
Networks 18 – March 1998

Spring in Sunderland

The Spring meeting for NCAF will be held for the second time at the University of Sunderland on 22/23 April, in the award-winning School of Computing & Information Systems building at the new St. Peter's Campus. Following on from the popular event in April 1996, the meeting will take a similar format, including a return to Beamish Open Air Museum for the social event. Those who were there last time will remember the social event with some affection - so do not miss out this time!

The evening will include a tram ride into the heart of a North East town set in 1912, complete with bandstand, Co-operative store, dentist, garage, printing works and sweet shop. Most important of all is the opportunity to down a pint or two in 'The Sun Inn', a cosy pub with a roaring open fire. An excellent evening is in store...with some surprises along the way!

Applications and theory

The programme for the meeting is the usual mix of excellence in theory and applications. On the first day the invited speaker, Lutz Prechelt of the Universitaet Karlsruhe, will give an overview of Professor Lionel Tarassenko's book 'A Guide to Neural Computing Applications'. This will be followed by a talk by Ian Nabney of Aston University about the problem of validating systems with neural network components. In a study carried out for Lloyd's Register, guidelines for the assessment of neural systems have been developed and applied to three applications. There are also lessons to be learned for conventional system developers! David Lowe, also from Aston University, will give a talk on the subject of error bars and their use in validation of neural network systems. This is based on comparisons of different error bar models on an engine management system.

After lunch, following on the 'guidelines' theme, Graham Hesketh of Rolls-Royce and Iain Strachan of AEA Technology will lead a workshop entitled 'Cracking the Code', a fully interactive workshop putting the guidelines into practice. To round off the afternoon Tom Harris and Lee Gamlyn of Cardionetics Limited will present the processes involved in developing a neural network based product, from an undergraduate project, to a successful cardiac monitor.

Robust networks

The second day begins with a talk from Julian Morris and Elaine Martin of the University of Newcastle on developing robust neural networks, which provide confidence bounds as their output. This will be followed by Mihaela Duta of the University of Oxford who will speak on neural network techniques for on-line monitoring of vigilance.

Dan Bretherton of BG Technology will talk about neural networks in gas demand forecasting, then Odin Taylor of the University of Sunderland will present the issues of data fusion within a neural network based system applied to

monitoring complex machinery. The morning will be completed by Graham Hesketh's infamous Puzzle Corner solution, promising a pantomime of 'The Good, The Bad and The Ugly' (Committee members again?).

After lunch, Peter Mattison of the University of Sunderland will present his research on applying neural networks to steam leak location, which will be followed by Andy Wright of British Aerospace who will speak about a new error bar model for noise on inputs. Most models consider output noise, but for real systems it is just as likely that sensor measurements used as inputs will also be subject to error.

We look forward to seeing you all in Sunderland in April!

John MacIntyre
University of Sunderland

No blood spilt at DERA Malvern

NCAF's joint meeting in January with DERA, organised by Jane O'Brien, combined the afternoon of DERA's annual artificial intelligence meeting with an NCAF meeting.

A murder mystery evening at the end of the first day produced no foul play, but did encourage everyone to mix with other members over an excellent meal. The only difficulty was that the following day involved meeting familiar faces only known by their alias and our knowledge that they were 'drug taking Olympic swimmers' or 'dodgey politicians'!

The first afternoon of the meeting comprised presentations from several different DERA establishments on current developments of Artificial Intelligence. Most of these made extensive use of knowledge based systems to advise human operators on topics such as Satellite Control (Mark Hutchins from Farnborough), autonomous vehicle navigation (John Pearce from Farnborough), and shipborne aircraft sortie planning (Jon Haugh from Portsmouth). Tom Leonard from Malvern had assessed a wide range of schemes for ship target classification. His talk emphasised the importance of selecting the correct features upon which to base a classification and on the wide range of classification schemes which may be used on these features.

