

The value of visualisation

DTI, London, 23–24 January 2007

*Geoffrey Butlin
(TranscenData
Europe) will review
40 years of progress
in visualising and
what happens inside
engineering artefacts
while in use.*

“With the emergence of cheaper processing power and Grid technologies, computations of scientific and engineering problems, financial models or any number of large-scale or complex systems can be carried out that generate ever larger sets of data. Previously the understanding and interpretation of the data was often aided by some form of visual presentation but as these technologies and challenges become more widespread it is becoming increasingly difficult to do so without advanced visualisation.” – DTI

Through a competitive call early this year, the DTI has allocated approximately £9m to Collaborative Research and Development projects in the field of Data, Scientific and Medical Visualisation for innovative products and services. Visualisation is of interest to NCAF and the DTI is very generously sponsoring this meeting.

On the first day, Lee Vousden of the DTI will give an inaugural talk highlighting the Department's contribution to the visualisation of complex systems. This will be followed by a presentation from Stuart Revell from Freescale Semiconductors UK Ltd on their recent VoC Hipnet project. Geoffrey Butlin (TranscenData Europe) will review 40 years of progress in visualising and what happens inside

engineering artefacts while in use. Roger Bluff from QinetiQ will also give a themed presentation.

Andy Pryke from University of Birmingham will present his work on multi-objective algorithms followed by David Clifton from University of Oxford who will speak on the visualisation of jet engines vibration characteristics for crack detection. Nick Granville from Smith & Nephew will be looking at wounds. The first day will end with Puzzle Corner, and a social event organised for the evening.

On the second day, Rade Ognjanovic from Innoval Technology Limited will present one more themed paper on a DTI-funded fast track project, PhysVis. The project is about visualising the way carbon fibre optics are moved by robot onto a mould. This will be followed by general papers from Rui Zhang (University of Oxford) and me.

The Annual General Meeting is also planned for NCAF members after lunch and we expect to close the meeting at around 2.30pm to give us sufficient time to go out of London and avoid the rush hour.

On behalf of NCAF, I am very much looking forward to seeing you all at London in the New Year.

**Rajesh Ransing
Swansea University**

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NCAF Student Paper Competition 2007

With the success of the first NCAF Student Paper Competition at the Bristol meeting in September, NCAF is keen to make this competition an annual event during its autumn meetings. The competition is open for Masters students (MSc, MRes, MPhil and MEng) registered at a UK university. All finalists receive a certificate from the publishers Springer and NCAF, and the winner receives a prize of £150 towards book vouchers.

To enter in the 2007 Competition, students need to submit a 2-page extended abstract on any natural computing subject along with a PowerPoint/PDF presentation file by 1 August 2007. Further details are available at www.ncaf.org.uk.

Animals and imaging

The audience were captivated by many video sequences illustrating various complex problems, and the behaviour of the proposed approach.

The September NCAF meeting was hosted by BAE Systems and held at Bristol. The theme was image processing and it also hosted the first ever NCAF student paper competition. Over the two days we were treated to a number of varied talks from academia and industry that were both on and off the theme. The excitement of the meeting started somewhat earlier than anticipated when our Chairman got locked out of his room at about 3am.

Carsten Rother from Microsoft Research started the meeting with an interesting presentation on Markov random fields (MRF) as applied to computer vision. He presented a technique, Graph Cut, to solve MRFs in an efficient manner, before discussing applications of MRFs to image processing. MRFs are well suited to image processing because of the strong spatial coherency generally exhibited in photographs. During the presentation Carsten gave an impressive demonstration of the 'grab and cut' algorithm for desktop photo editing. In addition, he mentioned the applicability to creating collages of photos and matching and blending multiple registered photos.

