Networks 25 – November 1999

Strathclyde – first meeting of Year 2000

The first meeting of the year 2000 will take place at the University of Strathclyde in mid-January (hopefully well after any 'Y2Kaos' has subsided). This is a comparatively rare visit North of the border and represents the start of an initiative to encourage more of our Scottish colleagues to join in NCAF activities.

As in all the recent meetings, the first day is themed; this time the subject is 'Computational Linguistics' (CL) and 'Natural Language Processing' (NLP). Broadly speaking, the aim of CL is to make computers able to cope with linguistic constructs like words and sentences in much the same way as they have been traditionally used to handle arithmetic constructs like numbers and vectors. This is a field with clear and strong links with artificial and computational intelligence and this is reflected in the presentations.

In order to give the audience a broad view of the issues involved in NLP, a tutorial will be given by Dr Bill Black of the University of Manchester Institute of Science and Technology (UMIST). The keynote presentation for the theme day will be presented by Dr Henry Thompson of the University of Edinburgh, who will discuss his work on the development of XML (Extensible Mark-up Language) which is poised to replace HTML as the standard publishing format for the World-Wide Web.

The remaining talks are more focused on specific aspects of CL/NLP. Dr Siobhan Devlin of the University of Sunderland's Natural Language Engineering Group will speak on her work on the automatic simplification of newspaper text for aphasic readers. The general term aphasia denotes the distressing loss of language skills which sometimes follows head injuries or strokes. Dr Leslie Smith of the University of Stirling will speak on 'Sound Interpretation: The Front End' a subject that reflects his research interests in neural networks and the interpretation of sensory data. Professor Colin Fyfe of the University of Paisley will present some of his ideas on the 'Evolution of Language', Professor Fyfe's work ranges broadly over the whole field of computational intelligence. Dr Ehud Reiter of the University of Aberdeen will speak on a subject of considerable importance to many people - how to stop smoking! His STOP (Smoking Termination with cOmputerised Personalisation) is designed to create personalised letters to help people kick the habit. The analysis of large bodies of language (corpora) is the object of intense activity in the speech laboratory and some of their approaches will be discussed by Dr Simon Arnfield. The theme of NLP spills over a little onto the second day with a presentation by Dr Ben Hounsell of the University of Edinburgh on 'System Level Integration'.

As usual the second day is mainly concerned with general applications. A further keynote presentation will be made on this day by Professor Brian Culshaw of Strathclyde on 'Smart Structures and Materials'. The basic idea of a smart structure depends heavily on the use of computational intelligence; broadly speaking it is a structure with integrated sensing, actuation and control which can sense changes in its environment and adjust its behaviour to optimise for

new conditions. The game of draughts or checkers has occupied a place in the heart of AI researchers for many years now, dating back to Samuels' classic study. The game is the subject of a talk here by Ken Chisholm of Napier University who has been using Genetic Algorithms to develop machine learning strategies for the game. A number of applications of feedforward neural networks are discussed in the presentation by Dr Jim Kay of the University of Glasgow. Finally Dr Kevin Swingler of Neural Innovations will be presenting some of his ideas on developing 'Customer Intelligence'.

The meeting is structured so that after a long first day, it will be possible to leave a little early on the second. It is hoped that this meeting will help to elicit renewed interest in NCAF activities in Scotland.

Keith Worden
University of Sheffield

Neural Computing at the beginning of the new Millennium

At the end of the twentieth century, it is worth looking back at progress in the various areas of 'neural net' research and looking forward to what we can expect in the foreseeable years of the next century.

William James, in 1890, gave a neural net diagram which would be familiar today, and articulated a model of neuron activity as the sum of inputs, weighted by the history of past correlations, current excitement of other neurons and an inhibitory mechanism. In 1943, in their paper 'A logical calculus of the ideas immanent in nervous activity', McCulloch & Pitts drew analogies between neural function and the recently emerging digital computers made possible by the theoretical advances of Church, Turing and others in the 1930s and '40s. In 1949, Hebb's 'Organization of Behaviour' described the principle of strengthening of connections that we call Hebbian learning. Turing himself, in 1950, predicted that by the year 2000 it would be possible to programme computers such that their responses would mostly be indistinguishable from that of a person.

