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## **Networks 26 – March 2000**

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### **A new name to reflect a new era - what could be more 'Natural'**

We are in the middle of a data explosion. Commerce, industry and academia are generating terabyte databases that need to be managed, indexed and searched efficiently. Speed and computing power may help with simple operations on lists of names and addresses, but how do we search large protein shape databases? How do we find rules or patterns hidden in the data? How do we relate new information to past, approximately similar, experience?

We are also approaching the time when Moore's Law meets the quantum limit. Moore's Law suggests that computers will continue to get bigger and faster, but the speed of transfer of information and the physical size of computers will soon reach the stage where the left hand (side of the computer) doesn't know what the right hand is doing. How can we use a system like this?

A third change we may see is in the area of programming. Today's operating systems and applications run to tens and hundreds of Mbytes. We are looking at software writing costs running to tens and hundreds of millions. What will happen in another ten years? How will we make good use of the computer power available to us?

### **Plain English**

At another level, computers are still not achieving the role they were imagined to fulfil as early as the 1950's. We still cannot give a computer plain English instructions. People are very good at following qualitative instructions and using judgement or past experience to fill in any gaps, the trouble is that the task can be tedious and that leads to human mistakes.

We can look for solutions to these questions in the natural world. Neural networks were originally inspired by simple models of the neurons in the brain. As neuron models they were pretty poor, but they reproduced some of the pattern matching and function approximation behaviour of the brain. Neural networks are now entering the statistical and operational research mainstream. They are one of the most powerful tools for finding patterns in large volumes of data.

We can look elsewhere for natural analogues, which are able to deal effectively with the other changes we are observing. Man made systems, particularly networks, be they power distribution, communications or manufacturing plant, can exhibit inimical emergent behaviour. That is, individual parts of the system can follow apparently well ordered well behaved, simple rules, but large collections of these individual parts develop new, complex and frequently destructive behaviour. At the trivial end we have buses arriving in threes. At the near catastrophic end we have trans-continental power system instabilities.

The natural world has evolved solutions to this. Social insects, flocks and herds manage to produce complex beneficial behaviour from the simple reactions of individuals. Perhaps we can emulate this constructive behaviour and harness it to our programming and network control problems. Evolutionary algorithms have already proved their worth but they do not scale well to generating (evolving) complex software. Perhaps combining evolutionary algorithms with a new understanding of emergent behaviour will give us benign and usefully complex distributed systems.

On a rather more mundane level, human society copes pretty well despite the fact that the left hand rarely knows exactly what the right hand is doing. We learn to cope with partial information. Fuzzy logic and belief networks are crude computer models of the higher level reasoning processes. Despite their crudity they are showing considerable promise for representing 'engineering judgement' which allows hitherto intractable systems to be automated.

### **What is the link?**

So what is the link between NCAF and all these naturally inspired new computing tools?

As neural networks come of age, it is clear that the NCAF membership wants to keep abreast of the whole range of new techniques that are currently finding practical use alongside neural networks and conventional statistics. We have always done this to some extent, with one or two tutorials on new techniques each year. Now it is appropriate for NCAF to adapt to the changing interests of our membership more positively. Consequently NCAF is changing its name to the Natural Computing Applications Forum. The change in name is subtle (just replace the *e* with *at*). The Forum will continue to emphasize real world applications, but the change in scope recognizes the need to embrace a range of new algorithms to meet the challenges computing faces in the immediate future and recognizes that many of the challenges have been solved in the natural world. Neural networks are our heritage, but if we are to flourish in the future we must be prepared to take more than one leaf out of life's book.

Long live neural networks, welcome to evolutionary computing, agent technology and many exciting new solutions for our rapidly changing business environment.

*Peter Cowley*  
*NCAF Chairman*

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## **Computational Linguistics - the language of success - naturally!**

*A review of NCAF at Strathclyde University, Glasgow, 20 - 21 Jan 2000*

If you were not there, you missed a real treat of a meeting! From the warm welcome to Strathclyde on Thursday morning right up to the 'Tale of a Neural Computing

Company' on Friday afternoon, there was much to interest most attending, in spite of the no-show of four promised speakers, for a variety of reasons. And the visit to Tennent's Brewery, the oldest continuously operating brewery in the UK (complete, of course, with free samples!), was a refreshing (!) break in the midst of all the normal business of the Winter meeting.