Piotr Dudek from the University of Manchester followed providing a detailed insight into his analogue vision chip. This chip integrates image sensing and parallel processing at the pixel level to perform preliminary image processing (like edge and change detection) in a way that is inspired by the vertebrate retina. During the talk Piotr showed videos of the chip working in real-time. He highlighted the fact that by using an image chip the bottle-neck from processing multiple pixel arrays can be removed from conventional computers, allowing more time for high level vision applications. After his talk, Piotr kindly demonstrated his vision chip during the coffee break, and we all spent some time waving our hands in front of the camera and being duly impressed.

Hyper-spectral imagery

After coffee, Chris Willis from BAE provided an insightful talk on the applicability of hyper-spectral imagery within the military domain. The first half of the talk introduced the concept of hyper-spectral imaging (HIS) and the second focused more on HIS's application to detecting military significant targets through anomaly detection. Chris highlighted three methods and compared them using a test example. He was unable to show results on real data due to the sensitive nature of the work (one of those 'I could tell you, but I would have to kill you' moments).

Neil Thacker from the University of Manchester followed, presenting 3D model matching software as used within the TINA computer vision system. The talk started by looking at matching wire-frame models to edge features in the image and their experiences with TINA in doing this. Neil then moved onto describing recent amendments to their object modelling strategy where, using a systems engineering approach, they test the conformity of data distributions assumed during algorithm design against those they have practically observed. The results of the tests can then be used to help improve the detection, localisation and validation of features from the 3D wire-frame models.

Andrew Cooke from BAE Systems gave an interesting talk demonstrating the non-trivial problem of tracking multiple targets in dense occluded scenes with background clutter. After giving an overview of the potential computer vision problems, the author presented the self-adaptive discriminate filter as a novel solution, along with a

qualitative comparison to the mean shift algorithm and variants. The audience were captivated by many video sequences illustrating various complex problems, and the behaviour of the proposed approach. An emphasis was placed on the importance of target discrimination.

Jon Chambers from Sheffield University presented a fascinating field of work based on biologically inspired computer vision. A thorough and informative talk was given, not only outlining the research carried out within their group, but focusing with more detail on several key models of parts of the vertebrate brain, including the basal ganglia. The latter was presented with excellent dynamic slides and enthusiasm for the subject, which built up to describe a complete oculomotor system. Results were shown which demonstrated the ability to reproduce the neural behaviour involved in visual target selection.

Valerie Leung, from the University of Kingston gave the last talk of the day, speaking on identity estimation using fusion of multiple features. She used a range of descriptors to identify a target, and compared it to one of 47 subjects in an image database. A key result was in understanding the impact of the choice of descriptors on the matching performance, with the MPEG-7 colour descriptors unable to produce an average of less than 7.4 potential matches for a given target. Techniques such as information gain analysis, ranking and ROC curves analysis were described to assess the quality of the match.

This was followed by an extended Puzzle Corner. Graham Hesketh started by demanding ten pound notes from every audience member, but settled for using them as random number generators to set him a version of the Puzzle Corner known commonly as the 'secretary problem'. The random numbers managed to outwit him, but he convinced us of the validity of his technique. We then moved onto the full problem, and despite robust discussion from the floor were equally convinced by the explanation.

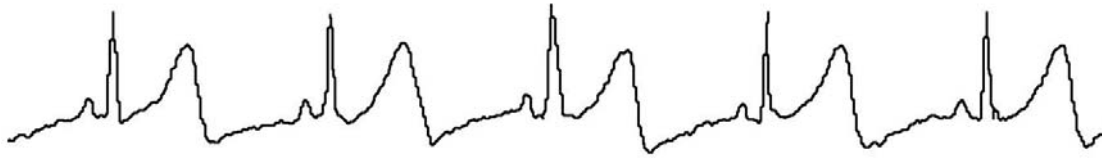
The social event started with a leisurely stroll across Bristol Downs to Bristol Zoo Gardens, where we were greeted with a glass of Pimms in the Rose Garden. Wandering around the grounds gave us the privileged view of a mother gorilla and her baby enjoying their food in the balmy September evening. The theme of the meeting may have been imaging, but there are no pictures of the animals wandering round the zoo as most people forgot their cameras. Just as it started to rain we headed indoors to eat far too much delicious food overlooking the gardens.