Applications of neural computing came to the fore in the late 1950s with the work of Rosenblatt, for example. The development of the field has been marked by two characteristics: firstly its interdisciplinary nature, with the corresponding interaction between the practical and the theoretical; secondly the repeated swings between wild optimism and scathing scepticism.

After Minsky and Papert's 1969 paper pointing out the limitations of the single layer perceptron, a small number of workers continued to research artificial neural approaches to associative memory and learning. Notable among these few were Willshaw, Buneman and Longuet-Higgins, also von der Malsberg, Teuvo Kohonen and James Anderson. The backpropagation algorithm, shown in Paul Werbos' thesis in 1974, (a version of which was also to be found in Bryson and Ho, 1969), was popularised in 1985-86 by Rumelhart, Hinton and Williams. Stephen Grossberg, Shun-ichi Amari and Leon Cooper severally continued important aspects of the development of neural network theory throughout the 1970s, but the paper which captured the audience of the scientific community was that of the physicist John Hopfield in 1982.

Late 1980s hype led to many unsubstantiated claims about neural networks. It took the revisiting of statistical pattern recognition to build robust applications.

Broomhead and Lowe, together with Moody and Darken, gave us 'Radial Basis Function Networks', while significant books by our ex-chairman Chris Bishop and by the statistician Prof. Brian Ripley boosted the use of neural networks as a statistical tool. Many workers, for example, Mackay and Bishop, picked up on the Bayesian theme, viewing the output of a network as a posterior probability. This was illustrated by an application to meat grading by Thodberg while working for the Danish Meat Research Institute. We now see the ideas of probabilistic graphical models, gaussian processes and support vector machines extending the scope of our modelling capabilities.

Industrial and commercial applications have continued to flourish, especially in engine and plant condition monitoring, and in customer data mining, giving commercial organisations an improved ability to 'know' their customers and predict their buying propensities. However the emphasis has moved away from systems which emulate humans, to designing intelligent capabilities which form part of an integrated system. This is true also of robotic applications where many modalities must be modelled.

What of the future? With smart materials and sensors, data sources will be pervasive. Users' expectations of the intelligence and naturalness of systems will increase very rapidly in the new century, as will our understanding of how natural systems work with information. Biometrics and smart cards together with intelligent agent systems enable a step change in the level of personalisation of information and computation. A step further, though more intrusive, would be the use of an implanted chip (to identify an individual, for example, as demonstrated recently by Prof. Kevin Warwick of the Cybernetics Department at Reading). Intelligent technologies will also be able to transform the lives of medical patients and those with disabilities.

With rapid change as a norm, what is certain to continue is the value given by exchange of ideas between the academic community and those in industry and commerce. NCAF will celebrate its tenth anniversary in 2000, and has made its mark by enabling rapid, honest and fruitful interchange of research and experience.

The challenges of the forthcoming years will be met by not only 'neural' computation, but by harnessing the many forms of natural information processing which occur in the world's ecosystems. For example at the Santa Fe Institute in New Mexico, programmes are in place looking at adaptive networks of agents, where the 'agents' could be processors, elements of algorithms, cells in the immune system, genes, species in an ecology or consumers in an economy.

Happy New Millennium to NCAF!

