Degrees and Ethics Coordinator during this period.

Two very significant events happened last month. The first; the team that finished at the bottom of the ladder last year, Melbourne, secured their place in the finals this year. The second; almost all the research undertaken within the School was on proud display on Open Day. What do these events have in common? Quite a lot.

This school is making the transition from a non-research, CAE, based institution to a research based, University organisation. The Melbourne football team has also made a transition from being the team that everyone defeated to one that is tightly integrated and effective. "What was the turning point", I heard a radio journalist ask the Chairman of selectors of the Melbourne Club, "a particularly tough match won against Sydney that happened after a huge thrashing

at the hands of Geelong weeks before. That was when the players really started believing in themselves".

If there is such a turning point for research in this School, then I think it happened on Open Day. With help from Professor Pham, Dr. ZhongWei Zhang did an excellent job in getting so many of our PhD students and staff to prepare posters of their research. On the day, a number of resolute members, Dora Pierce, Heather Mays, Victor Bistak contributed all day to proudly showing off our work to scores of visitors.

New projects:

The Birth of a New project By Andrew Stranieri

According to the categorisation of organisations put forward by management theorist, Mintzberg, a research team is best seen as an adhocracy. Organisations that are adhocracies have loosely defined lines of authority, frequently change direction, rarely have standard procedures and are extremely flexible and innovative. That this is so can be seen by tracing the recent birth of a new project within the School. The story began some time ago

with the a successful ARC grant put in by Prof. Pham and Prof. Maeder (Engineering) to host a workshop on medical imaging that would bring to Ballarat, a broad interdisciplinary group of researchers from around the world. Sometime before the workshop, Prof Pham asked John Yearwood and I to see if an insight into medical imaging could be brought to bear from our respective specialisations; information retrieval and artificial intelligence and law. We did so, and together with Prof. Pham drafted a paper. This was well received at the workshop. So much so that Professor Ken Thompson, Chief radiologist at the Royal Melbourne and Western General Hospitals in Melbourne approached us to see if we would be interested in trying our ideas with cervical spine X-Ray images that he could supply. Prof. Pham, agreed that, if sufficient groundwork was done, two research assistants that she had secured whilst in Germany, due to arrive in October as exchange students, could assist on the project. Despite John Yearwood being on leave, Prof. Pham and I, redrafted the paper after new insights and feedback from the workshop. Recently, Prof Pham and I visited Prof. Thompson at Western General and met a radiologist with sufficient vision to commit his own time, that of his staff, and resources toward the project. Late at night, I find myself asking, "what am I doing learning about diagnostic procedures associated with injuries of the cervical spine?". The question does not linger for long because I know the answer; research is an activity performed by an adhocracy that is flexible enough to see a new idea and chase it.

By Andrew Stranieri.

Projects in Progress:

As a part of the University of Ballarat 1998 Open Day, the School of Information Technology and Mathematical Sciences (ITMS) postgraduates displayed their work in the form of a poster display and an informative program demonstration. This took place in both the Research & Development lab and the IVRIF lab. Below is the list of poster titles of selected research projects included in the Open Day display;

1. Dynamic Modelling for the Modification of Three Dimensional Scenes by Lloyd Walker
2. Spatial Analysis of Pollution Health Effects: PM10 by Dora Pearce
3. Intelligent Diagnostic System for Algebra by Heather Mays
4. Attracting Attention Ross Brown
5. Generating Intelligent Interactions between Actors in Environments by R. Hall
6. Population Estimation from Satellite Imaging by Jack Harvey
7. SplitUP: Predicting Property Outcomes Following Divorce by Andrew Stranieri

8. Smoothing the Free form Surfaces in Evolutionary Approach by Binh Pham & Zhongwei Zhang

Research Proposal Development and Grant Application Writing:

On Wednesday 2 September 1998, Prof. Binh Pham ran a two-hour discussion seminar on how to develop a research proposal and how to write a research grant application for staff and students, organised as part of the Graduate Centre Seminar Series. The following brief summary of the discussion would be useful as a checklist for staff and students in their development of research proposals and grant applications.