Student award finalists

The eating and drinking did not delay the start of the meeting next morning, with everyone's curiosity piqued as to the entries to the student paper competition. The competition involved two finalists, who having previously submitted their papers, were to give presentations, and be judged by the NCAF attendees.

Xu Yang from Queen Mary, University of London started the morning, presenting her work on NEAT (a technique involving the evolution of a set of neural networks using genetic algorithms) to call admission control, achieving near optimal performance over a range of conditions. This allows a range of policies to be utilised by the phone network provider, and chosen according to the current priorities over the network. The work is applicable to the control of mobile phone networks, where the rate of dropped calls is a key factor contributing to customer satisfaction.

Building the bridge between the NHS and industry



Back in 1997, I arrived at Aston, planning to stay for one year, to complete the Pattern Analysis and Neural Networks MSc run within the Neural Computing Research Group (NCRG), with the intention of returning to industry with my newly acquired skills. I am still here, but now working as a lecturer and researcher. My journey began when I was convinced to stay to convert my MSc work into a PhD. Following the PhD, I worked on the Cardionetics project as a research fellow, developing 'clever' algorithms to embed into an innovative device designed to help primary care doctors identify heart conditions in their patients. Following the completion of the post doc, I became a lecturer in computer science – and kept my roots of research within NCRG.

My research is just on the academic side of industrial applications, which means that I need to work with industry to test and develop my research. I have a strong bias toward technology transfer and innovation with industry. For example the skills and knowledge that I learned through the development work with Cardionetics have produced a PhD in the field of predictive on-line maintenance for electric motors operating industrial manufacturing machines. I continue to work in the field of automated ECG analysis and diagnosis, and currently supervise a PhD CASE award in partnership with Huntleigh Diagnostics.

Obtaining collaboration with industry or large organisations, such as the NHS is often difficult. My work with Cardionetics, during 2000-02, was with the C.Net2000 device. The current version of the device is the C.Net5000, but Cardionetics is having difficulty penetrating the NHS. Why does this process need to be so difficult? How do innovators, industrial or academic, make contact with the NHS?

I recently began work in a new role as an Innovation Manager for MidTECH, the NHS Innovation Hub for the West Midlands. My role is to identify potential

commercial opportunities, map capability and to promote awareness of intellectual property and innovation amongst NHS employees. This includes bringing companies into the NHS for collaborative work in key areas.

MidTECH is part of a network of nine regional NHS Innovation Hubs, established by the Department of Health to deliver improved healthcare to patients through innovative medical technology and services, and to protect the intellectual property (IP) that belongs to the NHS. The work of the hubs is co-ordinated by the new National Innovation Centre, which was launched in September and is part of the NHS Institute for Innovation and Improvement. MidTECH aims to bring commercial opportunities to healthcare using local business and knowledge networks. It is co-funded by the DTI and Advantage West Midlands.

Innovation Hubs offer advice on IP management to NHS inventors and assistance with commercial exploitation, including licensing deals and, where appropriate, the formation of spin-out companies. They help to turn ideas into reality and build the bridge between the inventor and the market place, linking IP management, business and technology expertise.

The hubs work with local universities and the NHS R&D function to develop new products and services, and introduce commercial opportunities to healthcare companies. MidTECH can provide access to NHS knowledge and expertise for those companies wishing to develop their products in the healthcare market. MidTECH aims to add value for the NHS, academia and industry by facilitating new partnerships.

Visit www.midtech.org.uk or email me at d.j.evans@aston.ac.uk, for more information or an informal discussion.