Simon Cumming
British Airways

11 Angry Men and a Bayesian
Fitzwilliam College, Cambridge, 28-29 September 1999

By the time the meeting got under way, many of the delegates had already enjoyed a night in Fitzwilliam College. Perhaps some of them had enjoyed it more than was wise. Others arrived, just in time, after a ridiculously early start from some distant part of the Kingdom. All in all there were a lot of people who

found themselves at a disadvantage in the battle to stay cool and extract oxygen from the room on the Tuesday morning. It was all credit to the speakers that the audience made it through to the coffee break and implementation of plan A, which was to get the air-conditioning switched on. This kept us awake as much by the noise as through improving the air quality. The challenge for the speakers switched to maintaining sufficient volume to be heard. So plan B was devised, turning down the air-conditioning during the sessions and going for a good blast in between.

The first talk was by Steve Renals from the University of Sheffield, and his subject was 'Speech Processing'. A tremendous amount falls under this heading, so with only an hour, Steve concentrated on speech recognition and its conversion to text.

The rest of the first morning had a medical slant, beginning with Maria Petrou from the University of Surrey speaking about 'Textural Features for Medical Imaging'. Then Steve Attfield told us about his work at the Derbyshire Royal Infirmary in correcting walking problems, mainly for children with cerebral palsy. He felt sure that some of our pet technologies could vastly simplify and improve the decision-making processes towards corrective action. Discussion of the possibilities continued vigorously over lunch.

The biometric theme continued in the afternoon with four talks. John Daugmann of Cambridge University provided the keynote speech about 'Iris Recognition' as part of an authorisation process for bank cards and the like. Ironically, some of the greatest interest in this is coming from the Japanese who tend to have eyelashes that grow downwards to obscure most of the iris. This was followed by Tony Mansfield from the National Physical Laboratory who told us about his work comparing alternative technologies for personal identification, including iris recognition.

After tea, another speaker from Cambridge University, Richard Prager, covered the processing of Ultrasound data to build 3D images - a very valuable medical tool. To complete the formalities, Brian Kett of Neusciences spoke of more personal identification methods, this time through recognition of faces and hands.

The evening event was a banquet, but there was just enough time for some of us to have a quick, or in some cases not so quick, punt along the River Cam. Afterwards there was still enough time to purchase pints of beer and numerous bottles of red wine from the bar to lubricate the meal. Quantity took priority over quality here. Sadly, the banquet was Chris Bishop's only participation in the meeting. The Bayesian was off to join 11 angry men on jury service. With the meal out of the way, there was yet more time for socialising. One member of the group took on all comers at pool, eventually retiring unbeaten. What were the chances of this rookie female hustler making as many as 11 men so angry? After an interlude of heavy gambling and more drinking, all fell into unconsciousness for the rest of the night. Breakfast was a sombre affair.

The task of lifting spirits was ably carried out by a team comprising Chris Kirkham and Adrian Long from Brunel, and Odin Taylor from Sunderland University. They brought us round with an account of their Neural-Maine project. After coffee, and standing in at short notice for Chris Bishop, John MacIntyre spoke on the 'Vision' system used for machinery condition monitoring. Rounding off the morning, Fenella's solution to 'Puzzle Corner' was

presented in its now traditional pantomime form.

After our Wednesday lunch, British Telecom's Divine Ndumu gave a talk on 'Software Agents'. This was followed by Asoke Nandi of Liverpool University describing how a combination of Genetic Algorithms and neural nets had arrived at a successful combination of inputs and network architecture for diagnosing bearing faults.

One more cup of coffee and it was into the final talk. Phil Husbands from Sussex University told us about 'GasNets' and how they had helped in the learning process of robots responding to visual information. One more step for artificial intelligence.

This was yet another fascinating NCAF meeting bringing an excellent mix of formal presentations interspersed with informal discussion. What a shame the committee members had to miss bits of it as they took turns playing the role of Sally. Let's do it all again in Strathclyde, January 2000.

Maura Lessitt
From the back benches
Pseudonyms 'R' Us Inc.

Conference Report: FUSION99

Sunnyvale, California & NASA workshop on Data Fusion and Data Mining - July 1999

The following account is a summary of both the Information Fusion conference (Hilton Inn, Sunnyvale, CA) and the Data Fusion and Data Mining Workshop which was run immediately following it (at NASA Ames). Although there was some overlap between the two events, I was very glad to have attended both of them.