1. The Players

- **Researcher**
wants funding to support an interesting and / or a (perceived) useful project
- **Granting Body**
wants to support certain policies, directions of development
- **Potential External Collaborators (e.g. industry, government bodies)**
want to improve their own core business
- **Researcher's Institution**
wants external funding or to support certain policies (internal or external)
- **Assessors**
judgements based on funding criteria and on their own knowledge and experience.

2. Developing a research proposal

Purpose?

- To solve a specific problem
- To explore a good idea
- To get a research degree
- To produce publications
- To attract funding

What?

- Description of problem
- Aims
- Expected outcomes
 - *contribution to new knowledge*
 - *new theoretical concepts*
 - *new products or tools*

Why?

- Background information
existing knowledge and methodology that are relevant to the problem
- Motivation
gaps or drawbacks in existing knowledge and methodology
- Significance
value or merit of project within a specific discipline and within a wider context

Feasibility

- researcher's expertise and experience

- resources: time, data, material, fieldwork, equipment, software, technical support, etc.

How?

- Lists of research questions / problems / issues to be addressed
- Collection of evidence / data
- Methodology (step-by-step) for solving these problems or analysing these issues, including justification
- Methodology for testing and evaluation of results obtained
- Comparison of new knowledge and results to existing knowledge
- Contribution to the specific field of research
- Impacts exerted within a wider context

3. Writing A Research Grant Proposal

- examine carefully criteria specified by granting body
- match the aims, objectives and significance of the research project to these criteria
- write for both laypersons and experts in the specific discipline
 - well-structured content*
 - overview of concepts in each section*
 - clear signposts for skim reading*
 - selected details to emphasise the significance*
 - selected illustrations to facilitate understanding*
 - highly professional presentation*
- to demonstrate very clearly the feasibility of the project
 - appropriate researcher's expertise*
 - well-prepared "homework"*
 - sound proposed methodology with sufficient details to convince experts*
 - sound critical analysis*

4. Collaborative Proposal with External Body

- to examine carefully the core business of the organisation
- to demonstrate clearly
 - close relationship between the proposed project and their core business*
 - how project outcomes can enhance their core business*
 - you are the best person to carry out the work*
 - this is the most cost-effective for the organisation to achieve such outcomes*
 - any medium or long-term benefits to the organisation*
 - clear modes of working and interactions (incl. personnels and expenses)*
- negotiate right to publish, intellectual property and commercial rights in advance

5. A Few Practical Tips

- allow sufficient time for working out project details and improving writing

- seek comments from colleagues, and if possible proof reading from a non-expert
- a realistic request for funding
- a realistic estimation of time commitment
- gradually build up a good track record (publications, consultations, grants, collaborations)
- establish and extend professional networks
- do not let an unsuccessful grant application dampen your spirit

*Remember: You still own a good research proposal!
Experienced researchers also have many unsuccessful grant applications!*

Research Profile:

Scott Hebbard



Scott Hebbard recently joined the School of Information Technology and Mathematical Sciences as a part time lecturer and postgraduate student. He is currently working on his PhD in Information Technology and has a wide range of computing interests. Some of these areas include: multimedia, on-line learning, artificial intelligence, data mining, the Internet, electronic commerce, and modern computing hardware. Scott has become actively involved in multimedia, on-line learning and Artificial Intelligence research within the School. In particular, he has been working with final year Bachelor of Computing students Anna Caine, Sara Gardiner and Maree Dunne on a project using LearnLinc. Developed in the United States in 1994, LearnLinc is largely used in business applications and for company training. It is understood that the University of Ballarat is the first higher education institution in Australia to introduce the program. A demonstration of the LearnLinc system was recently given to the Minister for Tertiary Education and Training, the Hon Phil Honeywood MLA.

