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## **Networks 21 – November 1998**

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### **Cutting Edge Presentations at Sheffield January 13-14, University of Sheffield**

The first NCAF meeting of 1999 will be hosted in Sheffield by the University's Department of Mechanical Engineering. It will be the first of two meetings following the theme of condition monitoring and fault diagnosis. This is a field rich in applications and the substantial contribution by industrial speakers reflects this.

The meeting is a little unusual in that it will have two invited speakers. The first is Professor Ron Patton of the University of Hull who will give his views on the problems of intelligent fault diagnosis, an area in which he has considerable experience. The second invited speaker is Professor Ulrich Rueckert of the University of Paderborn, Germany, who will present 'The Silicon Way to Artificial Neural Networks', a discussion on how neural network hardware will emerge from the developing field of microelectronics.

The usual tutorial has been put aside for once in favour of a panel discussion on 'The Role of Computational Intelligence in Condition Monitoring'. The panel is composed of Paul Anuzis (Rolls-Royce), Andrew Starr (University of Manchester), John MacIntyre (University of Sunderland) and Chris Kirkham (Brunel University). This small group will hopefully voice enough conflicting opinions for a lively discussion to ensue. The participation of the audience will, of course, be vital.

In order to complete the programme, the usual shorter talks will be presented by a blend of industrialists and academics, each giving their view on the general area of fault diagnosis, or presenting a particular application. Among the industrial speakers is Peter Lloyd from DERA Farnborough, who will discuss the role of computational intelligence in 'Structural Health Monitoring' and outline how the burgeoning field of 'Smart Materials and Structures' has much to contribute.

Colin Wignall of AEA Technology will be discussing his recently completed survey of health monitoring activities in the UK and giving 'A Business Users Perspective'. Trevor Holroyd of Holroyd Instruments will be talking about the application of 'Acoustic Emission', and giving his view of the steam leak work in progress at Sunderland which formed the basis for a previous NCAF talk. Dr. Robert Milne of Intelligent Applications Limited will give an overview of their TIGER monitoring system which has proved effective in gas turbine diagnostics. Finally, Jeremy Kingston will be talking about how Bruel and Kaer actually implement condition monitoring strategies.

Amongst the academic speakers, all from groups well known for their activities in CM, Professor James Penman of the University of Aberdeen will be addressing the crucial problem of feature extraction for effective condition monitoring. John Brandon of the University of Wales at Cardiff will be giving some of his thoughts on 'black boxes'. Sophoclis Patsias of the University of Sheffield will be discussing a concrete application, namely fault diagnosis in bearings, and

Professor Asoke Nandi of Strathclyde University will also be outlining an approach to the monitoring of rotating machinery. Finally, Nick Lieven of Bristol University will present his work on the updating of 'Finite Element' models using neural networks, a subject which has direct relevance to the problem of health monitoring.

The social event for this meeting sees a return to the traditional conference dinner, which will be held at the University's Halifax Hall. NCAF's AGM will take place on the second day (see the back page for details).

Note: Immediately preceding the meeting, on January 12, the University's Department of Engineering hosts a meeting of the EPSRC network on 'Structural Integrity and Damage Assessment'. Any NCAF members who wish to attend will be made welcome. Please e-mail [janice@mechnet.liv.ac.uk](mailto:janice@mechnet.liv.ac.uk) for more details, or [k.worden@sheffield.ac.uk](mailto:k.worden@sheffield.ac.uk) if you wish to attend.

*Keith Worden  
Sheffield University*

## **Oxford Meeting Review September 22-23, 1998**

Getting off the train from London to Oxford, then passing the 'The College is closed to visitors' sign before entering the quadrangle of St. John's College for the Autumn meeting of NCAF, it felt that I had truly arrived.

The origins of St. John's College date from the 15th Century, but the meeting was held in recently-built seminar facilities surrounding a courtyard with a view of the peaceful Fellows' Garden. The introduction was given by Professor Lionel Tarassenko, author of 'A Guide to Neural Computing Applications' (which has proven indispensable to me, and, I suspect, others) and leader of the Medical Engineering Group at St. John's College.

The first speaker was Dr. Ian Nabney, from Aston University. He gave an excellent introductory tutorial on the Netlab Neural Network Toolkit. Netlab has been developed on the basis of Chris Bishop's Neural Networks for Pattern Recognition, and therefore provides a sound and coherent basis for neural networks teaching, development of applications and new models.

Basic multilayer perceptron and radial basis function applications can be developed with the aid of the good practice guidelines in Tarassenko's book, but the software is also capable of more advanced techniques. Best of all, it is available for free to encourage its wide distribution to neural networkers everywhere, and may be downloaded from <http://www.ncrg.aston.ac.uk>. Ian Nabney is currently preparing a book to accompany Netlab, and has promised to offer a short course in the Spring.

