NCAF celebrates 50th meeting

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NCAF is preparing for its 50th meeting at the University of Exeter on 4–5 June. The University can trace its origins back to the middle of the nineteenth century as a result of the energy and vision of individual educational reformers and philanthropists throughout Devon and Cornwall. Evolving through a number of incarnations, the University finally received its Charter in 1955. In 1995 Her Majesty the Queen attended the University for its 40th Anniversary Celebrations and in both 1996 and 1998 the University received the Queen's Anniversary prizes for research into diabetes and children's health respectively. This venue is a fitting setting for NCAF's Golden Anniversary Meeting, the first day's theme of which is Safety Critical Systems.

Perhaps now is a good opportunity to take a look at the history of NCAF and to highlight a few fascinating facts that you may or may not know about the organisation. Some of you who have been involved with NCAF for a long time will already be well versed I'm sure, but for those people who have joined us relatively recently, I hope there is something of interest to you in the following 10 facts:

● NCAF held its first meeting at Southampton University in September 1990 and has now been running for more than 12 years. The organisation began life as a user support group for a commercial neural network package, attracting a range of people interested in implementing the technology. However, as numbers grew, NCAF rapidly became the focus for a wider community and has since broadened its remit to incorporate all soft computing techniques.

● In 1996, the Department of Trade and Industry commissioned NCAF to rewrite their best practice guidelines aimed at assisting users in developing software based on neural networks. The results were published in a book written by Lionel Tarassenko on behalf of NCAF. The book itself, *A Guide to Neural Computing Applications*, remains an excellent introduction to the field.

● In the autumn of the same year, the NCAF meeting in Edinburgh attracted so many people that we were forced to turn people away at the door! Despite a capacity of 120, the venue (which has now become the National e-Science Centre) was full to bursting.

● In the early days, NCAF experimented with hosting a meeting in mainland Europe by organising an event in Heidelberg, Germany. Although the meeting was enjoyed by those brave few who attended, there was neither the interest nor the funds to justify further excursions outside of the UK.

● The commitment to keeping meeting costs low for delegates is demonstrated by the Corporate membership category. For £185 a year, Corporate membership of NCAF allows an unlimited number of people from your organisation to attend meetings at the member rate (currently £25 per person).

● Following Exeter, NCAF will have held 50 meetings since its inception, visiting more than 25 different locations and delivering in excess of 400 presentations, workshops and tutorials.

● There is an ongoing requirement for volunteers to give talks at meetings. NCAF is always pleased to hear from people who have material they would like to present.

● NCAF has forged links with the British Computer Society (BCS) both as an affiliated group and in its close links with the BCS Specialist Group on Artificial Intelligence (SGAI). The mutual agreement allows NCAF members access to SGAI events at reduced rates.

● An integral part of every NCAF meeting is the social event. The now famous occasions have included whisky tasting, a ghost walk, a murder mystery, skittles, bowling and quizzes as well as visits to such diverse locations as a Roman baths, an aircraft museum, a brewery and the 'London Eye'. More often than not, a meal is the central part of the event.

● During its lifetime, NCAF has benefited from involvement and contributions from more than 70 different companies and 50 different universities; clearly demonstrating the wide reaching influence the organisation has had in the natural computing arena.

With the first half-century of meetings almost complete, the future of NCAF continues to be bright. The increasing number of first-time attendees and presenters is providing fresh impetus to the organisation and is driving NCAF forward. I hope you will all continue to support the meetings long into the future to ensure that NCAF reaches the hundred mark, which by my calculations will be somewhere around its 30th birthday!

Mark Cheeseman, Rolls-Royce plc

Aston Review

Hence, it was proposed that a new breed of engineer, the biomedical engineer, must evolve.

An unusually sunny Birmingham City Centre, got the NCAF 2003 winter meeting, hosted at Aston University, off to a bright start. The first day, with a general theme of Applications in Medicine and Biology, was chaired by Ian Nabney (Aston University) and Iead Rezek (Oxford University).

