

Emergent Computing at Oxford

Wadham College, Oxford 3–4 July 2001

Like Neural Networks in the early days, Emergent Computing has yet to fully define itself and its boundaries, and so this is an exciting time to discover what new techniques are being developed and used.

This summer NCAF will be meeting at Wadham College, Oxford. The first day of the meeting will have the theme of Emergent Behaviour although, as usual, it will be a guide rather than a limit! Emergent Behaviour (or emergent computing as some know it) is a very broad field and over the course of the first day we hope that the breadth of the field becomes apparent. Like Neural Networks in the early days, Emergent Computing has yet to fully define itself and its boundaries, and so this is an exciting time to discover what new techniques are being developed and used. Confirmed first day speakers are Andy Wright (BAE Systems), Paul Kerney (Btexact Technologies), Edmund Chattoe (Oxford University), Andrew Swann (Rolls-Royce plc), and Nigel Allinson (UMIST).

Oxford University is where both Lionel Tarassenko's and Steve Robert's research groups are based. These groups have been at the forefront of research into novel methods for signal processing in the past decade both in terms of theoretical research and successful application of these theories to industrial problems. Their work has resulted in commercially exploited products

as well as numerous papers and a spin-off company, Oxford BioSignals. Lionel will conclude the first day with an update on recent developments, which other members of the research groups are presenting on the second day.

Wadham College is a beautiful sandstone college in central Oxford and is close to the river Cherwell. During our visit the Bold & Saucy Theatre Company are (coincidentally) giving evening performances of 'The Taming of the Shrew' in the gardens of the College for which tickets should be available on the door. Even better, Oxford BioSignals have very kindly agreed to sponsor a reception in Wadham's Old Library, one of the most beautiful rooms in the College and a punting trip on (or for the brave, in) the Cherwell afterwards. With our traditional Oxford NCAF glorious weather already pre-booked, we can look forward to another thoroughly enjoyable meeting amongst the dreaming spires. We hope to see you all here.

Neil Townsend
Oxford University

NCAF and SGES get closer

NCAF and the British Computer Society's 'Specialist Group on Knowledge Based Systems and Applied Artificial Intelligence' (SGES) have recognised that they offer complementary interests and facilities. Each group has a different focus, with NCAF offering expertise in data driven technologies like neural networks and GAs to complement SGES's established emphasis on KBS, CBR, KM etc. Most AI practitioners, however, have broad interests that include elements from both camps.

Recognising that each group could benefit from the skills, contacts and services offered by the other, NCAF and SGES have taken steps to enhance the co-operation between the groups without diluting the autonomy or focus of either. I was elected to the NCAF committee to act as a link between the groups. I have been a member of the SGES committee for some years and have also been closely involved with NCAF through the DTI sponsored Smart Software for Decision Makers initiative.

As a first step towards closer links, I will be trying to provide more information on SGES events and activities to the NCAF membership. This article is part of that process and it will be matched by a similar article about NCAF in September's issue of Expert Update. In the future it is hoped that both groups will be able to offer discounts on events to the other group's members and hold joint events where there is a common area of interest.

For more information about SGES or ES2001, the group's website is at www.bcs-sges.org.

I hope that we are at the start of a positive and profitable collaboration between NCAF and SGES. I look forward to welcoming NCAF colleagues at future SGES events and to bringing more SGES members to NCAF meetings. Read more about the benefits inside.

Richard Ellis
Stratum Management Ltd

INSIDE

Inside Pages

- York reviewed
- NCAF and SGES link-up
- Puzzle Corner No. 17

Back Page

- Oxford BioSignals
- Diary dates

Modern to Medieval

A Review of the Bioinformatics Conference at York, 10–11 April 2001

Rod Hubbard of York University showed the audience how, by studying Oestrogen Receptors (ER), we can gain better understanding of gene transcription and regulation. It was shown that an understanding of such structure also helps understanding of function, which has the clear benefit of helping in the design of modern drugs.