To start everyone off on a similar footing, Bill Black of UMIST presented an excellent tutorial on 'Natural Language Processing', at the same time answering one of the linguistic puzzles with which this conference presented us. It appears that what a science department defines as 'Natural Language Processing' becomes 'Computational Linguistics' in a linguistics department! Now, having sorted out that apparent dichotomy, think of the current standard of your average English written communication. It is often difficult for a human to analyse properly, is it not? (I guess I will have to be careful here!). Our tutorial guided us through some of the methods of computational analysis of our colloquialisms, so that ultimately, for example, we can hope to have natural dialogue with computers, instead of the kind of response our favourite software company gives us at present:

The question you asked in English was: 'How many stars has the Jamaica Pegasus Hotel?' Answer – "I could not find a meaning for the noun 'star'."

Siobhan Devlin of Sunderland University followed, with a presentation of Automatic Simplification of Newspaper Text for Aphasic Readers. Apparently, amongst patients suffering from serious head injuries or strokes, there is a significant proportion who find it very difficult to understand any written text other than the most simple concepts and grammatical constructs – she presented a disturbing illustration of these problems in real sufferers.

Leslie Smith from Stirling University and Stirling Hearing Systems Ltd introduced us to the complexities of auditory scene analysis (ASA): how do people decipher speech from any other noise? And thus how can a front end be designed to analyse or amplify just the speech signals, without all the other sounds being amplified along with it?

### **Keynote Talk**

The first day's keynote talk was given by Henry S Thompson from Edinburgh (via Philadelphia and California) on the role of XML in allowing the low-overhead sharing of research resources via the www. His view that XML (a mark-up language for annotating text, transferring data etc via recognised document types) is the ASCII of the 21st century issues us all with the challenge to familiarise ourselves with its use. XML is a success, not because separating form from content is right (which of course it is) but because data must travel the www. Imagine not having to scratch around for test sets for that new neural computing application you have developed, but having a load to choose from, ready and waiting in usable form on the www ... ! And a few trained networks ready for comparison.... Dream on, guys!

Colin Fyfe from Paisley University then took us through the 'Evolution of Communication'. Research with artificial life and communication has illustrated that the evolution of co-operation, honest signalling and aggressive displays has led to

the emergence of a self-organising 'language' in such simulations. A pre-requisite to learning a language must be that there is something in the environment to make a language worthwhile – although the development of a language facility in humans has led to a greater tendency for us to choke! (So that's what they mean by eating one's words!). Dialects develop when there is communication only with nearby agents in a simulation, but a 'global dialect' will develop when there is communication between random agents. Like the worldwide Americanisation of English, I guess.

The role of genetic algorithms or evolutionary algorithms in the evolution of hardware design was discussed by Ben Hounsell from Edinburgh University, with the ultimate prospect of 'bringing circuit design to the masses'. (Methinks I could do with that right now!) Using a GA with both intrinsic and extrinsic evaluation of the results has resulted (so far!) in the creation of the very first auto-generated 3-bit parallel multiplier, with the prospect of more complex DSP chips to follow.

We were then treated to Slippery Sam's 'Probability Paradoxes for Personal Profit – a Primer', in order to soften us all up for Puzzle Corner 11 later in the meeting. Unfortunately, Lisa was unable to grace us with her presence during this meeting, in order to explain the process, so the Rottweiler gave us a brief overview, prior to the full explanation later. Hold onto your wallets, all!

There was extraordinary interest in the next session: a visit to Tennents Brewery, complete with tour and samples. Samples included brews rejoicing in names such as 75/- (yes, shillings!) and 85/-, which apparently was the duty paid on a barrel of the ale! And worth every penny (that's 1d, of course) too.

### **Cracking Presentation**

Day 2 started with a cracking presentation from Keith Worden (Sheffield University). He discussed his research into the characteristic acoustic emissions from cracks, to determine the type and extent of the damage it indicates. Visualising it is not feasible directly, so he used PCA or Sammon mapping to reduce the problem. But even so, he says, don't always believe your eyes!

You've heard of chess-playing computers – but what about a draughts tournament by computer?! Apparently openings and end games are well understood in draughts, but mid-games are more complex, and strategy here is important. Ken Chisholm of Napier University discussed his use of GAs to evaluate mid-games, to increase win ratios significantly. This technique, he feels, could be applied to fund management and economic problems, or even transportation. H'mm.