The importance of checks on the relative effectiveness of alternative methods was echoed later in Mahesan Niranjan's (Cambridge University) presentation which clearly illustrated the correct way to go about constructing a neural network solution, in this case on interpreting the output of Multi-Sensor arrays. Further details are available on www-svr.eng.cam.ac/~niranjan (note the hyphen rather than a dot).

The final DERA presentation introduced current work at Malvern on Non Parametric Tree Networks. These offer an alternative method for multivariate probability density estimation instead of methods such as projection into lower dimensional space. A dependency tree is constructed between pairs of categorical or continuous variables. It can allow expert knowledge and learned knowledge to be combined. The work is shortly to be published in the open literature.

Sue McCabe from the University of Plymouth gave a fascinating talk on auditory perception. Neural networks have been widely used for image segmentation, and hearing about the auditory equivalent of an optical illusion and Sue's approach to producing a neural model to reproduce these effects gave us some new insights into neuro-physiological modelling.

Dimla E Dimla Jnr reported on work at Wolverhampton on cutting tool monitoring. This is a popular research topic at present and has great economic significance. The Wolverhampton approach is to use an MLP to combine information from several data sources to discriminate between new and worn tools.

Mark Brookes from British Steel Teesside reported on the assessment of steel quality by monitoring the attenuation of a transmitted ultrasonic signal. The principal of the approach has been proved with a water model, and transfer of the technique to a low melting point alloy is underway. The complex, continuous obscuration signals have been successfully correlated with different types and sizes of simulated inclusions by using a neural network.

Graham Hesketh illustrated the solution to the 'Puzzle Corner' by organising a short pantomime in the form of a self-organising identity parade. This exercise in unary logic served to introduce both the front and the back of most of the committee.

The final presentation of this NCAF meeting was a preview of NCAF's Guide To Neural Computing Applications by the author, Professor Lionel Tarassenko. The book was launched at the meeting by Edward Arnold. Despite the free distribution to NCAF members, early sales seemed to be brisk.

*Dr Peter Cowley
Rolls-Royce plc*

ICANN'97, Lausanne, Switzerland October 8-10, 1997

The 7th International Conference on Artificial Neural Networks

The early Autumn event was held at the impressive EPFL - Ecole Polytechnique Federale de Lausanne - in a beautiful mountain setting on the shores of Lake Geneva. EPFL is a powerhouse of postgraduate training and applied research, with 600 PhD students and 2,300 scientific, technical and administrative staff (74% of scientific staff are paid from external contracts). Evidence of Swiss strategic planning is in enviable abundance, not only in education but in a superb, environmentally friendly and user friendly transport system.

As usual a tutorial start-up day preceded the three day ICANN'97 conference with four tutorials covering important developments in theories of learning and generalisation (Oppen, Aston, UK), finance applications (Refenes, LBS, UK), hardware implementations (Arreguit, CSEM, Switzerland) and theory of cortical synchrony (Kreiter, Max Planck Institute, Frankfurt).

Each day of the conference was structured into plenary talks followed by parallel sessions covering topics such as signal processing, learning, forecasting, adaptive autonomous agents, brain dynamics, robotics and analog VLSI. The opening invited plenary session was given by Vapnik (AT&T, USA)

who summarised his Support Vector Method. This is a new general method of function estimation which does not depend on the dimensionality of the input space and produces highly impressive results. Invited speaker Oja (Helsinki) then followed with a talk on extending neural learning rules for linear principal component analysis (PCA) to versions containing nonlinear functions which produce neural independent components.

At a later plenary session on the opening day, Sutton (University of Massachusetts, USA) gave an exceptionally well delivered talk on the significance of Markov processes as a problem facing an artificially intelligent agent, with emphasis on goal-directed behaviour. This was useful for another excellent invited session later in the conference by Boulard (IDIAP, Switzerland) on state-of-the-art and recent progress in hybrid Hidden Markov Models/ANN speech recognition showing the very rapid progress being made in this field.