The University of York has a strong presence in the field of Bioinformatics and provided major contributions to the conference. NCAF would like to thank all those who presented and participated in the conference and in particular, Prof. Jim Austin, Dr Simon O'Keefe and Carol Nicholls for their efforts in making local arrangements, hosting the event and allowing use of their facilities.

The conference was opened by Jim Austin who provided a brief introduction to the event before Sandie Baldauf of York University presented an introduction to Bioinformatics. Sandie began with the biological background presenting an illuminating overview of the field of molecular biology from cell structure through to DNA sequences before covering some of the salient points in the history of the subject. After the subject history had reached the point of the latest techniques, the audience were informed about molecular evolution and the forces that shape the genome.

Rod Hubbard of York University presented a talk on the analysis of protein structure. He described how modern biology allows us to investigate the workings of biological systems at many different levels. He showed the audience how, by studying Oestrogen Receptors (ER), we can gain better understanding of gene transcription and regulation. It was shown that an understanding of such structure also helps understanding of function, which has the clear benefit of helping in the design of modern drugs.

DNA microarrays

Prof. Niranjana of Sheffield University then presented some machine learning tools for analysing microarray gene expression data improving the understanding of DNA microarrays and the design methodology of classifiers based on the objective of maximising the area under the Receiver Operating Characteristics (ROC) curve. It was also shown that by appropriately reducing the feature space a simplified solution can be reached without significantly reducing classification performance.

Christopher James briefly presented the latest MSc research project on Pattern Analysis and Neural Networks being run by the University of Aston.

Stephen Muggleton of York University presented a talk on knowledge discovery in the biological and chemical domains. His approaches were based on Inductive Logic Programming (ILP) and examples based on the determination of protein fold classes were given. The overall message of this presentation was that ILP can provide a comprehensive representation for discovery that allows the use of expert domain knowledge, supports the reuse of learned knowledge and may lead towards the automation of some aspects of science.

Mike Sternberg of the Imperial Cancer Research Fund provided an insight into the application of advanced computation to genome projects. There is clearly a big push within the Bioinformatics field to increase automation and while significant improvements are being made, the human expert is

still more accurate. However, the advanced computing systems currently being used and further developed for application in this field are a significant aid to the prediction of functionality of protein sequences.

Mathew Trotter of UCL presented his work on the application of Support Vector Machines (SVM) to pharmaceutical data. He began with a comprehensive overview of the SVM and its associated issues moving on to consider the application of this technology to pharmaceutical data. Possible improvements of this technique such as automatic parameter selection, multi-class formulation and the incorporation of domain knowledge were considered.

After a brief commercial break where the new MSc in intelligent systems at UCL and a forthcoming workshop on modelling uncertainty in geometric computation being held in Sheffield were presented, the audience were entertained by the solution to Puzzle Corner. We were treated to an Exercise in Problem Solving using only Regional Communications (EPSRC) by Felicity the Roquefort (Mark Cheeseman, Rolls-Royce plc) who was making his debut performance. At the start the volunteers were having some slight difficulties working out north from south, but expert guidance from Felicity soon had them on the right track. Appropriate orders were issued and the solution to Puzzle Corner Number 16 was seen by all.

The social event, sponsored by Cybula, was one of the best and incorporated all the necessary elements of a medieval banquet with food, drink, music, good company and good conversation. A lord and lady were required for the evening and the lucky people were Lord Jim Austin and Lady Brandy Madly. Fortunately for the rest of us they were in good spirits and bestowed many honours on the guests with one fortunate person being granted all lands east of Grimsby while the title of Felicity the Roquefort was also officially bestowed.