As yet another speaker dropped out through illness at a late stage, Caroline Lyon from the University of Hertfordshire gallantly agreed to fill in at short notice. She told the special Computational Linguistics NCAF audience about her 'Alpine' partial parser (that's 'Automated Language Processing with Neural Networks') to find the structure in a sentence. It is used to classify word-strings in a sentence for sense, and ultimately for grammatical correctness. I wonder: could these NNs (PLEASE!) teach us how to speak and write our own language?!

In explaining the reasoning behind Puzzle Corner 11, where Slippery Sam tries to make a profit out of Lisa, the Rottweiler then attempted to persuade a member of the audience to take his bet. This was rejected. Imagine his chagrin, when it was found that he could have taken £10 from our friendly hound! But I still want to go through that 'reasoning' again ...

After the AGM, where the change in NCAF's name from 'Neural Computing Applications Forum' to 'Natural Computing Applications Forum' was approved, to reflect the wider current interests of NCAF, our Winter meeting in Strathclyde was rounded off with a fascinating insight into British industry's attitude towards technology. Kevin Swingler, from Neural Innovations, told us a (nearly) tragic tale of a neural software company. Neural Innovations' NNs-based predictive software was developed under a SMART award into an easy-to-use but powerful tool. They made no secret of its neural base. And it did not sell. Come 1998, after investments, loans, grants, etc., it was still seen as 'a tool looking for a problem', and a 'black box'. So in 1999, just in time, they dropped all reference to its neural origins (it is still basically the same tool), and started talking about its use in CRM, e-commerce, and web-based CRM solutions. Now it is a fast-selling success in Customer Intelligence.

Overall, it was another great meeting, with plenty to think on. You should have been there!

*Mandy Bradley*  
*Royal Sun & Alliance Insurance*

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## **NCAF at the DTI**

*London preview, 26 - 27 April 2000*

The first Spring meeting for the new look Natural Computing Applications Forum will take place at the Department of Trade and Industry in London. It will take the same format as the NCAF meetings, with the first day theme this time on the DTI SSDM clubs, and the second day with general papers.

### **Day One**

Day one will focus on the work of the latest DTI 'Smart Software for Decision Makers Campaign', featuring the activities of the two clubs based at ERA Technology in the South, and the University of Sunderland in the North. The aims of the clubs are to investigate the development of demonstrable solutions to real world problems using 'off-the-shelf software' where possible on data supplied by club members, and to disseminate how the results were achieved. A wide range of subject areas have been tackled by the two clubs, and six demonstrators will be presented on the first day detailing what steps were taken and overcome to achieve the solution, two of which involve the end user and technology provider.

Ian Lang of Assistum will discuss their work on producing a 'Smart technology advisor', a popular subject which deals with how to decide on what technology from

the toolbox is most applicable in certain situations. Tom Bayes of Satra will outline the work undertaken in co-operation with Neuscience to develop a system using Genetic Algorithms for arranging leather-cutting layouts for shoe patterns. This is not as simple as it may sound, since leather being a natural product is subject to flaws and variations in quality, and adds to the high number of constraints already imposed by the requirements of each part of the shoe pattern. The remaining presentations by the clubs organisers will concentrate their work for the club.

Two presentations by Dr Giles Oatley of the University of Sunderland will focus on 'Business Clustering and Fault Detection'. For the former of these, a software tool was developed that could provide a graphical view of UK companies, and permit a visual data mining process upon the data to visualise the clustering of business – important information for market researchers. The Fault Detection demonstrator involves fusing typical manufacturing data (varied, incomplete and noisy) into a coherent form for presentation to a Smart model, the success of which is based upon how the data is processed, which has wide reaching consequences in all problem areas.

From the ERA club, Dr Rajan Amin will discuss how ERA developed a model for Clinical Data Analysis for drug trial analysis, and Dr Chris Kirkham of Brunel University will present investigations into 'Novelty Detecting Criminal Patterns', where only 2% of the dataset relate to the criminal in question. The first day will finish with a lively debate and panel discussion, including Ray Browne of the DTI, and Dr Tom Harris of Cardionetics Ltd, on the subject of 'Getting Results with Smart Technologies' - how to get ideas developed and to market.

The social event will be a ride on the London Eye, which will start early so that we can appreciate London in the daylight and will be rounded off afterwards by a meal at a local drinking establishment – always a memorable experience!