Christopher James (Aston University) started the themed talks by challenging us to think of the requirements of the biomedical engineer today, and what value is added to clinical diagnosis from the field of Biomedical Engineering. Evidence suggests that even with the amount of resources that are being directed towards the field, there seems little confirmation of success when the actual products available in the market place are surveyed. One of the main objectives of the field is pragmatic support for clinicians who face an ever demanding task of assimilating and interpreting the vast volumes of information that are generated by today's increasingly sophisticated technology. Natural Computing was suggested as an umbrella that could help improve the situation by providing a frame in which to develop data-driven diagnostic aids that could aid clinical decision making.

Hence, it was proposed that a new breed of engineer, the biomedical engineer, must evolve. This new engineer faces the challenge of finding the 'abnormal' in the sea of 'normal' data that is collected today. To achieve this, a multi-disciplined approach should be adopted with fluency in mathematics, computing, engineering and biomedicine and having the capabilities of applying these skills to data analysis and pattern recognition applications.

Temporal models

After coffee, Will Penny (UCL) described ongoing work developing probabilistic models of brain image data. The power of Bayesian analysis was exhibited by an application relating to the analysis of temporal models for fMRI data. Multiple levels of Bayesian Inference were described, showing how prior information may be encoded in the model which comprised a generalized linear model with an auto regressive error process. It was shown how the Bayesian approach facilitates model selection with an approximation of 'model evidence', enabling different basis priors to be compared (i.e. gamma versus sinusoids). The method was tested on synthetic data and validated on an event-related fMRI experiment involving face processing and showed encouraging results.

Evangelos Roussos (Oxford University) gave a highly technical talk on the applications of Wavelets and Independent Component Analysis (ICA). The focus of the talk was to show how wavelets and ICA can be combined under a common model, called W-ICA. The talk ended with an example of the application of W-ICA to separating foetal Electro Cardiogram (ECG) from maternal ECG.

After the lunch break Douglas Kell (UMIST) ensured that we did not fall asleep with an illuminating talk on the application of genetic programming to solving high dimensional combinatorial problems in complex Metabolome data sets. Several examples were given and it was shown how a variety of metabolomic examples succumb to genomic programming (GP) where otherwise they could not be successfully deconvoluted. In conclusion the GPs discovered not only the biological differences, but also the important biological pathway of interest.

Many engineers/inventors/creators/academics are often faced with the dilemma of whether to publish or take their idea to market and not publish, owing to Intellectual Property Rights (IPR) issues. Emma Braithwaite (Oxford Biosignals), by example of the product BioSleep, tracked the progress and development of taking an idea to market. There are several stages in this process: concept, prototype, proof-of-concept, selling the idea, manufacturing, regulatory issues, and product on sale. In summary, it would appear that there is not one recipe for success, but the lessons learnt suggest that everything should be written down, the intellectual property adequately protected and that the product can be demonstrated to assist or improve medical diagnosis.

Oculomotor control

Following afternoon tea, John Bullinaria (Birmingham University) gave the final talk of the day on modeling the evolution of oculomotor control. The work is motivated by a need to understand if virtual reality head mounted displays have an effect on oculomotor control. On the surface, the problem would seem straight forward. However, we went on to discover that there are many influences on the development of oculomotor control through time, including age dependent factors, adaptation of time, and the Baldwin effect. A neural network model was presented, the training algorithm had some degree of regularization. The model was further developed to account for the Baldwin effect. The results presented were encouraging and confirmed the idea that evolution factors have crucial effects on oculomotor control. However, it would appear that there are many more details yet to finalise.

Of course, the first day would not be complete without puzzle corner! This time David Lowe and Ian Nabney competed in a James Bond style game of wits to prevent electrocution – fortunately, Fenella's wiring and the arrival of Lisa saved David Lowe's bacon.

… and so it was that the social event for the January meeting took the form of a Mongolian barbecue, located on the magnificent sprawling Mongol steppe that constitutes Birmingham's Jewellery Quarter. The sumptuous feast (for those who are not familiar with the culture of Ghengis Khan) comprised a variety of raw delicacies, stored in

the traditional Mongol tupperware containers, selected and imaginatively arranged in a bowl and handed to a burly warrior with a griddle and two large sticks (which are also used in the birthing procedure for Mongol cattle – a fact of which the diner would probably prefer to remain in ignorance). The expertly prepared result is then returned for consumption. The traditional fermented mare's milk, which is normally quaffed in large measure was unfortunately unavailable and was replaced by fermented grape juice, courtesy of our most generous keeper of the emperor's treasure.