Pattern recognition

The second day began with Jim Austin describing his approach to high performance pattern recognition. His group has developed the Advanced Uncertain Reasoning Architecture (AURA), based on a binary-valued correlation matrix. The binary weighting permits very rapid learning and recall, but sacrifices some recall accuracy when the capacity of the matrix is small. Although binary correlation matrix methods have been around for several years, the recent drop in RAM prices have made high capacity systems affordable; more importantly the York group have developed efficient encoding and post-processing methods for applications such as text searching, numeric data and, most impressively, constraint graphs.

Although the hearts of us all must eventually die, each year about 100,000 do so prematurely, Arun Holden's group at Leeds University has a long-standing project to investigate and simulate the electro-chemical causes. Early work on the simulation of spiral waves in excitable media showed that the excitatory spiral wave that keeps the heart beating are extinguished if the focus of the

NCAF and SGES link-up

NCAF recently took steps to strengthen its ties with the British Computer Society's 'Specialist Group on Knowledge Based Systems and Applied Artificial Intelligence' (SGES). This article offers some details of SGES and its activities, explaining why closer co-operation should be good news for both organisations.

SGES was founded in 1980 by Professor Donald Michie, AI pioneer since the 1960s and a wartime colleague of Alan Turing. The group's initial aims were to foster awareness and achievement in Expert Systems (ES) in both business and research communities. Since those times the group's activities have expanded to cover a much broader scope, although the ES legacy has lived on in the group's name and in the title of the annual conference (ES2001 this year). The group's scope now embraces a wide range of technologies that loosely fall under the KBS banner, including expert systems; knowledge representation, inference and reasoning, machine learning, case based reasoning, data mining, knowledge management, natural language processing and intelligent agents. Underpinning the group's interests in all these technologies is an emphasis on their practical application to address real world problems.

Chaired today by Professor Max Bramer of the University of Portsmouth, the group has some 200 members, drawn from both the academic and business communities offering a range of services to its members and to the AI community at large, of which some are outlined below:

wave meanders into a boundary medium. This seems to provide an explanation of the 'long QT' clinical phenomenon in people with a particular gene. Arun's group has related the expression of this gene to ion conductances in their simulations, finding that those with the gene have meandering spiral waves. Imaging of messenger RNA involved in the production of the proteins defines controlling the ion channels in cell membranes. Accurate knowledge of the protein concentration can be related to the channel conductances in the 70 parameter equations that must be simulated, while MRI imaging gives detailed pictures of the mechanical structure. In combination with raw computational power the imaging promises the possibility of high throughput, biochemically realistic simulations – perhaps to aid surgery.

Mark Swindells of Inpharmatica returned to the bioinformatic theme to tell us how structural information is added to protein sequences. Inpharmatica brings a range of tools to bear on the problem of deducing structure in an unknown sequence from sequences with known structure even though the sequence similarity may be well below 30%. After initial masking of known difficult regions a protein sequence is matched against profiles of different structures. Following this a 'gene-threader' is used to refine the matches: a gene-threader works by computing whether a proposed structure for a protein matches a protein known to have that structure, thus ruling out physically implausible structures. These methods enhance the probability of identifying protein superfamilies by 25% over standard methods. But it

Annual Conference – The ES series of conferences have been run annually since 1984, becoming a familiar landmark to many in the KBS and applied AI world. In addition to workshops and seminars, the conference runs two parallel streams for technical and applications papers, with all papers rigorously reviewed before acceptance. The application stream makes the conference stand out as one of the largest practical AI events in Europe, attracting an international range of delegates from industry, commerce and academia. The next conference, ES2001, will be held in Cambridge on 10–12 December 2001.

Expert Update – Recently given an extensive makeover by its editor, Frans Coenen, the group's journal, 'Expert Update', is issued free to all members. It aspires to foster the aims of the group by publishing technical articles, news, conference reports, book reviews, announcements and news stories.

Evening Lectures – For many years SGES has organised and promoted a series of free evening lectures on AI related subjects. Held in London, these are open to the public. This year's series is drawing to a close, but as the next series of lectures begins to take shape for the autumn, information will be made available through *Networks* and through the SGES and NCAF websites.