## **Day Two**

Day two will feature a keynote speech by Professor Geoff Hinton, Director of the Gatsby Computational Neuroscience Unit, on 'Recent developments in Products of Experts'. Geoff will present leading edge work on a new model and learning procedure for extracting features from images which give state-of-the-art performance at digit recognition – a restricted type of Boltzmann machine with millions of weights that can be learned overnight! Dr Mark Plumbley of Kings College will discuss 'Information Theory and Learning in Neural Networks'. Mark will provide some background to information theory and related techniques, which has proved particularly useful both in explaining features of biological systems, and in the development of learning algorithms, and discuss recent results for neural feature maps, and Independent Component Analysis.

On a different note, Robin Brooks of Curvaceous Software will present case studies using their Visual Explorer, a tool which allows multiple variables to be viewed simultaneously by using novel co-ordinate transformation. This is a very powerful, unique (and dare I say sexy?) data visualisation tool, particularly for process variables, but which I am sure will find many applications within the NCAF membership.

Dr Mark Nixon of the University of Southampton will present his work on 'new biometrics for automating gait identification', which provides the possibility of identifying particular people from video images just from the particulars of the way they walk, which is a very difficult trait to hide or emulate.

Dr Chris James of Aston University will talk about his work on 'EEG analysis for identification of epileptic cases', where spike and seizure data are identified in the EEG signal. Dr Ray Frank of the University of Hertfordshire will wind up the meeting with a presentation on a 'telecommunications application for fraud detection', which enables detection of similar pieces of code in large programs – in this case, 26 million lines of code!

Meetings at the DTI always prove to be popular, and this one should be no exception. We have a wide range of application based real world solutions to business problems, plus experts in the field giving us views from the research world, to provide theory to balance the practical. The depth of the programme reflects NCAF's new image, and along with the Eye experience, should give everyone plenty to talk about – and who knows what the DTI may have to offer? See you there.

*Chris Kirkham  
Brunel University*

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## **PUZZLE CORNER**

*Number 12*

The Church of the Common Collective (CCC), a substantial organisation of equals, had a complete change of heart one day, and decided to become the Haven for Hierarchical Heretics (HHH). They invited Lisa to provide them with a fully democratic procedure for introducing a new multi-tiered structure.

"I've counted your membership", said Lisa, "and the following procedure will do the trick. Allow the members to form into groups of five. The extra individual left over should be summarily dismissed, since he [note, not she – Ed] obviously has the worst inter-personal skills in the organisation. Each group of five will nominate one of their number to become a Level One Acolyte. The remaining ordinary members will again form into new groups of five, and the excess individual (trust me, there is always one) should be expunged. The groups should nominate one of their number to become a Level Two Acolyte. This procedure must be repeated (group in 5's, expunge the one excess, nominate one from each group) until the Level Six Acolytes have been determined. The remaining ordinary members will then become the Level Seven Supreme Executive."

"Excellent", said the CCC representative. "Will the procedure work for any other sizes of membership?"

"An infinite number", replied Lisa, "but your membership size is the only one below 30,000."

How many members did the CCC originally have?

The answer will be given at the next NCAF meeting (26-27 April 2000, dti London).

*Fenella the Rottweiler*

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## **WELCOME TO NEW MEMBERS**

The committee is pleased to welcome the following new members:

*Safia K. Hussain, Manchester University*  
*Inspector Rick Adderley, West Midlands Police*  
*Dr Neil Lightowler, AXEON Ltd*

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## **Members' news and views**

What new techniques do you want to know more about? Please tell us if there are any new techniques that you know about or would like to know about so that these can also be included in Networks.

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## **NCAF AGM**

The AGM, approved the change in NCAF's name from 'Neural Computing Applications Forum' to 'Natural Computing Applications Forum', to reflect the wider current interests of NCAF.

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## **ELECTIONS**

This year there were five vacancies for the NCAF board. Five committee members were elected – three new members and two current members who were returned for another term of office.

Professor John McIntyre and Dr Simon Cumming were returned for a further term of office. Inspector Rick Adderley, Dr Neil Lightowler and Dr Andrew Starr were elected to the committee for the first time. For your information we offer some background notes (provided by the candidates) on the newly elected members.