In all, a fine time was had. Interesting combinations of cuisine were discovered: prawns with parsnips and five spice, beef with garlic and sugar, goat giblets with custard and chilli etc. Interesting topics were discussed: beer consumption optimisation matrix, ingredient permutation theory, variational ways home etc. Warriors retired tired but happy.

Visual and audio data

The second day of the meeting began with a talk by Professor David Saad (Aston University) on watermarking schemes for visual and audio data. In a departure from his usual theoretical and statistical physics flavoured presentations, the talk highlighted current principles and important considerations in the design of watermarking schemes, from the obvious minimal perceptible distortion principle to the non-intentional and malicious attack that results from compression and additive noise. With some clear examples, it was pointed out that a simple blind operating of the message on the image will result in visible distortion of the original. The key, he pointed out, is that the message should be encoded in the important (or most informative) components of the data. This minimises distortion and maximises watermarking capacity. Thus, using ICA for extracting independent and significant components, the message can be embedded in the independent components (using the simple Quantized Index Modulation in his example). The improved watermarking quality was demonstrated on various image and audio examples which showed clear improvements of other Discrete Cosine Transform or Wavelet based methods.

The second talk by Professor David Lowe (Aston University) also focused on issues in Image Processing. This work followed a EU research project which aimed to monitor oil slick pollution in the Mediterranean (the Blue Water Project). The slick here is not that of major oil spills due to a naval catastrophe, but subtle releases of oil by fly-tippers or small motor boats. With many pictures of the 'mundane' task of collecting data in gloriously sunny beach resorts in the Mediterranean, David visually showed the problems he faced when trying to detect surface slick activity using low cost camera equipment. Apart from the obvious obstacles, such as accounting of anomalous events (speed boats etc) and space-time resolution capabilities of the algorithms, one important and very hard problem was the detection of the changing contrast effects due to the non uniform distribution of the illuminating sunlight. Two approaches were presented, the first based on homomorphic filtering (which assumes a multiplicative model of illumination and reflectance) and the other modelling the illumination with radial basis functions on the image boundary. As it was

repeatedly pointed out, the essential task of these two algorithms is that of feature extraction since good separation in the feature space allowed the use of faster and simpler classification methods. Proving his method with many examples, the RBF solutions demonstrated a very good detection capability when compared to a homomorphic filtering follow-up algorithm by Y. Weiss *et. al.* (2002).

The coffee break was followed by Dr. Julian Miller's (Birmingham University) talk on adaptive and self-repairing, evolving programs. Using a biologically, not only inspired but also mimicking device, the hope is that the produced software can be of arbitrary complexity yet self-regulating and repairing. The examples focused on the developmental behaviour of 'cells' from a single cell entity to multi-cellular ones, all governed by a rule designed to achieve a particular pattern and an emulated chemical diffusion process. A 'Cell' in Dr. Miller's framework is a Cartesian Genomic Program designed to encode directed graphs (as compared to trees). He went on to demonstrate how important concepts in Biology, such as response to environmental stimuli, regulation of growth and repair after injury can be emulated in his framework.

This concluded the morning session. During the lunch break there was a poster session and the AGM.

Metrological models

The final technical lecture of the day was given by Dr. Dan Cornford (Aston University). Aiming to keep marital harmony by predicting precipitation accurately ('when to hang up the laundry'), He explained how his approach synthesises hierarchical state space models with physical metrological models. Two coupled state space chains, modelling advection and rainfall respectively, determine the actual radar observations. The state transition equations are derived from physical models and evolve single and multiple Gaussian densities respectively in each state chain. An important consideration and constraint in this work is computational complexity. It dramatically increases with prediction area size and real time model updating requirements. Thus, as far as model parameter estimation is concerned, Dr. Cornford concluded that Markov Chain Monte Carlo (MCMC) methods are not desirable and faster methods need to be found. On the other hand, a strength of his approach is a considerably faster prediction when compared to currently used deterministic methods.

The NCAF meeting was wound up with a presentation by Bill Neobard and Alexander Korenberg of the patent agency Kilburn and Strode. Starting by introducing the basics of patents and patenting, the talk culminated in the crucial issue in European patent law, namely that of software patents. In EU law, software 'as such' are excluded from patentability. However, when tied to a computing procedure or an industrial process, the software obtains a 'technical' character and becomes patentable. The intricacies of the software vs. technique were then elaborated upon with a study of the VICOM Image Processing case. It stressed the delicacy in the wordings of the patent claim and its effect on the examiner's decision.

