![NCAF — Natural Computing Applications Forum logo]

Networks

Healthy Applications

David Lowe will be talking about how wavelets and neural networks are being used to analyse digital camera imagery to detect sea-surface pollution near beaches. Being a European-funded project, this has involved work in Cyprus rather than Skegness.

NCAF Winter Meeting, Aston University, Birmingham, 22–23 January 2003

The next NCAF meeting will be held at Aston University and will have as its theme 'Applications in Medicine and Biology'. This is one of the strongest areas of research in the UK, so the talks will be at the leading edge. We have an excellent group of speakers: some familiar faces and some new.

The meeting will be opened by Chris James (Aston University) who will give us a survey of biomedical applications involving natural computing. We then have two talks given by Evangelos Roussos (Oxford University) and Will Penny (UCL) on the use of probabilistic models and ICA for biosignal analysis, particularly of signals from the brain: EEG and MEG. This will be complemented by a commercial perspective from Emma Braithwaite (Oxford Biosignals) who is asking the question "Marketable neural network applications: an easy ride or bumpy road?" I think that we can guess the answer to that, but hopefully Emma can tell us how to get past the worst potholes in the path to exploitation of research.

Genetic programming

Two other talks complete the first day's programme. Douglas Kell (UMIST) will show how genetic programming can be used to analyse genomic data to generate understandable rules for biological function. John Bullinaria (Birmingham University) will also be talking about genetic approaches, in this case for modelling the evolution of oculomotor control in order to understand developmental problems in children and problems that may arise through using virtual reality head mounted display.

As usual, the second day consists of a more general selection of papers. David Saad (Aston University) will be telling us about how to do steganography. Steganography is not the latest dinosaur fossil, but the science of concealing information in data (for example, for digital watermarking or copyright protection). David has found an ingenious way to do this so that the performance of the algorithms can be predicted (and optimised) using methods from statistical physics.

In the bleak midwinter, it is pleasant to contemplate warmer times to come: David Lowe (Aston University) will be talking about how wavelets and neural networks are being used to analyse digital camera imagery to detect sea-surface pollution near beaches. Being a European-funded project, this has involved work in Cyprus rather than Skegness.

Self repair

Julian Miller (Birmingham University) will be talking about artificial life with adaptation and self-repair capabilities. Dan Cornford (Aston University) will tell us how probabilistic models can help us decide whether it is safe to hang out the laundry without fear of rain; a very useful tool for Brummies.

The NCAF AGM will also take place on the second day: this is your chance to find out the direction of the organisation and have your say in how it should be run. For those who are not NCAF members, there will be a poster session run over lunch and through the AGM featuring student research: as an extra incentive, attendance for those giving posters will be free on the second day.

Ian Nabney
Aston University

Durham Review

Dr Giles Oatley got us all into the criminal mind as he described how they are developing software using Bayesian Belief Networks to predict where and when burglary victimisation will occur, and to profile the offender so that other unsolved crimes can be matched to known offenders.

The NCAF Autumn 2002 meeting was held at Grey College, University of Durham, but there was nothing grey about the weather or with the special theme of Data Mining (DM). Views over the city and the Cathedral and the better than average English weather made this meeting a very pleasant couple of days.

The first day began with our host, Kath Thornton, stepping in at the last minute for a colleague. Kath presented ongoing work into identifying accurate patterns of movement through various stages of alcohol addiction and recovery, so that the most appropriate treatment and support can be given at the correct time. By considering the drinker recovery movement on inter-stage levels, rather than at an overall macro level, the accuracy of stage classification can be improved by 20 per cent.

Stuart Roberts (Leeds University) then talked about work they have done with a UK water company to identify why pipes burst. Geographical information, pipe age and soil type data were used to look for explanations as to why certain hot spots of pipe bursts occur. Using Quinlan's C4.5 decision tree builder (Stuart included a brief tutorial on this method) they successfully identified causes which reassuringly confirmed, to a large extent, what the water company already suspected.

Mass Spectrometry

How DM could be applied to Mass Spectrometry was the next subject presented by Jing Wen Yao (Shimadzu Research Laboratory, Manchester). After a brief introduction to amino acids, proteins, digestion and peptides, Jing outlined a case study comparing the C4.5 method to neural networks; they found that machine learning gave better results. This was thought to be due to overlap between species and insufficient rules in C4.5. However, DM shows promising application to Mass Spectrometry.

Dr Giles Oatley (University of Sunderland) got us all into the criminal mind as he described how they are developing software using Bayesian Belief Networks to predict where and when burglary victimisation will occur, and to profile the offender so that other unsolved crimes can be matched to known offenders. The technique could be applied similarly to other crime types and be further enhanced by additional data sources.

Tom Khabaza (SPSS) outlined the relationship between DM, AI and Natural Computation. He proposed that the best Data Miners are those who know the knowledge domain, not the technical experts who understand DM, and that DM is better regarded as intelligence amplification as it represents patterns in ways that non-technical users find natural and transparent. He concluded that Natural Computation is important as it allows non-technical data miners to understand the data better.

