# BMVA News

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

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BMVA News[1] 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 and workshops. Items of 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 19th October 1998.

## Contents



[1] The British Machine Vision Association and Society for Pattern Recognition is a Company limited by guarantee, No. 2543446, registered in England and Wales. Registered Office: Granta Lodge, 71 Graham Road, Malvern, WR14 2JS. The Association is a non-profit-making body and is registered as charity No. 1002307.

## Sullivan Doctoral Thesis Prize

The Executive Committee has established a prize fund to commemorate the contribution made by the late Prof. Geoff Sullivan to the advancement of the field of Computer Vision in the United Kingdom and his contribution to the operation of the BMVA. The prize (£250) will be considered for award, on an annual basis, to the best doctoral thesis submitted to a UK University in the field of computer vision, including computational studies of natural vision.

Recommendations for the prize will be considered by a Selection Panel appointed by the BMVA Executive Committee. The decision of the Selection Panel will be announced at the end of the following July. Where possible, the presentation will be made at the conference dinner of the British Machine Vision Conference, usually held annually during September. The successful author will be encouraged to publish the thesis on the World Wide Web if copyright permission is granted.

The submission period for the prize covers a full calendar year (1st January – 31st December). Electronic submissions should be sent to the BMVA Secretary to arrive, at the latest, within 2 months (i.e. end of February) of the year following the date on which the University has formally accepted the thesis. Submissions should be supported by signed authorisation from the student, a supporting statement from the research supervisor, and a recommendation from the external examiner. Submission forms and details of the electronic submission format are available from the BMVA Secretary, and will be made available on the BMVA Web page www.bmva.ac.uk).

Tim Ellis
BMVA Chairman

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# Computer Vision and Image Processing

## Scott E Umbaugh

Prentice-Hall, 1998, 528 pp.
ISBN Paperback with CD-ROM 0-13-790882-2
ISBN Cloth Bound with CD-ROM 0-13-264599-8
Info in P-H Web catalogue:
http://www.prenhall.com/search.html

### What's in this book?

This is a book on image processing (IP) accompanied by a CD-ROM. The CD-ROM contains a software package, CVIPtools, CVIPtools is the author's implementation of a good number of algorithms for image segmentation and morphology, restoration, enhancement, and compression. All this is introduced in the first part of the book (286 pages), CVIPtools in the second part (194 pages, effectively a user manual).

### What is good in this book?

First, the abundance of images. Every algorithm is illustrated by a good number of examples from various applications, which must definitely be applauded.

Second, you can try your hands on all the algorithms in the book by installing CVIPtools under UNIX or Windows95. You can develop you own applications using C libraries, or play with the algorithms through the GUI provided. You have access to algorithm parameters as the package is meant ofr teaching and research.

Third, the good coverage (numberwise) of IP topics and algorithms. You find nearly all that you expect to find in an introduction to IP, plus the code.

### What could be better in this book?

First, the title. I do not believe names are really important, as scientific disciplines are defined by people, not by names. But it *is* important to understand what you are buying. According to Chapter 1, IP is the part of "computer imaging" the output of which is "for human consumption", whereas the images output by computer vision applications are "for use by a computer". The book is faithful to this *ouverture*, and is all about algorithms producing images or descriptions of image elements. By any definition familiar to BMVAnews readers, there is no computer vision in this book: no camera models, no calibration, no 3-D vision, no geometry, no shape-from-X, no motion analysis, no basic physics of image formation ("Lambert" is not in the index), no pattern recognition or classification, and so forth, you got the idea.

Second, mathematical foundations. The theory behind each algorithm is minimal, and mathematical details are just hinted to. I found no attempt to explain why things work or to quantify how good performance is (e.g., where do digital images come from? How do you design, say, a Gaussian mask given the frequency range you want to preserve? How do you compare quantitatively the performance of edge detectors?). From this viewpoint, this is yet another "try and see" presentation of IP: we take images for granted, we try an algorithm, we see what happens. It may be what you are after, but it may not, particularly if you are reading this newsletter.