Over the last thirty years, most work on the development of methods for Data Fusion has ignored the purpose for which the data was collected. The speakers who have been working over this period, argued that this has been a mistake. The established contributors to the field now stress integration of Data Fusion, upwards to the decisions which fusion is intended to support, and downwards to designing the sensory system (e.g. [Hall]). Presentations were run in parallel, and the only concrete idea I saw for integrating fusion with sensor specification was suggested in [Hung&Zhao]. For some problems, it is possible to scatter a number of micro-sensors throughout the rig, and thus reduce the number of rig tests needed to determine where to position a smaller number of sensors.

The relationship between Data Mining and Data Fusion was given some attention. Data Fusion uses a model to turn sensor readings into decisions. The model may be produced by a direct application of domain expertise. On the other hand, expertise may not easily provide such a model. Data Fusion performs worse than the worst sensor, if it is based on a bad model. Data Mining produces models from data, and can be thought of as a tool for building a Data Fusion system. Data Mining was described as an iterative process of applying a fusion system to the data, examining the results, and then modifying the fusion on that basis [Goan&Spencer].

Llinas distinguishes between fusion using redundant sensors, and 'dimensional recovery'. The latter kind of fusion is achieved by means of a good model of the system states, such as a three-dimensional shape model, with parameters determined by two sensors (eyes) each providing two dimensional data. Dimensional recovery must be distinguished from format diversity, which can be far easier to deal with when different kinds of sensor report the same physical feature (redundancy). The third category of Data Fusion, novelty detection, must also be distinguished from redundancy and dimensional recovery. Llinas argued that the Data Fusion community is confused about these issues and that further clarification is needed.

Aside from raising these issues of integrating the different fusion techniques, both events, of course, included a number of applications. Their variety proved that encountering one or several Data Fusion problems will not make you an expert in this very diverse and still volatile field. Their utility proved that this problem is unavoidable! It was pointed out that the enormous amount of money that has been spent on sensor system design and on decision making has not been reflected in funding for the Data Fusion that acts as a bridge between these two activities. Very recently, however, this shortfall has prompted a rapidly increasing rate of spending on Data Fusion techniques.

Andrew Swann
Rolls-Royce plc

(For the references relating to this article contact Andrew at Rolls-Royce plc)

PUZZLE CORNER Number 11

Slippery Sam, the founder and MD of 4P (Probability Paradoxes for Personal Profit) approached Lisa with the following bet: "My computer will randomly select an integer in the range 1 to 100 and will print that on the inside of a sealed envelope. It will then either double or halve the number with equal probability and print the result on the inside of a second sealed envelope. You may select, at random, from the two unmarked envelopes. Whatever is in your envelope you must pay to me in pounds. But, whatever is in the other envelope, I must pay to you in pounds. Since the other envelope must contain either half or double your amount, on average you stand to make a net profit of 75% of whatever your envelope contains. Naturally I must make a small charge for such a generous wager, but at only £10 per game you can see it is a good investment for you."

Lisa responded, "By your logic, it doesn't matter whether I get the first or second envelope. So, if you let me have the first envelope each time, I'll gladly pay £20 per game. What d'ya say?" Sam impolitely declined.

"Tell you what," says Lisa, "you secretly write down any two different integers, positive or negative, no limits, and seal each of them inside an envelope. I'll randomly pick one of the envelopes, open it and look at the integer. The chances of me correctly guessing if the other hidden number is smaller or larger must be strictly 50%, right? Well, I'll bet you £100 that I can show you a way to guarantee better than 50% success rate. If I'm wrong you get £100. If I'm right, you'll pay only £100 for a new scam. How can you lose?" The last sentence was accompanied by an unseemly amount of coquettish eyelash batting.

Where is the fallacy in Sam's logic, and why is Lisa's version worth playing? How

did Lisa sweet talk Sam out of £100?