Following morning coffee, 'Examples of Machine Learning Techniques Used Within Rolls-Royce' presented by Dr. Steve King from Rolls-Royce gave emphasis to the use of an expert system for fault diagnosis based on Zmod plots of vibration frequency versus engine speed. This problem seemed to strike a chord with several members of the audience.

## Smart Club

Lunch was served in the dining hall in the oldest part of the college. Afterwards, John Hobday from ERA Technology presented DTI's SMART Software Technologies Club (SSTC), which exists to make UK businesses aware of the benefits of artificial intelligence and knowledge-based techniques. Member companies are informed about SMART software through workshops and newsletters, and provided with hands-on assistance in solving industry problems. Chris Kirkham from Brunel University discussed several examples of projects which the club has conducted for industry. An SSTC website exists at <http://www.era.co.uk/proj/sstc>.

The first of two talks by members of Lionel Tarassenko's group was given by Tim Corbett-Clark, who presented part of his PhD work, which has been aimed at opening the black box to extract rules from neural networks. He has concluded that it is possible to extract rules from multilayer perceptrons, according to competing requirements of parsimony, effectiveness, comparative accuracy and safety.

The last talk of the day was given by the invited Speaker, Professor Chris Harris, who gave a comprehensive presentation of recent work at the University of Southampton on Intelligent Data Modelling, Estimation and Data Fusion, with a focus on neurofuzzy models. Regrettably, the large volume of information and number of examples of applications such as obstacle avoidance of helicopters, ship tracking, and vehicle collision avoidance did not allow a detailed understanding of the techniques. However, more information is available on a website at <http://www.isis.ecs.soton.ac.uk>, including software.

A wine reception with snacks followed the talks on Tuesday. When the supplies had been depleted, the crowd divided into two types of punters: navigational and libational. The former went out for a few hours on the nearly frozen Cherwell, and the latter to the White Horse, where there were excellent views from the bar, followed by a tasty curry at the trendy Simla. Most overnight guests were accommodated in the Thomas White Halls of Residence, emblazoned with a heraldic crest and the traditional motto 'non circumcoitus' (I think that this is Latin for 'no network meetings', and I was relieved that they had made an exception for NCAF).

## Second Day

Wednesday dawned bright and sunny, and some lucky meeting attendees were taken to view the dinosaur doodoo on the lawn of the Pitt-Rivers museum by Peter Herdman, before breakfast.

The first talk was by Mayela Zamora, who reported on continued work by Tarassenko's group in detection of sleepless episodes on the basis of electroencephalograms. Autoregressive modelling of the signal, followed by training of neural networks with the parameters from the AR model was used to recognise three categories of sleep. This was followed by Dr. Visakan Kadirkamanathan from the University of Sheffield on 'Static and Dynamic Approaches to Fault Detection'. This work was aimed at reducing identification of false faults in aircraft engines.

After coffee, Professor David Lowe from Aston University spoke on 'Feature

Extraction from Time Series Using Neural Networks'. He explained that modelling of time series data in the time domain is comparatively inefficient, and illustrated the use of principal and independent components analysis to obtain a feature space which will reveal structure in time series data. Following this, David Lowe continued his stage appearance in the role of the bouncy Lisa in Graham Hesketh's Puzzle Corner pantomime, which went off without a hitch except for a tense moment with a recalcitrant audience volunteer and some confusion about the definition of key terms.

After lunch, Giuseppe Baffi from the University of Newcastle made a presentation on 'Non-linear Projection to Latent Structures in Process Modelling and Control'. Then, David Esp gave a clear explanation of his work on the use of Kohonen networks to predict fault conditions, in particular arcing and overheating, based on 30 years of historical data regarding transformers for the National Grid. The final talk was given by Dr. Peter Goulding, who works in a position sponsored by Foxborough at the University of Manchester, on principal components analysis in multivariate statistical process control.

*Julia Stegemann  
Imperial College of Science*

## **ICANN98 Skovde, Sweden September 1-4, 1998**

### **The 8th International Conference on Artificial Neural Networks**

ICANN98 was held at the First Resort Billingeus, Skovde, an extremely good venue with all the required facilities on-site, including some very tempting outdoor activities. The conference was well organised by the Connectionist Research Group at Hogskolan i Skovde in close collaboration with the SNNS and ENNS. Despite access to Skovde being somewhat inconvenient, over 300 delegates attended and everything ran very smoothly.

The optional first day of the conference had seven tutorials. The main conference itself consisted of 14 plenary talks, 65 oral presentations in parallel sessions and 115 poster presentations. The usual topics were covered, as well as a special session on 'Industry & Research'.