Finally, and at the risk of treading into the subjective land of preference, some omissions. The Canny edge detector is ignored (too mathematical?). The otherwise good list of journals in Appendix F does not include IJCV (consistently with the declared scope of the book?), but includes IEEE Spectrum and IEEE Expert Magazine.

### Is this book useful for me?

Definitely yes, if you are after an introduction to IP with a minimum of theory, and accompanied by a usable, wide software package. Probably you are a teacher who must set up a course on IP, but you do not have much experience nor material at the ready. Or perhaps you are a scientist, student or professional, with an interest in IP but no great interest for the maths behind it, and all you want is to get a plug-and-play feel for what's behind packages like Photoshop and the like.

Definitely no, if you are already familiar with IP, have been in IP research for some years, or are working on computer vision as known to BMVAnews readers. There are more comprehensive, classic books on IP. I did not compare carefully CVIPtools with the various, similar packages I know, but then again, Paul paid in rubles. Do svidaniya.

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## New BMVA Technical Meeting Officer

Firstly allow me introduce myself, my name is Richard Bowden and I have taken over from Professor Davies as meetings officer for the BMVA. I am sure that everyone would like to join me in thanking Prof. Davies for the time and effort he has invested over the past years, making BMVA technical meetings a useful and informative forum, which is an integral part of the BMVA.

It is my hope to continue Prof. Davies good work in the organisation of technical meetings and I would therefore like to introduce myself as your point of contact for future endeavours.

We have a number of meetings lined up which will take us to the end of the year, but I am now considering proposed subjects for 1999 onwards. If anybody has a subject which they feel the BMVA has neglected recently or have a new area which they think would be of interest to the BMVA then please contact me.

I look forward to hearing from you

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## Evaluation and Validation of Computer Vision Algorithms

I had the pleasure in March of attending the workshop on 'Evaluation and Validation of Computer Vision Algorithms', at the Schloss Dagstuhl in Wadern, Germany. This delightful chateau up in the Schwarzwald was host to many distinguished researchers, plus myself, for a week long workshop on a problem which many of us face: how to evaluate algorithms.

There is the beginning of a movement within the image processing community to adopt more of a systems engineering approach to algorithm design. This requires that the developers of algorithms provide what engineers in other disciplines take for granted: performance information. This has been a long time coming, as extensive testing is very time consuming and is often not considered to be valuable new research. However it will enable researchers to quantify the improvements that their algorithm offers over existing techniques. It will help users to select the best tool for the job and allow potential investors in the technology to determine whether CV will work for their application, on a less ad hoc basis.

Sounds great. Unfortunately computer vision is a complex beast, and quantifying the performance of an algorithm and the conditions under which it is operating is no simple matter. The attendees split into workgroups to consider various approaches to the problem, such as modularisation of algorithms and the propagation of errors, the difficulties in obtaining groundtruth and the possibilities of more standard databases.

There were also many papers (well, too many to list in full here anyway). These ranged in focus from the general to the very specific. Robert Haralick, Wolfgang Forstner and Dov Dori and others discussed their methodologies for general performance characterisation work, which set out much of the framework of what was to follow. Work on segmentation and feature detection validation was described by Wiro Niessen, Max Viergever and Murray Loew. Patrick Courtney and Ishin Phillips discussed database issues. Maria Petrou, H. Siegfried Stiehl and others elaborated on evaluation of recognition and reconstruction algorithms. Luc Florack and Mads Nielsen aired their views on optic flow and Visvanathan Ramesh and Dmitry Chetverikov focused our attention on motion tracking. Finally it was left to Reinhard Klette, Detlef Richter and Fridrich Sloboda to give the proceedings real depth with their work on 3D scenes. Most were informative, some were even

entertaining. My apologies to the presenters of the many other excellent papers whom I haven't mentioned.