Scott was born in Geelong in 1974 to Neil and Pam Hebbard. He has one brother, Adrian who works on a large farm in the Torquay district. Scott grew up in a semi urban suburb of Geelong called Marshall, located on the other side of Geelong towards Barwon Heads. He completed his education at Grovedale Primary school and Grovedale Secondary College. Scott now resides in Buninyong and maintains close ties to family and friends in the Geelong region.

Scott worked for Coles supermarkets part-time for a period of eight years. He accepted a lecturing position at the University of Ballarat in January of this

year. Apart from working at Coles, he also gained employment at a local computer shop and was a tutor at Deakin University. Subjects taught include Information Systems in Organisations, Office Automation, Systems Analysis and Design and Data Collection and Analysis. Scott also conducted tutorials for many private clients and for the Koorie Institute located at Deakin's Waurin Ponds campus.

Scott completed a Bachelor of Science degree at the Waurin Ponds campus of Deakin University. He majored in Computer Science, Information Technology, Statistics and Operations Research. Scott also completed electives from a diverse range of subjects such as Psychology, Chemistry and the history of the Second World War. However, his strengths were in Information Technology and Computer Science which lead him to complete an Honours Degree under the supervision of Dr Chris Coomber at Deakin University. Dr Coomber was a lecturer in Information Systems and Systems Analysis and Design. Scott graduated from Deakin University in 1996. He received first class honours for his thesis entitled "Multimedia Applications and Multimedia Authoring Tools in Tertiary Education". Scott is most interested in education, and wanted to develop an authoring tool that could create multimedia applications that were suitable to teach tertiary course material. Scott proposes that multimedia applications offer several advantages to tertiary education and research that can enhance conventional learning systems. Users have the ability to search large volumes of on-line data to conduct research. They can control the pace and sequencing of their lesson to suit their needs. Multimedia material can be used to deliver course material in a distance education mode. All of the lectures, labs, tutorials and presentations can be packaged on a CD. Used in conjunction with packages such as LearnLinc, distance education students can achieve the same standard of education as on-campus students. Scott has continued his involvement with multimedia applications by teaching the units: 'Introduction to Multimedia' and 'Interactive Multimedia' within the School of Information Technology and Mathematical Science.

Accepted papers:

The paper "Increasing convex-along-rays functions with application to global optimization" by **A.M. Rubinov and B.M. Glover** has been accepted for publication in international Journal of Optimization Theory and Applications (JOTA). The first version of this paper was published in the School Research Report Series as Research Report 96/21 in October 1996. The paper was significantly revised due to referees' reports.

Published Papers:

The paper "Quasiconvexity via two step functions" by **A.M. Rubinov and B.M. Glover** was published this

summer in Proceedings of the 5th International Symposium on Generalized Convexity "Generalized Convexity, Generalized Monotonicity: Recent Results" published by Kluwer Academic Publishers. Symposium took place in France exactly two years ago. Editors of this Proceeding are J.P. Crouzeix (who visited Ballarat last December), H.J. Martinez Legaz and S. Schaible. The first version of this paper entitled "Generalized Convex Sets and Subdifferentials" was published as the Research Report 96/9 in June 1996.

Seminars and Workshops:

The German Connection: Opportunities and Limitations

By Prof. Binh Pham; IBM Professor in Information Technology; University of Ballarat
Monday 14 September 1998; 12:30pm-1:30pm
ITMS Meeting Room

This talk will be based on the experience acquired during my recent two-month study visit which was sponsored by the German Academic Exchange Services. The main purpose of the visit was to enable me to participate in a collaborative research project between staff from the Fachhochschule Fur Technik Esslingen and the Daimler-Benz Company. During this period, I also had opportunities to examine the German tertiary education systems, and in particular, their efforts in bringing industrial and academic sectors together, within Germany, across Europe and globally.

The discussion will cover the following aspects: cultural differences, tertiary education systems, industrial collaborations, international programmes (teaching and research), staff and student exchange and funding opportunities.