Partial Least Squares (PLS) applied to non-linear systems in process industries was the subject of the next talk by Elaine Martin (University of Newcastle). She highlighted a new projection based modelling methodology, Constrained PLS, which selectively removes sources of variation that are not of interest. A case study showing how the technique has been applied was presented, and an improved quadratic PLS weight updating procedure was highlighted.

The last presentation of the afternoon was by Jim Austin (University of York & Cybula). Jim outlined the latest developments in Advanced Uncertain Reasoning Architecture (AURA). This is a set of neural network methods, hardware and software for high performance pattern recognition on large unstructured data sets. The hardware is scalable to allow processing of tera byte data sets, an example being Rolls-Royce's engine data diagnostics.

The day was concluded by the usual pantomime as Fenella made 'Honest' Rick Adderley hold his breath until Nick Granville had solved 'Sophie's Problem' (or 'How to open the safe door before the oxygen – and Rick – expired'). Nick was also praised for having solved the puzzle without resorting to brute force, and he was rewarded with a bottle of wine from Fenella's own collection. The social event data mined the best pubs in Durham, but singularly failed to extract the hard earned winnings from 'Who wants to be a millionaire'.

Pattern recognition

Day two opened with Ian Nabney (Aston University) discussing pattern recognition in theory and practice. Using real examples such as wind field modelling and oil drilling condition monitoring, Ian highlighted the different approaches and goals used when tackling a practical problem or a theoretical one.

Stephen Payne (University of Oxford) showed new probabilistic models that provide combined visualisation, novelty detection and classification, and demonstrated them on medical data sets.

The next presentation, by Amos Starkey (Edinburgh University), on 'Making the universe a cleaner place' highlighted the current work going on with the Supercosmos Sky Survey to map the night sky. This involves careful inspection of large photographic plates where spurious artefacts, such as satellite trails, aircraft lights, lens flaring and even scratches on the plate need to be identified and removed from the data before the stars can be catalogued. Included in the presentation was a 3D fly-around, a plate that George Lucas would have been proud of.

Peter Bladon (BAE Systems) concluded the morning by comparing single and multi-graph techniques when used in learning Bayesian networks. They have found that mixtures of trees methods are competitive with single graph algorithms for learning Bayesian networks of large size.

Inspector Rick Adderley (West Midlands Police) began the final session by bringing us up to date on the latest results in identifying consistency of behaviour in offenders who commit serious sexual assaults. Results are promising in that patterns have been found and confirmed by independent

Data analysis for medical devices research

Smith & Nephew is a worldwide company that develops medical devices. It has its Group Research Centre (GRC) based in York, and three major business divisions. These are Orthopaedics (selling artificial hips, knees, bone fixation devices, etc.), Endoscopy (selling small components used in keyhole surgery, as well as the cameras and associated equipment to perform such surgery), and Advanced Woundcare (selling a range of hospital dressings used to cover large wounds, burns and ulcers). It used to have a Rehabilitation division until it was sold in early 2002 - but more of this later.

The majority of Smith & Nephew's clinical trials are organised from York, and the data generated from the trials are analysed by our Statistics department. Therefore, GRC has a larger statistics department than many companies of a similar size. Clinical trials are designed with the help of a statistician, the data collected are usually of a very high standard, and the analysis after the trial is very rigorous. The methods used to analyse trial data are usually defined at the start of the trial and, with most trials taking a couple of years or longer, new methods of data analysis cannot be adopted very quickly. Another difficulty is that trial data sets may comprise only 200 records.

Using neural networks

In 1997, an academic approached us saying that he had a novel method for analysing gait using neural networks (NN's). At this time, we knew little about NN's but wanted to know more about gait. So, we funded both a gait analysis laboratory and the academic to collect some data and then analyse them. Unfortunately, the novel method came to nothing, but the research showed what could be done with NN's, even if they were not particularly good at analysing our examples of gait. GRC was also a member of the Smart Software Technology Club run by ERA at Leatherhead. This ran from 1998 to 2000, and was invaluable in demonstrating how novel computer methods can complement traditional statistical methods. The club also gave us membership of NCAF, although it was not until 2001 that I joined.

The gait project demonstrated that NN's could be good at interpreting streams of data from different kinds of sensor. This coincided with the start of a project for our Rehabilitation division aimed at improving the manner in which patients carry out their physiotherapy exercises. Typically, they are done as well as possible during visits to a clinic and in front of a physiotherapist. Many patients 'forget' to do their exercises at home, and even the more motivated ones may do some of their exercises incorrectly, either due to tiredness or forgetfulness.

Monitoring patient movement

GRC developed technology that monitored patient movement during their exercises. Small sensors (accelerometers and gyroscopes) were attached to a patient, which transmitted output to a base station by radio. The base station was connected to a computer. Patients were able to move unencumbered by wires. Features were extracted from the data streams, and then fed into a neural network. For some exercises, a NN was required to determine whether the exercises were being done correctly; for other exercises, one key feature may have been sufficient to identify correct movement. However, when the sensor output was used to give advice to the patient, for example, to bend more or to move more quickly, a NN was nearly always required to analyse the motion. Unfortunately, the Rehabilitation division was sold before this work was complete, and none of the other business units wanted to become the new project sponsor. So now, GRC has a motion analyser in search of an application.