The group also organises workshops, seminars and meetings, either alone or in conjunction with other organisations.

Richard Ellis Stratum Management Ltd

comes at a price: it takes about a million CPU hours – three months – to add structural annotations to the existing publicly available databases. Their goal is to bring it down to a single month!

In a wide-ranging tutorial on wavelets, Joab Winkler sought to fill the gap between imprecise handwaving and obscure technicality. Beginning with a brief introduction to wavelets and their relation to the Fourier transform and short time Fourier transform, his talk was aimed at the problems of how to calculate wavelet shapes and the derivation of a fast recursive algorithm. To achieve this we were led rapidly through multi-resolution analysis and then two-channel filter banks. Bringing these two aspects together led to the construction of orthogonal and bi-orthogonal wavelets, and an understanding of the fast wavelet transform.

The Department of Trade and Industry was represented by Gerry Mogg, who closed the meeting by telling us about some of the DTI initiatives of interest to NCAF and bioinformatics. The government, through the DTI, and the European Union have a number of schemes of interest to industrial and academic members. The SMART programme for SMEs particularly seeks to fill the gap left by 'market failure', while the STOP (Software Technology Outreach Programme) aims to bring industrial and academic partners together. He also looked forward to the EU framework 5 and GRID – the next generation Internet – initiatives that will be important for all of us.

Richard Everson, University of Exeter
Neil Lightowler, AXEON Ltd

PUZZLE CORNER

Number 17

The manager of the Five-Kilometre Atoll nuclear power station outlined the problem quite calmly.

"There is a control cable containing 10 wires running from Room A to Room C, going via Room B. Unfortunately, someone got careless with an axe and severed the cable in Room B. The result is that Room B is now highly radioactive and getting worse. We need to reconnect the 10 wires quickly. Also rather unfortunately, the wires are all identically coloured (blame that on cut-price contractors). We know which wire is which in Rooms A & C, so all we need to do is identify their corresponding ends in Room B and then join the correct ones together."

Lisa took all this in and then asked the obvious question. "What sophisticated tools do you have for testing these wires?" The answer was one 12 volt battery and a bell.

"It's imperative that we minimise the length of time someone must spend in Room B", said the manager. He estimated that just getting into and out of the room would take about 30 seconds per visit. On top of that, twisting together a set of wires takes about 10 seconds whilst testing a pair of wires for continuity only takes about 5 seconds. The extra time taken to strip each wire, label them and finally connect them was an irreducible overhead of 5 minutes. All Lisa could do was to minimise the additional testing time spent in Room B.

What was Lisa's suggested testing plan and how long could someone have to spend in Room B given the worst-case scenario (i.e. having no luck in their choice of which wires to test first)?

The answers will be given at the next NCAF meeting (3–4 July 2001, University of Oxford).

Fenella the Rottweiler

COMMITTEE NOTES

Chairman

Graham Hesketh
Rolls-Royce plc

Secretary

Mark Cheeseman
Rolls-Royce plc

Treasurer

Dr Andrew Starr
University of Manchester

Editor of Neural Computing & Applications Journal

Professor John MacIntyre
University of Sunderland

Managing Editor of Networks

Inspector Rick Adderley
West Midlands Police

Publicity Officer

Richard Ellis
Stratum Management Ltd

Mandy Bradley
Technical Forecasts Ltd

Dr Simon Cumming
British Airways plc

Dr Richard Everson
University of Exeter

Dr Neil Lightowler
AXEON Ltd

Dr Ian Nabney
Aston University

Dr Kathryn Burn-Thornton
University of Durham

Please contact NCAF through Mark Cheeseman
Secretary - NCAF
PO Box 5944, Derby DE24 8ZD
Tel: +44 0 (1332) 246989
Fax: +44 0 (1332) 247129
e-mail: enquiries@ncaf.org.uk
<http://www.ncaf.org.uk>

Oxford BioSignals – Improving patient care

Oxford BioSignals Ltd is pleased to be sponsoring this summer's NCAF meeting in Oxford. This exciting new company, a spin-out from the engineering department of the university, is exploiting technology pioneered by Lionel Tarassenko, Professor of Electrical Engineering. Its core activity is the development of artificial neural networks that can be used in a diverse range of applications.

