

# BMVA News

The Newsletter of the British Machine Vision Association and  
Society for Pattern Recognition

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**BMVA** News<sup>1</sup> is published every three months. Contributions on any activity related to machine vision or pattern recognition are eagerly sought. These could include reports on technical activities such as conferences, workshops or other meetings. Items of timely or topical interest are also particularly welcome; these might include details of funding initiatives, programmatic reports from ongoing projects and standards activities. Items for the next edition should reach the editor by 30th September 1997.

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## Editorial

I can hardly believe it's already time for the next BMVA News to hit the press. I'm sure many of us have the feeling that amidst being bombarded with

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numerous calls for papers from conferences, workshops, technical meetings, and special journal issues, time seems to fly by. And that's not even including the rest of our job! So the smaller size of the current issue is indicative that many contributors are unfortunately too busy nowadays with other commitments rather than a sign that machine vision is stagnating and that there is little to report. This hive of activity is presumably beneficial for the discipline; it just happens to be a spoke in the wheels in the running of the newsletter!

## EPSRC Summer School

A shell-shocked Guildford is on the slow road to recovery this week after the next generation of machine vision researchers descended on it in a scene not unreminiscent to the fall of Rome at the hands of barbarian hordes in AD476. Similarly, the forty-strong band of fresh-faced researchers, now dispersed around the Isle, are convalescing following the intellectual marathon that was the third EPSRC/BMVA Summer School in Machine Vision.

The five-day course starting on the 23rd June, was aimed at first year Ph.D. students and was excellently organised by John Illingworth of the University of Surrey. Attended by students from the length and breadth of Britain, its challenge was to impress upon new members of the computer vision community the fundamental skills and methodologies recommended by recognised authorities in the field.

After registration and introduction, Tim Ellis opened proceedings with a look at the subject of image formation. This was followed by the first of a useful two part paper review exercise, designed to foster skills

in... well, paper reviewing I suppose. The first day ended with a poster session in which the participants endeavoured to visually present their research topics spurred on by the promise of an extravagant prize for the most spectacular effort. Wine was provided – which was nice – and fuelled engaging academic debate which in the end, fell off into a bar-based ‘networking session’.

The second day’s theme was low-level image processing and modelling with talks by Maria Petrou and Bernard Buxton and also saw the completion of the paper review exercise. Common consensus pointed to admiration for a paper of unknown author, later unmasked as John Illingworth himself. Dave Cooper brought the day to a close with a brief overview of the potential of the IUE project, joining the students later in the bar for refreshments.

David Murray opened the third day’s proceedings with a whistle-stop tour of active vision research including video clips of his Yorick project. Next up was Andrew Zisserman and his superb lecture on projective geometry. His efforts were nearly spoilt before he could start by John Illingworth, who introduced him as a key member of the vision team who ruled out Geoff Hurst’s controversial 101 minute goal in the 1966 World Cup Final against Germany. However, the audience were soon won over by a spectacular interactive electronic stage show reminding the authors of Jean Michel Jarre’s Docklands concert in 1988. After an afternoon lab tour, Mark Bradshaw inspired interest in aspects of biological vision with a series of hallucinogenic visual illusions designed to demonstrate some of the nuances of the human visual system. That evening, students and lecturers alike were treated to a formal dinner followed by the presentation for the best poster. This can only be regarded as a farce in which the two highly gifted students from Manchester were cruelly denied their rightful podium position as winners. Later on, when pressed, they freely admitted that the actual joint winners (A. Bosson and K. Moravec from the University of East Anglia) deserved to win, if only on merit of having better posters. It must be noted that the evenings activities spilled over into Guildford town centre, particularly ‘Bar Mambo’. This extended excursion continued into the wee hours culminating in – and words fail to express the sheer horror of what ensued – the participation of several of the school students in the ‘Hairy Chest’ competition. Enough said.

Thursday saw the last full day of the school being mainly dedicated to statistics in vision and performance evaluation. Neil Thacker and Josef Kittler

tutored on statistical approaches to machine vision while Adrian Clark provided an interlude describing software tools. The latter half of the day was given over to Neil Thacker’s presentation expounding the importance of performance evaluation of machine vision algorithms. This brought home the cultural deficiency in the computer vision community regarding performance characterisation. This was followed by a practical session designed to highlight issues of robustness in low-level image processing. And then we went to the pub.