I believe that around 3:30 one morning a small but dedicated group in the Schloss wine cellar finally managed to solve all the world's problems. Unfortunately no one could remember the specific details the following morning. The safest overall conclusion is that more work needs to be done.

For more information on the developments in performance evaluation, see the page set up by Patrick Courtney at the ECVNet website:

`http://pandora.imag.fr/ECVNet/benchmarking.html`

This has links to related activities and a bibliography of evaluation related papers. For a good general introduction to the area, try the work of Wolfgang Forstner or Robert Haralik.

Many thanks to the organising committee for their splendid work.

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## Image and Signal Based Analysis of Pigmented Skin Lesions

**BMVA Technical meeting**
**British Institute of Radiology**
**London 18 March 1998**

The meeting was opened and chaired for the day by Dr Ela Claridge from University of Birmingham. She welcomed everyone and noted the good spread of interests present with engineers, physicists, computer scientists and clinicians and hoped this would help to spawn new ideas.

Mr Per Hall a Plastic Surgeon from Cambridge started the session by describing the clinical problem and the solution he would like to see in the future. He pointed out that many presenting lesions were very easy to classify as worrying or friendly ones and that this was sufficient for a first line screening system. The real problem to be solved was providing the same separation for the large group of less obvious lesions. Many showed similar image features but had totally different clinical diagnoses. He noted that thickness was important and that it had been shown that lesions that were 1.5 mm thick when removed had a 5 year survival of 95% whereas a lesions that were 3.5 mm thick had only a 35% 5 year survival. Also he described work done in identifying shape and boundary features and identified symmetry and irregularity as important features. Colour was identified as another important set of features which still needed a lot of work to generate useful results. Texture was the last feature set talked about, the smoothness or roughness of the lesion surface was expected to give useful data. It was also important that any system did not give a false negative result and identify a Malignant Melanoma in particular as a friendly lesion. It was better to have an excess of false positives than a false negative.

John Curnow a Biomedical Engineer from Derriford Hospital Plymouth described a large literature review of over 120 papers published in the last ten years on Malignant Melanoma identification. Three main methods had been identified, clinical diagnosis by trained medical staff sometimes supported by Check Lists, Dermatoscopy and Computerised Diagnosis using pictorial images and/or Artificial Intelligence. There were other methods including Ultrasound and MRI that had been tried as yet without success. Computer Diagnosis included image processing and the generation of a diagnosis by statistical or artificial intelligence methods. Image processing used image segmentation, labelling and feature extraction. Each method still had problems and no final solution was identified. A review of the results from the papers showed that overall clinical diagnosis by well trained clinicians was still the best method.

Andy Duller, University of Wales, Bangor, described a boundary detection algorithm. He first identified the requirements for the algorithm as robustness, tolerance to lighting and to inexperience of operator, repeatability and speed. He stated that existing methods using grey scale images had serious shortcomings with either too detailed a border detection producing spurious small results in other parts of the image or coarser techniques that lose detail within the boundary. His method used edge focusing from a grey scale image where a very coarse identification of border is made and then progressively refined within the area of the boundary already identified. This produces a series of boundaries of increasing detail from which a 'best fit boundary' is identified. This method eliminated the identification of areas in other parts of the image and also gave a fine resolution to the final boundary.

Andrew Round, University of Wales, Bangor, described a new idea for detection of the skin lesion. The system is based on detection of skin lines are often disrupted by malignant melanoma. The method of detection is to first filter the image to enhance the lines, divide the image into small patches and identify the skin lines and their direction within each patch. The patches are compared and areas of high disruption identified as possible malignancy. The method has been tried on a very small set of images and it has been shown that it can provide an indicator of malignancy.

The meeting continued with Aida Babaramo, University of Portsmouth, describing a method of coloration analysis from Dermatoscopy images using both RGB and HIS methods to provide new features. It was stated that they were more sensitive than shape features and results of tests on 156 images with 42 Malignant Melanomas showed that by using a ROC curve to identify the best threshold for detection there could be a reduction of 34% in referrals of normals from Primary Care Clinicians with 100% sensitivity.