David Evans – Aston University
Iead Rezek – University of Oxford

NEXT EDITION
Review of Exeter Meeting
Preview of Cambridge
Meeting

ES2002 – What was in it for NCAF members?

December in Cambridge, in the picturesque surroundings of Peterhouse College. ES2002, the 22nd SGAI International Conference on Knowledge Based Systems and Applied Artificial Intelligence was widely acknowledged as the most successful for some years. We had negotiated a discount for NCAF members, but they were very thin on the ground. Was this because the conference did not meet our members' needs? Well here are my thoughts (perhaps slightly biased as I was on the ES2002 committee!).

Day one of the conference (10 December) was given over to tutorials and workshops including tutorials on AI planning, applied knowledge based engineering and the unification of AI. Professor Dan O'Leary (University of Southern California) presented a tutorial on knowledge management, backed up by a workshop on AI for Intelligent Business, chaired by Dan and Dr Alun Preece (Aberdeen University). Of particular interest to NCAF members was a tutorial on Genetic Algorithms and Simulated Annealing for Practical Applications, presented by Dr Lars Nolle (Nottingham Trent University). While all this was going on at various locations across Peterhouse, the main theatre was hosting the 7th Annual Case Based Reasoning Workshop, a full day of papers covering every aspect of CBR. This busy first day was rounded off with a welcome reception in the exhibition area, where delegates relaxed, had a drink, met old friends and made new contacts.

The main conference started the next morning. Papers were split into two streams: the Technical Stream, which presented the best of recent developments in AI, covering a wide range of technical areas, and the Application Stream, the largest annual showcase in Europe of practical applications using AI technology.

The Technical Stream was very well supported this year, splitting into two parallel streams of its own at times in order to accommodate all the papers. We were treated to a fascinating keynote presentation on Iris Recognition from Professor John Daugman OBE (Cambridge University) who has been at the forefront of research into this area. Iris recognition has made the transition from research to application, and is now providing enhanced security in a wide range of applications including computer access and airport security. The prize for the best technical paper was presented to M Kruusmaa (Tallinn Technical University) for a paper on 'Covering the Path Space: A Casebase Analysis for Mobile Robot Path Planning', demonstrating novel techniques for improving the efficiency of planning paths through a complex environment.

Meanwhile over in the Application Stream, there were papers covering a wide range of application areas, from rhino conservation to power system diagnosis, and using the whole gamut of AI techniques including neural networks, genetic algorithms, and natural language generation. The keynote address was by Professor Lionel Tarassenko (Oxford University), a familiar face to NCAF members, on the subject of applying AI in medicine. The Best Applications prize was awarded to Stewart Long (University of East Anglia) for a system now in regular use in automatic marking of exam papers.

ES2002 also hosted the first BCS Award for Progress Towards Machine Intelligence. This award will be an annual event, and planning is well underway for the 2003 competition which will be held at AI-2003 in December. The 2002 competition featured three finalists, with Lars Nolle taking the prize for his automated system for tuning probes used in the measurement and control of plasmas. The system, which is based on differential evolution, automates a function that previously needed time-consuming human expertise.

Throw in the exhibition, poster sessions and an excellent gala dinner, and it all adds up to an excellent conference, covering a wide range of applications and technologies, in the pleasant surroundings of Peterhouse and of Cambridge itself.

So what was at ES2002 for NCAF members? I believe there was a lot. Natural computing methods represented in all parts of the conference, a focus on applications and a forum for discussion with others in the field from all over the world. It sounds to me like a perfect match for NCAF!

SGAI plans to continue to give natural computing approaches a high profile in their future conferences, and I would commend AI-2003 to all NCAF members. Full details may be found at the SGAI website (http://www.bcs-sgai.org). See you there!

Richard Ellis
Stratum Management Ltd
SGAI and NCAF Committee Member

DIARY DATES 2003

MEMBERS' NEWS AND VIEWS

Deadline for contributions for the next edition – 9 July 2003. Please send to: Managing Editor – Inspector Rick Adderley, e-mail: Insp1908@aol.com or r.adderley@west-midlands.police.uk