With a heavy heart, we embarked on the final day covering project management: the epic task of successfully completing our own research projects. After a final lunch, new friends made, new knowledge gained and perhaps most importantly with an increased sense of community in computer vision, we all went our separate ways with the shared conclusion that the week had been both enjoyable and valuable and had given new momentum to our research.

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## Optimisation Issues in Computer Vision

This one day technical meeting on Optimisation Issues in Computer Vision was held on the 8<sup>th</sup> of May at the British Institute of Radiology in London. The meeting was chaired by M. Mirmehdi (Surrey) who kick-started the meeting with an Introduction. He stressed that the meeting was not just about the range of optimisation techniques, but also to do with issues such as the role of optimised data in a vision system, and the delivery of an estimate of data reliability as well as the optimised data.

R. Wilson (Warwick) presented an approach to boundary and corner detection using multi-resolution Hopfield neural networks. The advantage of the multi-resolution representation is to avoid the trap of the system getting stuck in local minima, to which the Hopfield network is prone. Some results for boundary and corner detection on simple geometric shapes were shown. A technique to recognise postcodes was discussed by S. Lucas (Essex). The optimisation problem consisted of finding the most probable sequence of postcode characters given some

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SEND IN THE CORRECT ANSWER TO WIN AN OUT-OF-FOCUS PICTURE OF LEVA'S SMARTER SISTER  
(THE ONE WHO SENT HER PICTURES TO BANKERS, NOT ACADEMIC PEERS.)



OH NO, NOT ANOTHER CARTOON BY MANUEL!



pre-defined constraints concerning character pairs. An interesting characteristic of the retrieval method for the postcodes was that it became faster as the size of the database of possible valid codes increased. Experimental results were shown for the postcode problem. He briefly illustrated how the approach could be extended to face recognition. A. Stoddart (Surrey) pursued optimisation in the context of general object recognition, in particular point set matching. He discussed various optimisers, such as simulated annealing and mean field theory. He selected mean field theory and showed the link with geometric hashing that achieves faster optimisation. Genetic search in relation to graph matching was the topic presented by A. Cross (York). The cost function of the algorithm was modelled in a Bayesian framework as a fitness measure. The usual GA operators were employed with crossover based on splitting and joining subgraphs. A Hill-Climbing method was used to enhance chromosomes after the mutation stage. Results of the application of the technique to matching aerial stereograms were shown.

Heap's (Leeds) talk was concerned with the problem of tracking objects that did not deform smoothly over time. He used a point distribution model optimised by a modified "condensation" algorithm. The modification involved handling the discontinuous transitions in the shape space by creating 'wormholes' between disparate points in the space. The pros and cons of the 'condensation' algorithm were discussed. Results for the shape model and shape transition model were presented.

Pronzato (Heriot-Watt), who started the afternoon session, discussed the use of genetic algorithms as optimisers for boundary extraction. He presented a framework for adaptive control for low-level contour extraction in visual pathways. Experimental results for various Gaussian noise levels were shown. S. Marchand-Maillet (Imperial College) presented an optimisation approach for line image analysis. The problem consisted of forming a skeleton representation of binary images e.g. fingerprints and road networks, by the shortest path. Daniel Alexander (University College London) proposed a ROC analysis for optimal linking of a set of data with a set of candidate models for that data. Results were shown for statistical snake algorithm for tracking roads in natural scenes. C.A. Glasbey (Edinburgh) presented a depth-from-focus algorithm for recovery of depth information from optical microscope images for opaque surfaces. A Quadratic program was employed for estimating the point spread function of the optical system and a constraint optimisation approach was developed for estimating brightness and depth infor-

mation at each location on the surface. Finally, Neal Harvey (Strathclyde) raised the problem of noise and dirt in images and presented a soft morphological filter to cope with film dirt problem. Optimisation of filter parameters e.g. Mean absolute and Mean square error was achieved using genetic algorithms. Results were shown for restoration of actual BBC archive film sequences.

The meeting was closed following a discussion on issues such as the combination of optimisation techniques and reasons for selecting a particular technique in preference to another. The issue of having performance measures to verify optimized results was also argued for.

The abstracts for the talks can be found on Peipa at: <http://peipa.essex.ac.uk/bmva/bmva-mtg.html>.

