Multi-agent Intelligent Systems

Southampton University, 7–8 September 2005

Always keen to be at the interface of academia and industry, a number of industrial speakers who are presenting at September's meeting are new to NCAF.

Multi-agent Intelligent Systems is the theme of the last NCAF meeting for this year. It will be held in Southampton, home of one of the U.K.'s largest multi-agent agent research groups headed by Professor Nick Jennings, on 7–8 September at Southampton University's Hatfield Campus. To set the theme, Alex Rogers of Southampton University will start the day with a tutorial introduction into Multi-agent Systems and Game Theory. The list of speakers consists of well-known researchers of this field who will have travelled the breadth of the country to present to NCAF. Timothy Norman from Aberdeen University is probably the most distant of this meeting's presenters, while Dr. Lee from Oxford will talk about his work with D.H. Wolpert at NASA. Daniel Kudenko of York University, Peter McBurney from Liverpool University and Prof. John Shawe-Taylor from Southampton University, to name just a few who we are pleased to have taking part at this NCAF meeting.

Always keen to be at the interface of academia and industry, a number of industrial speakers who are presenting at September's meeting are new to NCAF. We hope to welcome John Williams to talk about his work at the Royal Bank of Scotland, Jean-Jeaque Gras to present insights into developments at Motorola, and Armin Stranjak from Rolls-Royce to present on multi-agent systems applications at the company. The concluding talk will be by Chris Satchwell from Technical Forecasts about his new book about markets 'Pattern Recognition and Trading Decisions'.

Our social event, organised with substantial help by Chris Satchwell, will be a boat trip on the river Hamble and a concluding dinner at the 'Rising Sun' in Warsash. Chris writes:

Human presence around the river Hamble dates back into pre-history. From its banks early man found a ready source of food; forests in which to hide whenever danger threatened; timber to build canoes; and ready access to a water highway for trade and contact with other communities. Unsurprisingly, this bountiful area was heavily populated in Neolithic times. The river's sheltered waters, forested banks and ready access to the sea created the ideal conditions for a shipbuilding industry, whose evidence can be seen throughout much of its length, but whose best known product was Nelson's ship, HMS Elephant. The yard that built it now builds yachts; but is still known as the 'Elephant' boatyard and is located next door to a popular watering hole known as 'The Jolly Sailor', that enjoyed a brief period of fame as Tom Howard's local during the television series 'Howard's Way'.

Moving on to the early twentieth century, the yards that had built wooden warships were now building wooden sailing yachts and selling them to a gentlemen society of sailors, that the author Neville Shute described in his autobiography 'Slide Rule'. When tipsy yachtsmen bumped into a moored craft, the
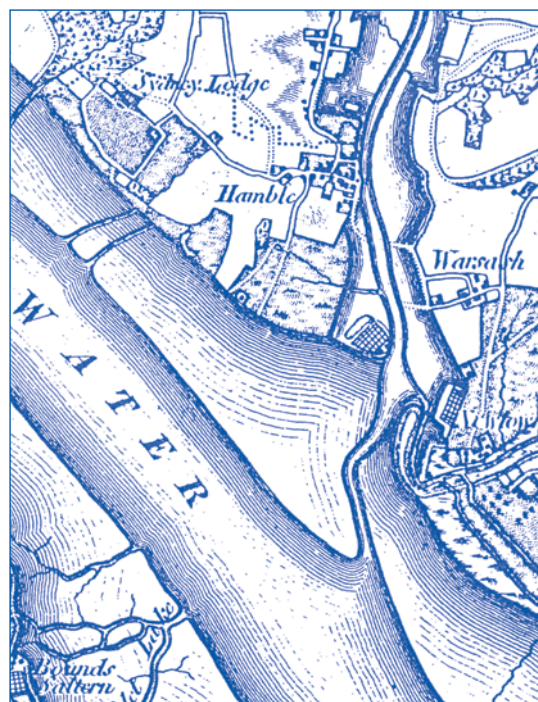
Map drawn by Lt. Col. Mudge in 1810

custom was to leave a visiting card and letter offering to pay for the damage. The river Hamble features in a number of his books. In the quiet years before the Second World War, the area became fashionable with screen celebrities such as Lawrence Olivier, Vivien Leigh and Ralph Richardson. More recently, its best-known residents are sports personalities and football club managers.