David Evans (with assistance from Louise Butler, MidTECH) Aston University

Michalis Smirnakis from Aston University spoke next, on recognising ischemic events from sections of an ECG. There is a clear need for easy and economical recognition of ischemic events, heart disease being the biggest killer in the industrialised world. He used a Bayesian inference multi-layer perceptron to perform classification, and obtained results close to the state of the art in this domain.

The standard of both talks were high, and there was no unanimous decision from the audience. The majority decision went with Xu, and she was awarded a prize of Springer book tokens.

Mark Cheeseman from Rolls-Royce returned after an absence from speaking at NCAF to give a talk on modelling the aftermarket using intelligent agents. This example was for the aerospace aftermarket, but the approach has broad applicability to business process modelling. Mark is passionate about his area of work and gave interesting demonstrations of a new software package used for modelling planes, parts and repair shops as agents, simulating 'what if' scenarios.

The afternoon started with a talk from Heather Turner from the Non-Standard Computation Group at

the University of York, who introduced us to the uses of rule migration as a technique for designing emergence. The idea of designing emergence is one likely to be of great value to systems engineers. Heather used simple cellular automaton behaviours to produce more complex behaviours like movement or aggregation – which can then be utilised when designing emergent behaviours.

The final talk was given by Paul Lepper, from the Underwater Acoustics Group at Loughborough University. Paul described some of his group's diverse activities in underwater acoustics. These included localisation for autonomous underwater vehicles, understanding the effects of human activities on marine wildlife, and the development of safety systems for home swimming pools

Overall, the Bristol meeting was a great success, with two days of extremely varied and interesting presentations and a dinner in very unusual surroundings. Apart from the standard of the talks, the highlight was definitely the baby monkeys at the zoo.

Felicity Dornon BAE Systems

PUZZLE CORNER

Number 34

On 30 April at the Annual Gathering of the Church of Bayesiology, the Grand Meta Prior announced that the meeting was blighted by a Frequentist presence. He, and everyone else there, could feel their aura and, ironically, could enumerate the number of other Frequentists in the room. Frequentists were members of the Church who had lost their faith. Sadly, they could not recognise this in themselves as they are unable to sense their own aura. However, when faced with indisputable evidence, they would accept the stigma and silently withdraw from the Church.

The Grand Meta Prior ordered the meeting to be adjourned for one day, and banned any Frequentists from returning. Nevertheless, the next day the whole Congregation rejoined the meeting and the Frequentist stench was the same as before. The meeting was adjourned again and the ban reiterated – anyone who knows they are a Frequentist must go into the wilderness, never to return. The following day the same thing happened, and the pattern repeated each day thereafter.

Given a Congregation of 365, of which 184 were actually latent Frequentists, when (if ever) did the meeting finally take place?

The answer will be given at the next NCAF meeting (23–24 January 2007, DTI, London).

Fenella the Rottweiler

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MEMBERS' NEWS AND VIEWS

Deadline for contributions for the next edition – 1 February 2007.
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NEXT EDITION

Review of DTI London meeting
Preview of Liverpool meeting

Let's Talk!

NCAF is about natural computing, and what could be more natural than talking? Ever since the dawn of computers, visions of the future have included machines that we could talk to. From the Turing Test to Spielberg's AI, via Kubrik and Clarke's HAL, we have dreamed of computers that could converse intelligently with us. We still haven't got quite that far yet, but the latest generation of 'chatbots' are making strides towards that goal.

Chatbots (or chatterbots, or conversational agents) are software elements that provide a natural language interface to their users, and which respond appropriately to user input. They have a long history in the AI world. Weizenbaum's ELIZA, regarded as one of the first chatbots, will be familiar to many AI students. Developed in 1966, this simulation of a psycho-analyst used the surprisingly effective technique of extracting words from the user's input and returning them as questions, but it held no memory of the conversation and so could not enter into any real collaboration or conversation.