Full answers will be given at the next NCAF meeting (20-21 January 2000, Strathclyde University).

Fenella the Rottweiler

PS There are some (deliberate?) mistakes in this version of the puzzle!

NCAF Web pages

The new-look web pages have proved quite popular, averaging 9 hits per day since they were introduced in May. As web co-ordinator, I have endeavoured to keep the pages up-to-date so that they can provide a first-stop shop for all NCAF-related information. Recent innovations include on-line membership enquiry and on-line registration for the upcoming meeting.

The pages contain links to many related sites, including the Neural Computing Applications Journal. The site also contains the current version of Networks and several back issues.

Have a look at the web pages on http://www.ncaf.co.uk. I would very much welcome any comments or suggestions about them. If you have any, please mail them to me at: graham@gbh.clara.co.uk.

Graham Hesketh
Rolls-Royce plc

NCAF Elections

This year there will be five vacancies for the NCAF board, and the election process is now underway.

Becoming a member is your opportunity to have a direct influence in developing NCAF's services to its members. Why not take advantage of this to get involved?

Nominations should be made by Friday 12 December 1999, using the form which has already been mailed to all members. Hustings will take place on 21 January at the AGM in Glasgow. A ballot run by the Electoral Reform Society, closing on 4 February 2000 will follow this. The new Committee members will serve for three years as detailed in the election mailing.

WELCOME TO NEW MEMBERS

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

Mr Dean Goff, University of Warwick
Dr Ivan Jordanov, University of Wales Institute

Diary Dates

January 20-21, NCAF Meeting. University of Strathclyde (includes AGM, January 21).

Contact: The Secretary. Tel: +44 1784 477271 or   +44 1784 431341 ext 270, fax: +44 1784 472879, e-mail: ncafsec@brunel.ac.uk

February 14-17. IASTED MIC2000 Modelling, identification and control, http://www.iasted.com

April 11-13. ADD2000 Practical Applications of Knowledge Discovery and Data

Mining, Manchester. Tel: 01253 358081/fax: 353811 http://www.practical-applications.co.uk/PADD2000/ e-mail: info@pap.com

April 26-27, NCAF Meeting. DTI, London.

Contact: The Secretary. Tel: +44 1784 477271 or   +44 1784 431341 ext 270, fax: +44 1784 472879, e-mail: ncafsec@brunel.ac.uk

May 23-26. NC2000 ICSC/IFAC Symposium on Neural Computation, Berlin http://www.icsc.ab.ca/nc2000.htm

June 29-July 2. EIS2000: ICSC Engineering of Intelligent Systems, Paisley http://www.icsc.ab.ca/eis2000.htm

July 5-6, NCAF Meeting. Manchester (provisional dates).

Contact: The Secretary. Tel: +44 1784 477271 or   +44 1784 431341 ext 270, fax: +44 1784 472879, e-mail: ncafsec@brunel.ac.uk

July 5-7. DM2000 2nd International Conference on Data Mining, Cambridge.

Tel: 02380 293223/ fax: 292853. http://www.wessex.ac.uk/conferences/2000/data2000/ e-mail: wit@wessex.ac.uk

July 17-19. EANN2000 Engineering Applications of Neural Networks, Kingston on Thames. Tel: 0208 547 2000/fax: 547 7497 http://www.kingston.ac.uk/eann/ e-mail: eann2000@kingston.ac.uk

July 24-27. IJCNN International Joint Conference on Neural Networks, Como, Italy http://www.ims.unico.it/2000ijcnn.html

29 Aug-1 September. ISCI 2000 International Symposium on Computational Intelligence, Kosice, Slovakia http://neuron-ai.tuke.sk/cig/isci or http://cns.bu.edu/~kopco/isci

Members' news and views
Deadline for the next edition is 14 February 2000.

Next Edition
Review of the Strathclyde Meeting.
Preview of the DTI Meeting in London.