Nowadays, the river's visitors of all nationalities are both numerous and made welcome. Skills and experience that created an aircraft industry have been replaced by finite element computer programs and specialist cast-metal billets; numerically milled into panels to form aircraft. Clay deposits that yielded bricks perfected for local coastal conditions have been largely worked out, the brickworks divided by a motorway, and a National Air Traffic Control Centre built over much of the site.

But, birds return to feed on mud flats every winter, the river is still beautiful, tipsy yachtsmen still have their bumps (but rarely leave letters or visiting cards); and I want you to enjoy the river as I do daily; so I leave you with the words of an old bearded fisherman who used to enjoy it by sitting on an upturned dinghy on the foreshore at Hamble looking out over its waters: "sometimes I sits and thinks, sometimes I just sits".

It promises to be a memorable evening, complementing an interesting meeting.

Iead Rezek
Oxford University

Brains and trains at York

The NCAF 2005 summer meeting took place at the York Neuroimaging Centre (YNIC) with kind sponsorship from Apple computers and 4D Neuroimaging. Professor Gary Green, Director of YNIC, gave the welcoming address and although there was brilliant sunshine outside, a greater enlightenment was arguably to be had indoors with talks on the first day centred on the special theme of Cognitive Systems: from neural imaging to neurocomputing.

The first speaker was David Willshaw from the University of Edinburgh who explained the formation of brain retinotectal maps and challenged dogmas of how the brain wires itself up. He presented a model in which mapmaking mediated by molecular mechanisms, rather than by neuronal activity, could account for results obtained in mouse transgenic experiments. David also showed the audience a rather scary movie of a rickshaw driver having to dodge a multitude of obstacles in his path. He explained how this was similar to growth cones of brain neurons being able to make the right connections in the brain.

Stefano Panzeri from the University of Manchester presented an analysis of neurophysiological data from rat barrel cortex. He showed that most of the information about the stimulus identity is already conveyed by the timing of the first spike after stimulus onset. A neuronal model was proposed to explain how downstream populations could decode this information without additional knowledge as to when stimulus onset had occurred.

Neuronal activity

After coffee, Will Penny from University College London addressed the question of estimating the neuronal activity from imaging signals. He presented a generative model of fMRI signals that incorporated prior knowledge about the spatial structure of both the evoked responses and the noise. He illustrated how a model-based probabilistic treatment and spatio-temporal deconvolution can enhance the quality of MRI images.

A buffet lunch was followed by guided tours of the brand new state-of-the-art neuroimaging facilities at YNIC. The Centre boasts a GE 3 Tesla magnetic resonance imaging scanner and a 4D Neuroimaging magnetoencephalography facility. A special tour of the YNIC was also arranged for those who 'wanted to see something big', with 'flashy lights'. What did they see? Only the most powerful Apple computer cluster currently in Europe that is used for the neuroimaging analysis!

First on after lunch was Padraic Monaghan from the University of York who gave an overview of the various brain-based theories thought to underlie dyslexia and their equivalent computational frame-works mapping orthography to phonology. In particular, he presented a computational model involving hemispheric desynchronisation and how this could explain the impairments seen in dyslexics.

Avgis Hadjipapas from Aston University was next stating the challenge of understanding the relationships between the macroscopic oscillations measured with MEG with high temporal resolution and the neuronal synchronizations at the microscopic level. This was done using a model of chaotic oscillators. Avgis further showed that MEG signals obtained using a visual paradigm contained enough information in the frequency domain to discriminate which stimulus had been presented.

The final talk of the afternoon was by Chandra

Aziz Asghar sits under the YNIC's magnetic resonance imaging scanner.

Khambhampati from the University of Hull who talked about quantum neuronal networks. Chandra explained how these networks could be used to design filters. He discussed how much data would be needed to train the network and emphasized the need for the appropriate parameter selection to ensure stability.

To end the first day, 'Fenella the Rottweiler' attempted to present the solution of the 'mafia assassination' puzzle using several 'volunteers' from the audience. Much to the delight of the volunteers, and gasps from the audience, Fenella made an uncharacteristic fatal error and the volunteers were spared from being assassinated!