On the second day, Teuvo Kohonen (Helsinki University) gave an intriguing presentation on current state-of-the-art in large-scale applications of the Self Organising Map. Particularly interesting were his speedup techniques, including linearising the initial SOM vectors via PCA and using random vector projection for dimensionality reduction. Chris Bishop (Microsoft Research, UK) was excellent as usual, giving a clear overview of variational methods with impeccable overheads. John Barnden (University of Birmingham) was enthusiastic in his support for diagrammatic representations of connectionist mechanisms rather than the traditional symbolic approach, although his presentation fell short of indicating how to achieve it.

On the third day, Barak Pearlmutter (University of New Mexico) gave a lively overview of Independent Component Analysis, which is rapidly becoming a popular alternative to Principal Component Analysis. His talk made good use of computer demonstrations (a technique sadly overlooked by almost all the other

presenters). Phil Husbands (University of Sussex) introduced GasNETs and their role in the field of evolutionary robotics. An important aspect of the work is the technique of minimal simulations (Jakobi, Sussex) which allows populations of prospective robot controllers to be evaluated in reasonable time scales. Ulrich Rueckert (University of Paderborn, Germany) gave a polished presentation on the evolution of microelectronics and the implications for development of highly parallel neural network architectures. He stood out as the only presenter who used a computer presentation package (Powerpoint) and the contrast with the hand-modified, sometimes illegible overheads, which are so prevalent at these conferences, cannot be overstated. John Taylor (Kings College) rounded off the day with an entertaining historical overview of artificial neural networks, and a plea that the diverse aspects of neurobiology, connectionism and statistical pattern recognition should maintain their links through these and similar conferences, as future breakthroughs may be dependant on this rich cross-fertilisation.

On the final day, Rodney Brooks (MIT) gave a very entertaining presentation on advances in learning social behaviour in robots. He clearly demonstrated the necessity for anthropomorphising the robots in order to allow them to interact and learn from humans. Francoise Fogelman Soulie (Atos, France) demonstrated the difference between traditional time series estimation, based on a global model, and structural local risk estimation as proposed by Vapnik. David MacKay (University of Cambridge) presented a clear case for Gaussian Processes, illuminated by very helpful computer simulations showing the role of the length scales (hyperparameters).

There were many other interesting and excellent presentations including some very animated discussions around the posters. But the highlight of the conference for me was the sight of Chairman John Taylor wielding his 'ten minutes to go' lollipop in an extravagant but ultimately vain attempt to attract the attention of David Hansel. We were more likely to see a 747 than an acknowledgement!

Overall, it was an enjoyable and useful conference. ICANN99 in Edinburgh will be eagerly anticipated by many.

*Graham Hesketh  
Rolls-Royce*

## **NNESMED '98 Pisa, Italy September 1-4, 1998**

### **Neural Networks and Expert Systems in Medicine and Healthcare - 3rd International Conference**

The late summer conference was hosted by Professor Antonina Starita at the ancient University of Pisa on the banks of the river Arno in Pisa, Italy. The proceedings of the conference were published in a book by World Scientific Press - editors Ifeachor (UK), Sperduti (Italy) and Starita (Italy) (ISBN 981-02-3611-5) providing a useful summary of the state of the art in medical intelligent systems in Europe.

The conference followed its traditional single track format with the aim of

fostering discussion and information exchange between researchers in the field. Each day started with opening keynote addresses followed by main sessions on Neural Networks (15 papers), Expert Systems (6 papers), Fuzzy Systems (5 papers) and Hybrid Systems (11 papers) - evidence of the rapid growth in Artificial Intelligence soft-computing techniques in this field.

An invited talk by Lisboa (UK) on clinical applications of Neural Networks included PAPNET for re-screening of conventionally prepared cervical smear slides, NNAM (NN alarm monitor) for monitoring of intensive care patients, QUESTAR system for sleep diagnosis, INFANT decision support tool for the analysis of cardiotacograms (CTGs) in the management of labour, and ProstASURE Index for the diagnosis of prostate cancer. Lisboa forewarned that neural network systems developers will have increasing difficulty in gaining European Certification for new products following the Year 2000. He recommends comparing new product performance with a traditional linear benchmark.

In an invited talk on the future of Intelligent Systems in Medicine, Icheafor (UK) emphasised that it was important that systems meet real clinical needs especially in the areas of diagnosis and prognosis, routine patient monitoring and screening, and computer assisted interpretation of data. Giles (USA), in an invited talk on searching the Web for scientific information, claimed that major Web search engines cover only a fraction of the 'publicly indexable Web' and discussed current research into new techniques in meta Web search.

Conference papers covered a diverse range of application areas such as NN real-time segmentation of diagnostic images (Pizzi et al., Italy), improved effectiveness of edge extraction using fuzzy reasoning (Scacepaniak et al., Poland), spatio-temporal networks (Ciuca et al., Rumania) and ARTMAP networks (Cross et al., UK) for diagnosis and prognosis, Bayesian input selection for neural network classifiers (Verrilst et al., Belgium), hybrid decision making for medical diagnosis (Dumitrache et al., Rumania) and provision of explanation facilities for a MLP network in medical diagnosis of low back pain (Vaughn et al., UK).