Jon Morris-Smith, formerly at University of Birmingham, had looked at the comparison of feature descriptions extracted by computer and clinician. As an example he described using fractal dimension to identify the irregularity of a lesion border and had shown that it corresponded closely to clinical assessment when judged in isolation. However textural detail within the border can affect the estimation of border irregularity by a clinician and this could affect the outcome comparisons between computer extraction and clinical assessment. He used this as an example to warn that it is important to take account of interactions of features and other human foibles when developing computerised feature extraction techniques.

Symon Cotton, from University of Birmingham, described a method using combined optical and infrared images that provides depth localisation of melanin. The standard visible light colour plane in the RGB space is shifted if the melanin penetrates the dermis/epidermis border. However the plane is in different places for different papillary dermis thickness and IR images are used to normalise this. Information on epidermal melanin, dermal blood flow and papillary dermal thickness can be extracted.

Dr Jeffrey Bamber from the Institute of Cancer Research, Royal Marsden Hospital, Surrey, described three projects to identify useful features to help diagnosis of Malignant Melanoma. The first method used spectrophotometry to collect optical reflectance characteristics from the lesion. Several features had been extracted and three had been shown to be most sensitive to identification of malignant melanoma. The diagnostic sensitivity was increased by accepting a positive result if any one feature was positive. A method using an ultrasound scanner could accurately identify keratin in the skin and could be used to differentiate between melanoma and basal cell papilloma. It is expected that further development could provide direct identification of melanomas. The third method was based on ultrasound scatterer size detection. It had been shown that this could differentiate naevi from melanoma. It was felt that continued research into combined use of optical and ultrasound methods could yield improvements in detecting benign tumours from the suspicious group.

The final paper by John Curnow from Plymouth described a database of digitised images with corresponding clinical features and diagnosis which is being developed at Plymouth. The data was to be collected on over 2000 lesions covering the whole spectrum of normal and abnormal types. This was to be used as the basis of a method of detection of suspicious lesions and was also to be made available to groups of researchers via the Internet. It was expected that it will take several years to collect the full database which it was hoped will become the standard for testing and comparing methods for melanoma detection.

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## MIUA-98

The Medical Image Understanding and Analysis conference took place in Leeds on July 6th and 7th. There were 116 delegates (of whom 34 were BMVA members), 28 speakers (representing 20 institutions) and 12 posters. Voxar and Floating Point Systems exhibited. So much for the statistics.

MIUA (only pronounceable as "miaow") was first held in Oxford in 1997 and provides a forum for the whole range of medical imaging interest – this is very broad. This breadth was accommodated successfully by running a single track conference in 7 sessions giving space to all topical issues; a simple calculation reveals that individual presentations were short (15

minutes plus questions) and the session chairs were careful to keep things on schedule. Such a constraint on time turned out to be very good discipline for the speakers, and talks were characterised by high quality delivery and AV in which speakers of necessity went straight to the point, with no opportunity to use bandwidth on tangential issues. Printed proceedings provided the references and supporting material the audience might have required.

What any individual might regard as the highlight of the conference would depend on personal interest and it might be hard to find a majority view. Everyone this reporter spoke with over coffee agreed that there was "something for everyone", and it would be inappropriate to single out any particular topic for special mention. Having said that, two themes which surfaced more than once that took personal attention were evaluation, and the nature of demand for 3D data. Evaluation, both of machine systems against clinical opinion and of various clinical opinions among themselves, provided some interesting and provocative results. Whilst it may not be true to say that machine systems are trying to hit a moving target, the target's precise location may depend on who you ask. Similarly provocative was a clinician's enquiry about whether 3D information was actually necessary; all those designing visualization systems, please note.