In the evening, the Great Hall of the National Railway Museum in York was the venue for the reception and dinner. It was a little surreal to have dinner surrounded by various types of trains from the early locomotives all the way to Eurostar, as well as the world's fastest steam locomotive, the 'Mallard'. Happily, no one missed the train on this occasion.

Brain dynamic processes

For those who managed to overcome the excesses of the night before, and lucky enough to get a train on time back to the meeting, the second day started with a presentation by John Terry of Loughborough University. Using bifurcation theory, and a model of the brain's 'mean field dynamics', John presented a unifying explanation of generalised epilepsy. The model allowed the prediction of different brain dynamic processes. One objective underpinning his research was the need to use EEG signals to provide advance warning of an impending seizure.

One of the serious issues in neuroscience research is the management of very large amounts of data. Jim Austin from the University of York described solutions to this problem using neural networks. Jim described a commercial system called AURA (Advanced Uncertain Reasoning Architecture) that uses high-performance neural networks based on Correlation Matrix Memories. AURA has applications in high-speed approximate search and match operations in large datasets, and is used in matching vibration data from Rolls-Royce engines. Jim also described the Cortex II system technology, which is a parallel data store that implements AURA methods.

The next presentation was given by Kevin Gurney from the University of Sheffield who presented models of the basal ganglia. He explained how knowledge of the dynamics at the network level could help infer brain functions at system levels. Kevin proposed that one of the main functions of the basal ganglia might be to select which action to carry out from those requested by different brain systems.

The commercial theme was continued by Andrew Batchelor of PrismTech Ltd, who described the CORBA (Common Object Request Broker Architecture) software, which allows inter-operability between computers from different vendors and of various architectures, networks and programming languages. Andrew emphasized the advantages of using CORBA in embedded systems.

Next on was Alistair Armitage from Napier University who described an application of neural networks in advising health care professionals about the treatment options for kidney stones. The approach helped identify which variables were important in the ability to predict the outcome of a particular treatment. Alistair also explained why additional data should be gathered such as whether there was re-

Identifying prolific criminals
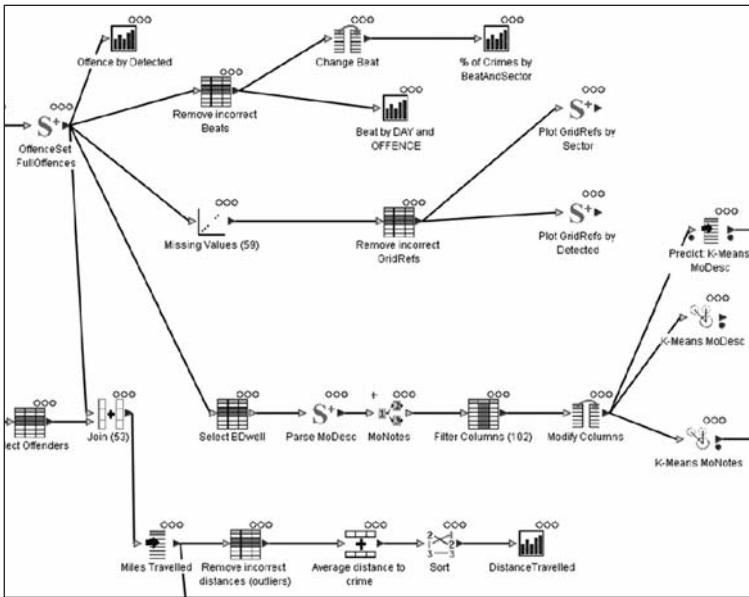
C rime is a far-reaching problem that affects society as a whole. However, serious crimes such as murder, rape or armed robbery are still, thankfully, rare events. More common crimes such as vehicle crime or burglary, although considered less serious, affect far more of the population. Anyone who has been unfortunate enough to be the victim of a house burglary will testify that it is a traumatic event. The crime rates for most UK Police Forces are reducing consistently year on year as these more common crimes are being tackled with crime prevention techniques and by Police Forces working in partnership with other agencies.

However, there is a nucleus of offenders in individual force areas that are responsible for most of the less serious crimes (the 80–20 rule). Central Government has issued a paper explaining how these offenders are to be identified using a scoring matrix (http://www.youth-justice-board.gov.uk/Practitioners Portal/PracticeAndPerformance/PPO/)*. Every Force, working with their respective Crime and Disorder Local Authority Partnership, is required to identity and report on their 'top' priority and prolific offenders.