On the second day of the conference Grossberg (University of Boston, USA) gave a comprehensive invited session on how the cerebral cortex achieves analog coherence and complementary fusion during its processing of visual information. On the last day of the conference invited speaker Markram (Weizmann Institute, Israel) gave an inspiring talk on the information content of action potential trains, focusing on the synaptic transmission between neurons. Responses of target neurons differ in the degree of adaptation suggesting that information contained in a single spike train is fragmented and re-integrated at specific locations of the network.

If a competition had been held for the most creatively titled paper, the winner must surely have been Benuskova (University of Technology, Slovakia) with 'Modelling Plasticity in Rat Barrel Cortex Induced by One Spared Whisker'(!)

In summary, this was an excellent conference with many very high quality invited plenary sessions and conference presentations providing an illuminating view of the leading edges of this multifaceted, still rapidly expanding field.

*Marilyn Vaughn,
Cranfield University (RMCS)*

Netlab simulation software

Netlab simulation software is designed to provide the central tools necessary for the simulation of theoretically well founded neural network algorithms for use in teaching, research and applications development. The library includes software implementations of a wide range of data analysis techniques, many of which are not widely available and are rarely included in standard neural network simulation packages. The software was written by Ian Nabney and Chris Bishop, and is freely available from the Aston web site <http://www.ncrg.aston.ac.uk/>

The Netlab web page has received over 570 hits since it came on-line in late 1997, so it is certainly proving to be popular.

Netlab is implemented as a library of Matlab functions and scripts and requires Matlab version 5.0 or higher to run. (Matlab is an extendible technical computing environment offering powerful numeric computation and visualisation tools. Because of this, Netlab is portable across all main platforms and operating systems. Although there is no GUI, Matlab does offer an

interpreter and a reasonably easy to use working environment.) Netlab is distinct from, and much more powerful than, the Matlab Neural Networks Toolbox. Documentation is provided in two forms: brief information is supplied via the Matlab help system, while a full on-line reference manual is supplied in HTML. Most important of all, Netlab is provided with 30 demonstration programs and some real world datasets to illustrate its use on a variety of problems.

The library is based on the approach and techniques described in Neural Networks for Pattern Recognition by Chris Bishop, (Oxford University Press, 1995). An important aspect of the library is that it implements many standard statistical approaches (such as linear regression and generalised linear models, Gaussian mixture models, K-means clustering, and nearest neighbour classifiers) so that it is very easy to compare the results of more complex methods with a sound benchmark. This is an important part of a well-founded application development and is all too often neglected, in part because of the obstacles that software packages impose.

In the neural network part of the library, as well as standard MLP and RBF models (with both Gaussian and non-local basis functions), there is a strong emphasis on efficient optimisation algorithms (including quasi-Newton, conjugate gradient and scaled conjugate gradient) and Bayesian methods (both David Mackay's evidence procedure and Radford Neal's hybrid Monte Carlo algorithms are supported). So if you have always wanted to try out Bayesian regularisation to avoid overtraining and Automatic Relevance Determination for input selection but have been put off by the lack of usable software, now is your chance! The demonstration programs will help show you the way.

Throughout the library there has been a strong emphasis on making different parts compatible with each other and making it easy to extend. A nice illustration of this is given by the implementation of Mixture Density Networks, which basically attach a Gaussian mixture model to the outputs of an MLP so as to model multi-branched functions, and the Netlab software reflects this. In the next release we intend to include two more Aston specialities: the Generative Topographic Mapping and Kohonen's network, and Gaussian Processes. Later this year we hope to run a data analysis course which will focus on the use of Netlab. We are also writing an accompanying text book which will provide more detailed information about the software, discuss the algorithms used, and explain how Netlab can be extended.

*Ian Nabney
Aston University*

PUZZLE CORNER - Number 4

Lisa's latest exploits found her at the University of Hard Knox, Brooklyn, where she worked on compression networks with Professor Zenner (a man permanently on the verge of breakdown) and Dr. Wolfram (a highly abrasive character). When they tried to claim the credit for her novel (and potentially lucrative) architecture she complained to the Principal. His response was that they must deal with this in the traditional manner - a three-sided duel to the death(s) with revolvers, the spoils (obviously) going to the sole survivor.