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## Medical Image Understanding and Analysis'97

In July 1997 the first national event aimed at bringing together the diverse research communities involved in medical image understanding and analysis took place in Oxford. The meeting was co-sponsored by the BMVA, the British Institute of Radiology, the Institute of Electrical Engineers, the Institute of Physics in Engineering and Medicine and the Royal Academy of Engineering. The one and half-day meeting was organised by Alison Noble (University of Oxford), Chris Taylor (University of Manchester) and Mike Brady (University of Oxford) and attended by a wide range of researchers from practising clinicians through to mathematicians. This mixture could be seen by the distinct lack of talks using OHPs, a sure sign that we were at a medical conference, and yet not much gore either, a sure sign that we weren't at a medical conference!

Many of the usual problems were tackled but within new applications. These included: assessment of drug delivery using inhalation techniques (Southampton); looking at hip replacement radiographs to determine loosening of prosthesis components (Aberdeen); using visual and infra-red images to provide a 'non-invasive' biopsy (Birmingham). Additionally, modalities showing

great promise were presented, including Magneto-Encephalographic (Surrey) which monitors functionality of the brain with high time resolution; and tagged MRI (Leeds). Encouragingly, it seems that the processing being applied is starting to mature and become more sophisticated than earlier attempts where errors from other applications areas were repeated. This extends to the new modalities and applications where principled image processing based on an understanding of the images is being applied.

This meeting highlighted some of those differences between traditional computer vision and medical imaging. Many computer vision groups now share data and this allows comparisons of algorithms, but this is only recently starting to happen in medical imaging where the data and in particular the ‘ground truth’ can be difficult to ascertain. Here we heard talks mentioning shared mammography databases (Manchester) and brain data (Guy’s Hospital) where the patients had fiducial markers screwed into the skull. It’s important to realise that ground truth can take months or years to ascertain in medical imaging, and yet most Engineering projects are funded for only 3 years. Retrospective data can be used but rapid improvements in image quality mean you can find yourself trying to analyse data which the clinicians consider poor quality.

Many classic computer vision techniques were mentioned, but all were altered in some way to adjust to the medical imaging domain. 3D ultrasound is hampered by high noise (speckle) but averaging over a number of images does not work without accurate registration (Cambridge), and that is hard to achieve with an organ such as the heart which is beating. Several groups are now using energy minimization techniques (ie snakes) and are finding that external forces are crucial because the shapes are so complex, but that since there are few square edges the internal (or regularising) terms tend to be quite stable. Landmark extraction for registration is proving relatively easy for some body organs, but near impossible in others and even seemingly generic routines such as ‘detect vessel’ have to be altered to suit the organ in which that vessel lies (University of Wales). Medical imaging does have some important advantages: we know what to expect in a medical image, it is a constrained environment; we can alter the practical details, for example we can dilate the eye (London) or we can use contrast agents. These factors mean that when addressing what appears to be an image processing problem one should also consider whether a practical solution exists.

Another interesting point made during the meeting

was that searching for the words modeling and simulation on the WWW gives an almost exponential rise in ‘hits’ since 1990. It is clear from attending these meetings that modelling for medical image processing is becoming very firmly established. Here we saw modelling used in a variety of ways including identifying limitations of the imaging system, optimizing the medical procedures (Oxford), and helping in the interpretation of image data. It is becoming evident that even simple models for incredibly complex subjects such as the heart pumping and breathing are useful, if not crucial. Several groups talked about mathematical modelling of body organs, including the heart (Oxford) and gall bladder (Cambridge). Several others groups discussed blood flow models (Oxford, City). The advances in technology that are happening almost daily mean that the models have to be almost constantly updated. Also, as the number of the modalities increases more and more models are needed and, as one clinician pointed out, often there is no time for basic theory. This makes one wonder whether the introduction of new modalities makes the medical community miss aspects of the perceived ‘old ones’.

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## Travel Bursaries

The BMVA has a limited fund that can be used to make partial contributions (up to a £250 limit) towards the cost of presenting a paper at a recognised international conference. The aim is to encourage and provide opportunities for younger researchers who are developing their research reputations. Applicants for awards should be presenting the paper at the conference. To apply for an award you should write to the Honorary Secretary, Neil Thacker, enclosing two copies of the paper to be presented and making a case for support (including details of where other financial support will come from). Applications will be considered by a small review panel appointed by the Secretary of the Association. If an award is made then the applicant will be required to write a short conference report for inclusion in a subsequent issue of BMVA News.