We are also investigating the use of genetic algorithms, decision trees and other forms of analysis to try and predict the outcome of various disease states. However, as is usual, we are restricted in the number of data sets that we have available.

Nick Granville
Smith & Nephew Group Research Centre

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analysts to link particular crimes with offenders in custody or to other crimes previously not connected. Rick informed us that the Home Office is to devote more resources to a follow up study. Rick's parting shot was to warn of the dangers inherent in the indiscriminate use of DM. By way of example he recounted the myriad 'coincidences' between the assassinations of Abraham Lincoln and J.F. Kennedy. There is enough material here to keep conspiracy theorists and statisticians arguing indefinitely!

The final slot was an open discussion led by Graham Hesketh about some of the mistakes that have been made in Natural Computing and how they could have been avoided if only hindsight was available beforehand.

Mark Brookes

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ncaf
Natural Computing Applications Forum

What's in a name? SGES becomes SGAI

As mentioned in the last copy of *Networks*, SGES has been pondering the subject of the Group's name for some time now, a situation that many NCAF members will recognise from their Group's experiences a year or two back! When SGES was established in 1980, the focus on Expert Systems was appropriate and accurately reflected the aims and activities of the Group. In the world of computing, alas, terminology changes as fast as the technology itself, and as time has gone on the ES tag had become outdated, less relevant and promoted an impression that the Group was limited to a specific branch of AI. Our dilemma was the choice of a name to replace SGES. A few years back we considered 'Specialist Group on Intelligent Systems' or SGIS, but it was not universally liked by the committee, and there were concerns that IS would be confused with Information Systems. At the time SGAI was also considered, but rejected, as it was felt that Artificial Intelligence still carried the albatross of over-hype and disappointment round its neck, and would not reflect the dynamic and forward looking approach that the Group wanted to promote.

Time moves on however, and earlier this year the SGES committee agreed that it was time to change, and that the term AI had regained enough dignity and poise to make it a suitable title for the Group. Accordingly we set about the process of changing all the Group's publicity material, the website and the URL (www.bcs-sgai.org). We have also decided that ES2002 (which will have been over by the time you read this) will be the last of the ES series of conferences, and next year's conference will be AI2003 (or Artificial Intelligence 2003). SGES is dead – long live SGAI!

As ever, if you have any questions about SGAI or its activities, please feel free to contact me.
Richard Ellis
NCAF/SGAI Link Man
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NCAF Publicity – we need your help

In addition to my role in promoting the link between NCAF and SGAI, I am also NCAF's Publicity Officer. In the past few months, we have been pondering how we could improve NCAF's publicity, and I would greatly appreciate your views, suggestions and opinions.

We would like to find ways of achieving three basic aims:
- Increasing Group membership
- Increasing attendance at meetings
- Enhancing awareness of natural computing techniques and their practical application.

We are considering a number of possible initiatives, including greater publicity in the computing press, greater involvement in other conferences, publicity on a wider range of websites, the use of e-mail discussion groups and even advertising.

We would very much appreciate your views. What do you think of the way that NCAF does its publicity? Where and how could we do it better? What groups or audiences should we target? What would catch your eye and attract you to meetings or conferences? If you are not an NCAF member, what would make you join?

If you have any suggestions or observations, then please contact me or any of the other committee members.
Richard Ellis
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DIARY DATES 2003

22-23 January NCAF University Applications in Medicine and Biology at Aston University
Contact: Mark Cheeseman e-mail:
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Tel: +44 0 (1332) 246989

3-4 June NCAF – Safety Critical Systems at Exeter University
Contact: Mark Cheeseman e-mail:
enquiries@ncaf.org.uk
Tel: +44 0 (1332) 246989

25-28 June CARS 2003 – Computer Assisted Radiology and Surgery London, UK
CARS Conference Office Im Gut 15, 79790 Kuessaberg, Germany
Contact Tel: 49-7742-922 434 e-mail: fschweikert@cars-int.de

30 June-4 July ICALP Thirtieth International Colloquium on Automata, Languages and Programming Eindhoven, The Netherlands
Contact: http://www.win.tue.nl/icalp2003/

20-24 July International Joint Conference on Neural Networks. Sponsored by the International Neural Network Society and the IEEE Neural Networks Society at Doubletree Hotel Portland-Columbia River, Portland, Oregon. For more information contact: Don Wunsch at: dwunsch@ece.umr.edu.

3-4 September NCAF – Human Computer Interaction with Microsoft at Cambridge University.
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MEMBERS' NEWS AND VIEWS

Deadline for contributions for the next edition – 5 April 2003. Please send to: Managing Editor – Inspector Rick Adderley, e-mail: Insp1908@aol.com or r.adderley@west-midlands.police.uk