The conference was dominated by computer scientists, mathematicians and physicists; indeed, on the first day a question to the audience elicited the information that only two people in the room had medical qualifications – this was an underestimate as various clinicians made themselves known over the two days, but it remains true that this was a "computer" event, augmented by a respectable contingent of mathematicians. Many of the talks were given by PhD students and this provided an excellent opportunity for them to gain experience in front of the expert community; they all acquited themselves very honourably.

The posters provided content as interesting and varied as the talks, but of more variable quality. Poster authors sometimes need to remember that this is a mode of presentation that requires more than verbatim translation from a paper or prepared talk.

The Conference does not award prizes, but a personal view was that for quality of presentation and delivery, Alan Jackson's talk "Improving time of arrival map quality in MR perfusion" stood out, while the best crafted poster was produced by Shark et al. of Central Lancashire on virus classification. There were many quotable quotes: The "If it works, leave it alone" award goes to Neil Thacker (Manchester) for his remark "I don't care about Fourier domain characteristics"; the "Best answer to an illustrious professor of statistics" award goes to Graeme Penney (Guy's) for "I'm just going to have to nod"; the "Be careful with this" award goes to Hava Lester (UCL) who counselled care with her warping procedure: "It can be dangerous if you don't know what you're doing - especially if you're doing brains"; and the "Most applicable work" award goes to Daniel Poxton (Manchester) for the observation "Neuroscientists assure me this is of some kind of interest". The "Making academics feel uncomfortable" award was won easily by Paul Taylor (UCL) for his remark describing "a whole bundle of measures that work well enough to get published but not well enough to get used". Mike Smith's (Leeds) wildly inaccurate introductory remarks describing Leeds architecture are best left unrepeated.

Congratulations go to Liz Berry of Medical Physics in Leeds who managed a thoroughly interesting conference, complete with highly successful dinner; the only technical hitches were attributable to the builders next door who began drilling to Australia (but were quickly halted) and to Bill Gates, whose software performed as normal (Liz was not up to solving this one...). Details of MIUA, including information on next year (Oxford) and availability of this year's proceedings are at `http://www.miua.org.uk`.

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## Computer Vision for Virtual Human Modelling

This colloquium held at the IEE, Savoy Place on Thursday 9th July and was cosponsored by the IEE, BMVA, UKVRSIG and VRS and chaired by John Illingworth and Adrian Hilton of Surrey University. The attendance was the most striking tribute to the day and the interest the meeting generated surprised even the organisers. The day presented work within the field of Human Modelling, Interaction and reconstruction from various academic and industrial perspectives but with the bias toward Computer Vision techniques.

The day opened with a talk by B. Roehl from the University of Waterloo, Canada entitled Modelling

and Animation of Virtual Humans. In this talk various approaches to modelling were discussed along with the need for standards. He introduced H-Anim, Humanoid Animation Working Group and covered its objectives and hopes for the future of Human Modelling. Based on VRML97 the standards evolving exist for the sole purpose of creating generic VRML representation for humanoids. The take home message was to visit the website `http://ece.uwaterloo.ca/~h-anim` and get involved via the mailbase with the next version of the standard.

Adrian Hilton then went on to demonstrate how H-Anim models could be used to produce realistic models of individuals for virtual worlds. By capturing four orthogonal colour views of a subject and automatically mapping these textures onto a H-Anim model, it was demonstrated how a realistic animated avatar could be created. The interested reader is directed to `www.ee.surrey.ac.uk/Research/VSSP/3Dvision/VirtualPeople`

Next on the podium were Andy Mortlock and Stephen McConell from BT Laboratories for an interesting talk about automatically creating 3D animated models of an individual's head from three orthogonal views. After acquisition of front and profile images, landmark points are identified and used to stitch these images into a cylindrical texture. This texture is then wrapped around a generic 3D model and the model shape altered to conform to the landmarks identified. It was then shown how this model could be animated in real time using BT's Text-to-Speech software, with impressive results.

The final talk of the morning session was by I.A. Karaoulova from Cardiff University and described preliminary work in the area of extracting 3D articulated models of humans from a video sequence. The process relied on heavy user intervention to assign key-frames, which are then used in the fitting process. It will be interesting to see the final results of the work.