### **Inspector Rick Adderley, West Midlands Police**

I am a serving Police Officer within the West Midlands Police. My 1st degree majored on databases and artificial intelligence and I am now combining these areas in my current study, which is towards a PhD in AI and crime trend analysis using a variety of neural network technologies within a data-mining framework.



I have been regularly attending the NCAF meetings; it is an excellent forum for discussion and exchange of information. The members are from a broad spectrum of the community who, themselves, contribute to the event. On attending each meeting my knowledge has increased and, on occasion, I have been able to contribute to the solution of another member's problem. It is pleasing to see the range of academic research and its application in solving 'real world' problems.

I would like to be considered as a candidate for the committee. I believe it is essential to retain the current combination of academia and business, and would like to build upon the excellent work that has already been completed by the present committee by expanding the marketing of advanced software techniques in solving business problems and increasing the membership. Not forgetting the continuance of social evenings and Puzzle Corner!

**Dr Simon Cumming, British Airways**

I have been active in the field of the application of neural computing techniques for over ten years. I have been involved with NCAF since 1991, and have served as Treasurer for the last three years. In my work at British Airways, I have undertaken projects researching the application of neural networks to forecasting, engine condition monitoring, and marketing data mining, all within the constraints of real-world commercial data. I have also gained a PhD in cognitive science from the University of Edinburgh.

**Dr Neil Lightowler, AXEON Ltd.**

Artificial Neural Networks (ANNs) have been around for a number of years and their potential is vast, but they are still in their infancy and have not been fully exploited. I am keen to promote their usage and understanding both within academia and the commercial world. NCAF appears unique in its ability to bring together academia and the commercial world in a way that aids understanding and promotes collaboration within the field of ANNs.

With over seven years of experience working with ANNs both in academia and the commercial world I am able to assist this promotion and would welcome the opportunity to contribute my efforts to such an organisation as NCAF. Indeed, I feel well suited to fill a place on the NCAF board as I have strong contacts in both the academic and commercial worlds, holding the positions of Honorary Research Fellow with the University of Aberdeen and Head of Research with AXEON Ltd, a company initiated to develop hardware based ANN systems.

**Professor John McIntyre**

NCAF has provided a valuable service to the academic and industrial communities since its inception in the late 1980s and early 1990s. The Forum has grown to become recognised as the leading body in the UK for dissemination of neural and related technologies. This is a considerable achievement and is testimony to the outstanding work done by the founding members.

As we enter the new millennium, NCAF faces some challenges and must be flexible

and adapt to a changing market. The Forum's activities need to reflect the maturing technology in neural networks, and particularly the relationship between neural networks and other technologies. It is important that we, as a body, reinforce our commitment to bridging the gap between academia and industry, and help those communities benefit mutually from our collective knowledge, experience and expertise. It is also essential that we continue to be responsive to the changing needs of our members.

To achieve these goals NCAF needs to continually improve. I, along with the other members of the Committee, have been working in the last three years to ensure that NCAF does improve, and I would like to continue this work as a Director and Committee member.

**Dr Andrew Starr, University of Manchester**

NCAF represents many of the motivations behind my research with the Maintenance Engineering Research Group (MERG) at Manchester School of Engineering. The application of advanced, adaptive data processing is central to condition monitoring, and particularly in our work in data fusion. In particular, the emphasis on industrial applications generates real problems which are necessarily more difficult than idealised models, but even at a level of abstraction, are fundamentally useful. I stood for nomination as secretary in order to support the running of NCAF and to further the common interests of NCAF and MERG in bringing natural computing solutions to industrial problems.

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**DIARY DATES 2000**

**April 11-13** ADD2000 Practical Applications of Knowledge Discovery and Data Mining, Manchester Tel: 01253 35808, fax: 353811  
<http://www.practical-applications.co.uk/PADD2000/> e-mail: [info@pap.com](mailto:info@pap.com)

**April 26-27 NCAF**, DTI London joint with IEE. Contact: Safia Hussain, Tel: +44 (0)161 275 4315, e-mail: [ncafsec@man.ac.uk](mailto:ncafsec@man.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**, University of Manchester. Contact: Safia Hussain, Tel: (0)161 275 4315, e-mail: [ncafsec@man.ac.uk](mailto:ncafsec@man.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](mailto: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](mailto:eann2000@kingston.ac.uk)

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

## **NEXT EDITION**

Review of the DTI meeting in London

Preview of the University of Manchester meeting

Deadline for contributions for the next edition – 29 May 2000