The conference was preceded by a tutorial on 'Data Mining Methods for Biological and Medical Databases' by Pierre Baldi, NET-ID, USA, author (with S. Brunak) of the book 'Bioinformatics: The Machine Learning Approach', MIT Press 1998. Baldi claims that the 21st Century will be the century of biology and computers, and an unprecedented wealth of biological and medical data is already being generated by many large projects, such as the Genome Project. The tutorial, based on the book, was a useful summary of machine learning techniques and model selection with applications to protein structures. Useful information was provided on Web links to public biological and medical databases, mostly taken from <http://www.cbs.dtu.dk/biolink.html> at the Centre for Biological Sequence Analysis, Denmark.

The highlight of the conference was the dinner held in the splendour of the magnificent Villa Mansi. This has to be the conference dinner benchmark and admirably met the conference aim of fostering discussion and information exchange between delegates! In all, a highly successful conference.

*Marilyn Vaughn,  
Cranfield University (RMCS)*

## Please Help

NCAF are continually wishing to seek new membership in order to spread the knowledge of applications to a wider audience, and introduce new views and perspectives on current problems. We have little difficulty in finding our desired audience in universities where we can send material to the appropriate departments, this is particularly true of EPSRC related events for some reason.

On the other hand we have had great difficulty in targeting the appropriate sections of commerce and industry. We have primarily been using lists of companies as provided by 'Business Links' and advising their senior officers of forthcoming meetings in their area. This strategy has been singularly unsuccessful.

More recently our links through the SSTC initiative has encouraged one or two very active new attendees. But the number of such opportunities is strictly limited. As Publicity Secretary, I would welcome any ideas as to how I may tackle this problem.

You can contact me at: [pt.herdman@butlers-court.co.uk](mailto:pt.herdman@butlers-court.co.uk) or Fax 01494 652295,

Tel 01494 652226.

*Peter Herdman  
Arjo Wiggins R&D Limited*

## NCAF ELECTIONS

There will be three vacancies for the NCAF board this year and the election process is now underway. Nominations should be made by Friday 11 December 1998 using the form which all members have been sent.

Hustings will take place at the AGM at the January 1999 meeting, followed by a ballot run by the Electoral Reform Society, closing on February 5 1999. The new Committee members will serve for three years.

*Chris Kirkham  
Secretary*

## PUZZLE CORNER - Number 7

Our intrepid student Lisa, refreshed from her holiday, was privileged to attend the birth of the world's first true artificial intelligence. Brainchild of the great Professor Robert von Newhart, the Gazornenplatt was primarily constructed of five higher brain functions - Wishful Thinking (WT), Sense and Sensibility (SS), Neurotic Dreams (ND), Abstract Abstraction (AA) and Curvilinear Rhetoric (CR). However, a problem was detected shortly after the machine was powered up. One of the higher brain functions achieved hyper-dianoetic cognisance before the Psychopathic Tendency Restraining Code had become fully operational, resulting in the deaths of three technicians and a general disposition towards



day-time TV.

Reluctant to turn the machine off for fear of wasting gigantic amounts of taxpayers' money, they attempted to diagnose the rogue module. On pain of shutdown, they elicited three relevant statements from each module. Unfortunately, the modules insisted on anonymity, referring to themselves simply as A-E. The following statements were obtained.

A1: I am not WT.  
A2: D is the rogue.  
A3: B is ND.  
B1: I am not AA.  
B2: I am not the rogue.  
B3: C is ND.  
C1: I am not ND.  
C2: Statement B2 is false.  
C3: D is not the rogue.  
D1: I am not CR.  
D2: A is the rogue.  
D3: E is WT.  
E1: I am not SS.  
E2: C is the rogue.  
E3: A is WT.

Unbeknownst to the machine, the BITE system reported the rather useful statistic that SS had made 3 truthful statements, AA had made precisely 2 true statements, ND had made only 1 true statement, and the other two modules (WT and CR) had made no true statements.

Paralysed by uncertainty, the authorities begged Lisa for help. After carefully studying the information, Lisa took an axe to the offending module and gave it a reprogramming it would never forget. Which module did Lisa downsize? The answer will be given at the next NCAF meeting (January 13-14 1999, Sheffield University).

*Fenella the Rottweiler*

## WELCOME TO NEW MEMBERS

The Committee is pleased to welcome the following new members to NCAF:

*Mr Jeff Fry, University of Warwick*  
*Mr Ian Cox, British Steel Strip Products*  
*Mr Roger Francis, British Steel Strip Products*  
*Mr Dafydd Roberts, British Steel Strip Products*