Workshop on Computation-Intensive Machine Learning Techniques

Swiss Grand Hotel, Bondi Beach
28th – 29th September 1998

On the 28th of September, **Scott Hebbard** will be attending the Workshop on Computation-Intensive Machine Learning Techniques in Sydney. The workshop conveniently falls in the mid semester break. The Workshop is sponsored by the Centre for Computational Learning Systems and workshop participation is free of cost. There will be a total of ten talks over the two days, allowing plenty of time for informal discussion. Scott Hebbard hopes to give a brief seminar on the workshop when he returns from Sydney. Usama Fayyad will be discussing recent developments in Data Mining. This may be of particular interest to other academic staff members who are conducting research in data mining and related fields. Below is an outline of the workshop.

If anyone is interested in attending the workshop, Scott can provide more details.

Monday 28th September

- 9.00-10.15 Usama Fayyad, Microsoft Research, USA, "Taming the Giants and the Monsters: Recent Developments in Data Mining"
- 10.30-11.30 Claude Sammut, CCLS, UNSW "Scaling up Behavioural Cloning"
- 11.30-12.30 Michael Harries, CCLS, UNSW "Splice: Batch Learning in Domains with Hidden Changes in Context"
- 1.45-3.00 Jerome Friedman, Stanford University, USA "A Statistical View of Boosting"
- 3.15-4.15 Kai Ming Ting and Zijian Zheng, Deakin University "Boosting Cost-Sensitive Trees"
- 4.15-5.15 Len Trigg, University of Waikato, New Zealand "Experiences with a Weighted Decision Tree Learner"

Tuesday 29th September

- 9.00-10.15 Ronny Kohavi, SGI, USA "Improving Accuracy by Voting Classification Algorithms"
- 10.30-11.30 Geoff Webb, Deakin University "Decision Tree Grafting"
- 11.30-12.30 Vladimir Estivill-Castro, University of Newcastle "Discovering Groups in Categorical Data"
- 1.45-3.00 Peter Bartlett, ANU "The Margin for Error: Improving the Performance of Combined Classifiers"
- 3.15-4.15 Zijian Zheng and Geoff Webb, Deakin University "Stochastic Attribute Selection Committees with Multiple Boosting"
- 4.15-5.15 Eric McCreath, CCLS, UNSW "Boosting and Noisy Data"

Conferences:

Evolution and learning are two fundamental forms of adaptation. **The Second Asia-Pacific Conference on Simulated Evolution And Learning (SEAL98)** will be held in Canberra, November 1998. SEAL98 will be the most prestigious conference in this field in Asia-Pacific region. There will be two presentations from the School of ITMS, University of

Ballarat at the conference, and two accepted papers are:

(1) Binh Pham and Zhongwei Zhang: Correction of Reflection Lines Using Genetic Algorithms.

(2) Richard Hall, Binh Pham and John Yearwood: Adaptive Simulation: An Implementation Framework.

The **International Joint Meeting of American Mathematical Society (AMS) and Australian Mathematical Society (AuMS)** will be held in Melbourne, July 12-16, 1999. There will be some Special Sessions at this Meeting. One of them, namely "Nonlinear Dynamics and Optimization" will be organised by Anatoli Ivanov (Penn State University and (part time) University of Ballarat), Alistair Mees (University of Western Australia) and Alex Rubinov (University of Ballarat). AMS is the biggest association of mathematicians in the world involving many mathematicians from different countries. From time to time AMS co-sponsors joint meetings with sister mathematical societies in different countries. Special sessions at the proposed Joint AMS - AuMS meeting will be organised by representatives of well-known universities of the USA and Australia. (Australian mathematicians who are organising these sessions include representatives of the University of Melbourne, Monash University, University of Sydney, University of Western Australia, University of Queensland, Macquarie University).