Through their extensive experience in signal processing, Oxford BioSignals are developing solutions in many market areas, covering medical applications through to general engineering issues.

On the medical side they have products and clinical research in the area of:

- Sleep disorders
- Vital signs analysis
- Clinical decision support
- Alertness

Oxford BioSignal's solutions are aimed at improving patient care and providing clinicians with new, cost effective, comprehensive tools to meet the demanding requirements of healthcare today. In addition, they are now applying their expertise to other engineering and monitoring projects.

For more details please visit the web site at <http://www.oxford-biosignals.com>

Neil Townsend
Oxford University

New contact details for NCAF

NCAF has now successfully moved its administrative centre to Derby. Our new contact details are:

NCAF, PO Box 5944, Derby DE24 8ZD
Tel: 01332 246989 Fax: 01332 247129
Web: <http://www.ncaf.org.uk>
e-mail: enquiries@ncaf.org.uk

We have registered ncaf.org.uk in addition to our existing domain name (ncaf.co.uk) and both will give access to the same web pages. Additional e-mail addresses have also been set up for the Webmaster (webmaster@ncaf.org.uk) and the Managing Editor of *Networks* (networks@ncaf.org.uk).

DIARY DATES 2001/2

13-15 June Workshop on Self-Organising Maps 01, Lincoln, UK- <http://wsom01.ee.umist.ac.uk>

3-4 July NCAF - University of Oxford (Wadham College). Contact: Mark Cheeseman
e-mail: mark.cheeseman@rolls-royce.com,
Tel: +44 0 (1332) 246989

4-6 September 14th International Congress on Condition Monitoring and Diagnostic Engineering Management (COMADEM) 2001 - <http://www.eng.man.ac.uk/mech/comadem.htm>

10-12 September The UK Workshop on Computational Intelligence, 2001, Edinburgh, UK. Workshop homepage: <http://www.dai.ed.ac.uk/~ukci-01>

20-21 September NCAF - Royal Holloway College. Contact: Mark Cheeseman
e-mail: mark.cheeseman@rolls-royce.com,
Tel: +44 0 (1332) 246989

10-12 December ES2001: Cambridge, England, <http://www.bcs-sges.org/es2001/>

Closing date for submission of papers is 25 May 2001. Contact Richard Ellis
e-mail: richard.ellis@stratum-management.co.uk

January 2002 NCAF - University of Exeter
Contact: Mark Cheeseman
e-mail: mark.cheeseman@rolls-royce.com,
Tel: +44 0 (1332) 246989

11-15 February 2002 Third WSES International Conference on Neural Networks and Applications (NNA '02), Interlaken, Switzerland, contact: interlaken2002@worldses.org

11-15 February 2002 Third WSES International Conference on Fuzzy Sets and Fuzzy Systems (FSFS '02), Interlaken, Switzerland, contact: interlaken2002@worldses.org

11-15 February 2002 Third WSES International Conference on Evolutionary Computation (EC '02), Interlaken, Switzerland, contact: interlaken2002@worldses.org

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*. Deadline for contributions for the next edition - 16 July 2001. Please send to: Managing Editor, Inspector Rick Adderley, e-mail: Insp1908@aol.com or networks@ncaf.org.uk

Edited and Produced by:
Chris Hawthorne
Forum Communications
Eastgate House
Eastgate Street
Winchester SO23 8DZ
Tel: 01962 877833
Fax: 01962 877988
e-mail:
chrishawthorne@forum-pr.co.uk

NEXT EDITION

Review of the Oxford meeting
Preview of the Royal Holloway College meeting