1995 saw the development of Richard Wallace's ALICE and AIML (Artificial Intelligence Markup Language). AIML is an XML variant that offers more sophisticated behaviour for chatbots, providing templates to generate responses and the control of context, conditional branching and supervised learning. The development of AIML marked a step change in chatbot capability, and spawned a large number of related 'Alicebots'.

Today we are in the midst of another revolution in chatbot technology, incorporating both learning from human behaviour, and the use of increasingly sophisticated scripting and recognition.

The learning approach to chatbot development is epitomised by Rollo Carpenter's Jabberwacky family (www.jabberwacky.com), including George and his 'sister' Joan, who have won the Loebner prize for the last two years. The system has no hard coded rules, but finds the most appropriate response using contextual pattern matching techniques drawing on the eight million conversations it has held with real users in many different languages. The result can be spookily human, but Jabberwacky is there simply to chat, and not designed to perform practical tasks.

At the more practical end of the scale are scripted chatbots developed and deployed for commercial purposes. For example, the Lingubot™ system, developed by Kiwilogic and extended by Creative Virtual and Elzware in the UK, is behind a

large number of commercial systems. In a Lingubot, the words and the grammatical structure of the user's input are analysed using customised templates, allowing intelligent conversation with the user through a rich mix of behaviours (including further conversation with the user, reading or writing to databases or opening a web page).

Chatbots can be used for a wide variety of tasks. They are being used for entertainment, either in the pure form of offering something fun to chat with (as with Jabberwacky, or try chatting to Boris at www.boristhefrog.com), or embedded in games, to give characters a more human feel.

In commercial applications, chatbots can provide a website with an efficient and engaging interface that can answer many visitors' questions and enquiries. In this way, a chatbot can provide an improvement to a traditional FAQ page, offering a more natural interface to users, and providing a richer range of responses. An analysis of the transcripts can offer insights into what users are asking about, and so help develop both the chatbot and services offered to customers. Lloyds TSB, Ikea, BT and many others have embraced this approach, and have live systems on their websites.

Another developing area is the use of chatbots in education. Traditional intelligent tutoring systems often have rather constrained and stilted interaction and the use of a chatbot interface as a front end offers a more natural experience for the user.

Where will chatbots be going from here? We are already seeing the marriage of chatbots with speech recognition and speech synthesis technology, and with human-like avatars. The next big leap forward will be the fusion of the sophisticated scripting approach epitomised by Lingubot, and the learning approach used by Jabberwacky, offering the best aspects of both approaches. Indeed Jabberwacky is already taking steps in this direction, and developments will be watched with interest.

Chatbots probably won't be passing the Turing Test in the next couple of years, but we will certainly be seeing more of them as they become an increasingly powerful weapon in the natural computing armoury. Talking machines? That's what I call natural computing!

Richard Ellis

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DIARY DATES 2007

11–13 April – EVOBIO 2007: 5th European Conference on Evolutionary Computation, Machine Learning and Data Mining in Bioinformatics. Valencia, Spain.
<http://www.cs.vu.nl/~elena/evobio07.html>

25–27 April – ESANN2007: 15th European Symposium on Artificial Neural Networks. Bruges, Belgium.
<http://www.dice.ucl.ac.be/esann/>

22–23 May – **NCAF meeting (theme: the analysis of multimodal and high dimensional data) at Liverpool University. Note that the meeting will not be held in Liverpool but at a university**

conference centre near Chester. For information, email enquiries@ncaf.co.uk or telephone +44 (0)1332 246989

3–7 June – ISNN 2007: 4th International Symposium on Neural Networks. Nanjing, China.
<http://liu.ece.uic.edu/ISNN07/>

7–11 July – GECCO 2007: Genetic and Evolutionary Computing Conference. London, England.
<http://www.sigevo.org/gecco-2007/index.html>

23–26 July – FUZZ-IEEE 2007: IEEE International Conference on Fuzzy Systems. London, England.
<http://www.fuzzieee2007.org/index.html>