Due to the late registration of many delegates, the lunch was rather over subscribed so various factions formed and retreated to the solitude of local public houses where in-depth discussions of the work continued, along with the consumption of beverages ;-)

Upon returning, the poster session was well underway and my only criticism of the day would be that the large number of people made it difficult to gain access to the posters. Unfortunately space also means that I must gloss over the session which is unfortunate as poster sessions rarely get the attention they deserve. My apologies to the authors.

David Hogg from the University of Leeds opened the afternoon session, demonstrating how they have extended their statistical human body tracker to model and predict human behaviour and interaction by augmenting the statistical model with probabilistic constraints.

Mark Wells of Televirtual entertained the audience with a look at their motion capturing and editing software and demonstrated the possible applications with synthetic video sequences they have produced. Also demonstrated were sign language motion sequences and facial animations, providing us with an insight of both what is possible and where the future of human animation may lie.

Next was the familiar face of Paul Siebert from the University of Glasgow demonstrating the C3D technology, which we have all had the pleasure of experiencing first hand at the last couple of BMVC's. He then went on to discuss the 8-pod full body scanner currently under development and current success with an 'all-round' version of the C3D system using a turntable approach.

After tea the talks reconvened with a presentation from L. Dekker of UCL who discussed the problems of automatic landmark point extraction from 3D models of humans. The talk was illustrated with work that has been performed on the 'Electronic Tailor' to extract shape and size changes in the female body.

The penultimate presentation of the day was from Shaogang Gong of Queen Mary and Westfield College who discussed using head pose and body gesture for computer interaction. Demonstrating how computer vision techniques can be used to automatically control active cameras.

Last but by no mean least, was a talk by Gordon Clapworthy of De Montfort University who brought us back to the virtual environments perspective from which the day had started. Gordon gave an informative overview of issues and an insight into his current work.

In summary the meeting was a great success as attributed by the number of delegates and pointed out the overlaps to many researchers, which they may not have been aware of. For this reason I believe that the event has the potential to become a regular event and look forward to attending a similar colloquium, perhaps in 12 months. My congratulations to John and Adrian for an interesting and informative day.

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## Software Engineer

### (Teaching Company Associate)

### Napier University and Hampton Data Services Limited

**Salary:** 18K to 26K (depending on qualifications and experience)

**Location:** Surbiton, London.

**Position 1:** Immediate Start

**Position 2:** Start Early/Mid 1999 (this would suit an undergraduate entering their final year of study)

**Description:** Hampton Data Services Ltd provide paper chart vectorisation, data handling and document storage software products and services to the oil industry. The company is a small but growing operation of currently 28 employees with mainly international customers. The company in collaboration with Napier University has recently been awarded a Teaching Company Scheme grant from the Department of Trade and Industry for the development of next generation versions of its core software products. The development methods and technologies will include Win32, object orientated software, internet and Microsoft client-server techniques, graphics and computer vision with artificial intelligence enhancements.

The grant provides two graduate software engineers to work as members of the development team. The duration of this support is two years for each individual post with a one year overlap. It is expected that each position shall become permanent at the end of two years service subject to satisfactory performance. Due to the enhanced postgraduate training and support from the academic partner, this opportunity would particulary suit new or recent graduates.

In addition to the technical experience that will be gained from the software development, the Teaching Company Scheme supports additional professional and postgraduate technical training in a structured career development programme. Successful candidates will be encouraged to register for a postgraduate qualification at Masters or Doctorate level with the University and also to register with the appropriate professional institution leading to chartered status.

Potential candidates will require a minimum of a 2.1 honours degree in either software or computing disciplines (a postgraduate qualification and/or relevant experience may also be used to substitute a lesser degree). Good software design and implementation skills are essential and previous experience of image processing, artificial intelligence and Microsoft Windows software development would be a distinct advantage.

Further details of the position and guidance for applicants can be obtained from:

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