Some very pro-active Police Forces, for example the West Midlands Police, already had such a scoring mechanism in place having the capability to prioritise such offenders. Trained analysts read the computerised crime reports and intelligence logs to score an individual's criminal activity. This process takes on average 20 minutes per person. The problem is exacerbated due to the larger Police Forces potentially having several thousand offenders who meet the government guidelines. Clearly, it is impractical to manually score each individual offender.

* Full link: http://www.youth-justice-board.gov.uk/PractitionersPortal/PracticeAndPerformance/PPO/

A pilot project has recently been completed within one of the UK's largest Police Forces to model offenders' behaviour and automate the scoring process. The 'Insightful Miner' data mining workbench tool was selected and used for the project. This tool uses a graphical approach to connect data sources, manipulate the contents of database fields and output to common office type products. This software allows non-technical domain experts to understand, interact with and validate the data mining processes.

Information regarding offending behaviour is not always contained in structured database fields, as there is a wealth of information contained in free text memo type fields. This is particularly true regarding intelligence data. 'Insightful Miner' is well suited to extract useful information from such fields due to its underlying SPlus programming language. Specific SPlus graphical nodes were written to create behavioural flags based on key words and phrases in the text. These were combined with the more structured data to provide a scoring mechanism for every individual offender based on criminal activities within certain time frames.

Each crime record was joined to its respective offender(s) record producing in excess of 27,000 offender/crime combinations. The resulting 'Insightful Miner' workflow has the capabilities of scoring all of those combinations in 1½ hours, and can to save over 9,000 hours compared to completing the task manually. A list of top scoring offenders is produced and given to a team of Police Officers who are responsible for managing the identified criminals. In these terms 'managing' means either arresting the individuals or encouraging them not to re-offend.

With such an automated system it is now possible to not only target those criminals who habitually re-offend but also assess the effectiveness of the management processes. A further benefit that has been realised is that by repeating the scoring data runs every two weeks, the list identifies those new offenders who are progressing up the scoring ladder. This means that these up and coming criminals can now be managed before they represent too much of a problem to society.

Rick Adderley
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growth of the stones at various time intervals post treatment.

Finally, the NCAF chairman, Graham Hesketh, gave a memorable personal account of his many years of travel along the neural net memory lane. Graham illustrated with various examples the many failures that lay strewn on the lane but also gave examples of the triumphs. It was interesting to note that approximately 80% of the Fortune 500 companies

currently have R & D programmes in neural networks.

Overall, the meeting at York was both enjoyable and successful. Leaves on the line aside, we hope that the NCAF train will soon return to the rapidly developing theme of cognitive systems-neural imaging to neurocomputing.

Aziz Asghar (Hull York Medical School)
Angel Nevado (York Neuroimaging Centre)

PUZZLE CORNER

Number 30

Revisiting her old haunts at the University of Hard Knox, Lisa dropped in on Professor Grey. The Professor showed her an unusual torch. Instead of one press-button switch it had four, evenly spaced around the cylindrical body. Each switch was an on-off toggle, so each press reversed its state. However, you could not tell which state it was in. The only way you could know for sure was when the light came on, and that only happened when all four switches were on.

The Professor took the battery out of the shining torch, secretly pressed some buttons and handed the torch to Lisa. He then challenged her to get the torch back on in the smallest number of moves, where each move consisted of Lisa pressing whichever buttons she wanted and then handing the torch to the Professor, who would reinsert the battery to check if it was now on. If not, he would take the battery out and, without altering any of the switches, hand the torch back to Lisa to try again.

'Simple' said Lisa, 'but how do I know you will give me the torch back in the same orientation I gave it to you?' 'You don't' replied the Professor, 'but that shouldn't be a problem.' After a few moments thought, Lisa realised it wasn't a problem. In fact, it made no difference to the maximum number of moves needed to guarantee getting the torch back on.

How did Lisa guarantee to get the torch back on, and what is the maximum number of moves it could take?

The answers will be given at the next NCAF meeting (7–8 September 2005, Southampton University).