In order to avoid the possibility of all three being simultaneously slain, the Principal decreed that they would have to take it in turns to shoot. To make this

fair, one gun (a Smith and Wesson .38) was loaded with only two bullets, a second gun (a Colt .45) was loaded with four bullets, and only the third gun (a Magnum .44) was given a full load of six bullets. The chambers of the first two guns were then spun to randomise the locations of the bullets (as in Russian Roulette). On each round the firing order would be determined by the number of bullets remaining in the guns, the one with the least going first. Each person would be free to choose their target, but to ensure a satisfactory conclusion in the absence of marksmanship skills, the protagonists would be required to stand within arms-length of each other.

Lisa was naturally apprehensive at the prospect of being gunned down in her prime, but started to cheer up when the Principal offered her first choice of weapon. When she asked him if the bullets had been randomly or consecutively chambered his response cheered her up even more.

Which gun did Lisa select, how had the bullets been chambered, what was her strategy, and what was her expected survival probability? The full solution will be given at the next NCAF meeting (Sunderland, 22-23 April 1998).

The Rottweiler

Welcome New Members

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

Dr David Aldabass, The Nottingham Trent University

Mr Chris Kirkham, Brunel University

Dr Dehan Luo, Hefei Institute of Economics & Technology, People's Republic of China

Professor Derek Partridge, University of Exeter

Mrs Patricia Steer, Barclays Home Finance

Dr W A Wright, British Aerospace (Operations) Limited

Thanks for your articles and news

I would like to say a big thank you to all those members who have contributed to 'Networks'. Without your help we would have little to write about.

On the same subject, I would be very pleased to receive more articles, news releases and reviews from NCAF members. They could include:

- Reviews - interesting conferences you have attended
- Books or products - assessment of products or books you have used
- Technical items - technical tips and information for readers
- Research - let us hear a little about any new research or developments
- News releases - products you have just launched or events you are planning

Articles do not have to be long, 100 to 200 words will be fine, but up to say 600 words if you have a lot to say about something. You can be sure that your material will be very welcome.

The next edition of 'Networks' is due out in May 1998 and the closing date for

that edition is Thursday 30 April. However, do not let the deadlines deter you. Networks is published four times a year so if we miss one edition your contribution will be equally welcome for the next. Please e-mail, fax, write or call me anytime, care of Chris Hawthorne at the numbers shown on this page.

Ila Patel,
Managing Editor, Networks

1998 NCAF Committee

This year the Committee received nominations for four candidates to fill four vacancies on the Committee, which increases the size of the Committee from ten persons to eleven. (Members will recall that one of our Committee members, John MacIntyre, has been appointed editor of our Journal which is why we could use some extra help.) A formal election is therefore not necessary.

I am delighted to welcome Chris Kirkham of Brunel University and Keith Worden of The University of Sheffield to the Committee as new members, and am equally delighted that Graham Hesketh of Rolls-Royce plc and Ian Nabney of Aston University are to serve another term on the Committee.

Peter Cowley
NCAF Chairman

Neural Computing & Applications Journal

As members will know, NC&A is an international journal for publication of original articles on the application of neural networks and related techniques. Our scope has widened a little to include such areas as genetic algorithms, fuzzy logic, and case-based reasoning etc., but remains firmly linked to an applications bias. We are currently working with our publisher, Springer Verlag London Ltd, to increase the international profile of the journal, and are also working on improving turn-round times from submission to publication.

We would like to see NCAF members support the journal through submission of their work, particularly this year as we move to a larger issue size of 96 pages. With the Research Assessment Exercise looming large already, NC&A provides an excellent opportunity for NCAF members to get recognition for their work. Please support your journal. Papers can be submitted to me at the following address:

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