Visitors to the School:



Milou de Vries arrived in Ballarat early on the 26th of August from Holland. She will be staying with us for 5 months. As a part of her medical electrical engineering studies, Milou is required to complete two traineeships. Each traineeship requires completion of a minimum 100 working days. Milou completed her first traineeship at a hospital in Holland. As a part of this traineeship she was required to rewrite a version of an existing technical manual to assist hospital staff. The simplified manual was for an apparatus used to monitor baby's breathing, heart beat, oxygen intake, sleep, brain activity, muscle activity, etc. Milou enjoyed this project very much. She is now here to begin her second traineeship at the University of Ballarat, under the supervision of Professor Binh Pham. Milou will be working in conjunction with Victor Bistak with the Silicon Graphics package, modelling humans in normal and abnormal conditions. Milou is currently

looking at comparing the differences in movement in people with and without diabetes.

Post Graduate News:

Scott Hebbard is working towards the development of a tailored learning environment as part of his postgraduate research. The system being investigated will lead to the implementation of a contractor based training schedule to enhance workplace safety at Australian underground mine sites. The system 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, however, the information is 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.

An intelligent tutoring system will be developed with the ability to certify OHS skills and train contractors with respect to specific company policy and general OHS principles. Significant here will be the development and application of a user model. "User modelling for intelligent tutoring systems involves creating a student model that represents a student's knowledge and understanding of the material being taught." [McTear, 1993, p.162] The user model will represent the level of OHS knowledge held by a contractor and can be used to develop appropriate training schedules.

There are various techniques for gathering user information in order to create a user profile. This project is concerned with student modelling for intelligent tutoring systems. "A common modelling technique is the use of overlays in which the students knowledge is represented as a subset of the system's knowledge of the domain. In this case it may only be necessary to maintain a checklist of what the student knows and does not know." [McTear, 1993, p. 162]. "User modelling is often undertaken by distinguishing a set of concepts in the domain knowledge, imposing a structure or order on these, and utilising the user's familiarity with them to formulate explanations and descriptions." [Beaumont, 1994, p. 26]

A more sophisticated modelling technique which is to develop intelligent agents that monitor the answers to a set of carefully orchestrated health and safety questions. "Agents themselves may be regarded almost as individual entities – pieces of software that control their own lives. They are (usually)

continuously running processes that know what to do and when to do it" [Haverkamp, 1996, p. 6] Once a user profile has been developed there must be a method of determining the performance of a given model. This may involve some kind of interrogation system that allows the user to assess and modify the user profile while maintaining performance.

There is no shortage of occupational health and safety data available that could be used to help prepare mining contractors for upcoming employment on a given work site. However this information is so vast it is extremely difficult to tailor this information for a given user. Users that are unfamiliar with searching for information on-line are often unable to locate the information they require. "To address this problem, intelligent on-line search assistants, or agents are being developed for information retrieval applications." [Haverkamp, Gaunch, p. 1] This intelligent agent research will be adapted for the purposes of retrieving specific occupational health and safety information from the vast array of current databases and on-line material. Software agents are individual pieces of software that can communicate with various other agents to produce a collective intelligence. The research will examine ways to alter the domain knowledge and information source model of an intelligent agent to meet the occupational health and safety requirements of the Australian mining industry.

According to Frawley *et al* [1991] knowledge discovery in databases (KDD) is the 'non trivial extraction of implicit, previously unknown and potentially useful information from data'. Data is now collected in a variety of commercial and scientific fields in such quantities that the problem of automating the elicitation of meaningful knowledge from data has become pressing. For example, according to Fayyad *et al* [1996] the manual analysis of data in astronomy is no longer feasible as data sets in this field often exceed 10^9 records. This situation is not dissimilar to the vast array of OHS information available on the Internet and in fatality databases.

The term data mining refers to the class of database applications that look for hidden patterns in a group of data examples. For example, data mining software can help discover common causes for mining accidents. The term is commonly misused to describe software that presents data in new ways. True data mining software does not just change the presentation, but actually discovers previously unknown relationships among the data. Data mining can be applied to OHS databases to extract rules that can teach the underlying OHS principles to mining contractors.

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 Kirsty Broadbent no later than the 27th August 1998.



University of Ballarat



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