Fenella the Rottweiler

COMMITTEE NOTES

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NEXT EDITION
Review of Southampton
meeting
Preview of Winter meeting

Industrial members — where are you?

For those of you that treasure your old copies of *Networks* (as all of you should if you knew how much care and attention went into the production of each edition), it should be easy to reread what I wrote in *Networks* 40. Shame on you if you bin each copy once you have flicked through it. You will have to go to the website for an electronic copy. And for the reader too busy to do either, I wrote "I am also keen that the current decline in industrial members of NCAF is halted, and even reversed".

In December 2002, there were 21 industrial and 27 academic members in NCAF. By December 2004, this had changed to 16 industrial and 30 academic members. The percentage of industrial members had fallen from 44% to 35%. Yet, in the presentation given by Graham Hesketh at the last NCAF meeting, he stated that 80% of the Fortune 500 companies (the largest 500 companies quoted on the US stock market) had neural network R&D programmes. Assuming that the same percentage holds true for the UK FTSE 100 companies, then 80 companies could be members of NCAF. With only Rolls-Royce, Smith & Nephew and BAE Systems already members, where are the other 77?

The Bath meeting in January 2004 was well attended and had the theme of the Fundamentals of Natural Computing. The last two meetings have had more specialised, but no less interesting, themes on Biopatterns and Neuroimaging, and have had smaller attendances. The members of NCAF will know that there are always general talks on the second day, but do prospective members? Maybe we should publicise the general nature of the meeting more, and the theme less. I am not against having a theme for some of the talks; however, it seems to me that we gain relatively few members as a result of having a theme, and a downgrading of the prominence of the theme might encourage more attendees with a general interest in natural computing. People that specialise in some aspect of the theme, but with little computing experience, are more likely to learn about the meeting on their grapevine rather than through NCAF publicity.

Would it help if one of the three meetings each year either did not have a theme, or concentrated on explaining the different techniques to a more general audience? Most people that I spoke to after the Bath meeting had learned something from at least one of the presentations – and we are meant to be experts in the field. Alternatively, we could require that the majority of presenters at one meeting use commercial software. New researchers to the area are unlikely to start by writing their own software. Potential members would be more likely to join if they were aware of all the robust software that is available, and of the experience within NCAF. I would have thought that the majority of new members are likely to be outside their organisation's computing department. Most academic IT departments should have already heard of NCAF.

These are just my thoughts, and the article was probably written because I knew that there would be a few column inches to fill. However, feedback will be welcome, either to me, or to Graham Hesketh. If I can fill a future edition of *Networks* with reaction to this article, and suggestions as to how we can encourage more industrialists to join NCAF, I will be very pleased.

Nick Granville
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DIARY DATES 2005–6

2–5 September – CEC2005: Congress of Evolutionary Computing, Edinburgh, Scotland. It includes a session on the applications of evolutionary computing to business, organised by CERCIA.
http://www.cec2005.org

7–8 September – NCAF Meeting on Intelligent Multi-Agent Systems at Southampton University. For information, email enquiries@ncaf.org.uk or telephone +44 (0)1332 246989

11–15 September – ICANN2005: International Conference on Artificial Neural Networks, Warsaw, Poland. Two days of workshops follow the conference.
http://www.ibspan.waw.pl/ICANN-2005/index.html

19–23 September – IURS-2005-ESNR: Summer School on Robotics and Neuroscience, Benicassim, Spain.
http://www.robot.uji.es/research/events/iurs05/

5–8 December – The Second Australian Conference on Artificial Life, Sydney, Australia.
http://www.itee.adfa.edu.au/~abbass/acal05/index.html

12–14 December – AI-2005: 25th SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence, Cambridge, England.
http://www.bcs-sgai.org/ai2005

January 2006 – NCAF Meeting at Swansea University (theme and dates to be announced). For information, email enquiries@ncaf.org.uk or telephone +44 (0)1332 246989

26–27 January – Bio-ADIT 2006: The Second International Workshop on Biologically Inspired Approaches to Advanced Information, Osaka, Japan.
http://www.ist.osaka-u.ac.jp/bio-adit2006/

MEMBERS' NEWS AND VIEWS

Deadline for contributions for the next edition – 1 November 2005. Please send to Managing Editor – Nick Granville, e-mail: Nick.Granville@smith-nephew.com