# 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, 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 28th April 2000.

## 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.

## Prizes at BMVC99

Following the tradition of previous BMVC's, the conference banquet at BMVC99 in Nottingham last September (it seems an age ago now!) saw the awarding of prizes for excellence.

The funding of the Conference prizes is provided from a variety of sources. The prize for the best applications paper (the Industrial prize) has been provided, on a long-standing basis, by Computer Recognition Systems Ltd, through the generosity of its Managing Director, Bill Adaway. More recently, the UK Industrial Vision Association (UKIVA) has become involved with the themed industry day at the conference, providing support for the demonstration prize. This prize is intended to encourage contributors to the conference to bring live demos of their research.

The two remaining prizes are provided by the BMVA itself, based on recommendations from the paper reviewing, and with final selection by the conference organising committee. The Science prize is intended to recognise outstanding achievement in the advancement of our field. The Poster prize is awarded to the paper that combines a high quality content with a matching presentation style.

The occasion of the conference was an appropriate occasion to announce the award of the first Sullivan Doctoral Thesis prize. This prize is awarded in memory of Geoff Sullivan, a founder member of the BMVA, who died in 1996. The prize is supported from a fund established last year by voluntary contributions from a variety of industrial, academic and individual sources, including Geoff's family.

The Science Prize (£250) was awarded to the paper by Sami Romdhani, Shaogang Gong and Alex Psarrou from University of Westminster and from Queen

Mary and Westfield College London for their paper entitled "A multi-view non-linear active shape model using kernel PCA".

The Industrial Prize (£250) was awarded to the paper by Tom Drummond and Roberto Cipolla from the Department of Engineering at Cambridge University for their paper entitled "Real-time tracking of complex structures with on-line camera calibration".

The Demonstration Prize (£200) was awarded to Aphrodite Galata from the School of Computing at the University of Leeds, for the demonstration based on the work in her paper entitled "Learning behaviour models of human activity".

The Poster Prize was awarded to K. Messer, Dick Ridder and Josef Kittler from the Department of Electronic and Electrical Engineering at Surrey University for their paper entitled "Adaptive texture representation methods for automatic recognition methods".

The Sullivan Doctoral Thesis prize was awarded to Neil Johnson from the School of Computing at the University of Leeds for his doctoral dissertation entitled "Learning object behaviour models".

Our congratulations and thanks go to all these individuals whose achievements have been acknowledged by these awards, and our encouragement to all authors at future BMVCs.

All the papers and the thesis are available on the BMVA Web page at `www.bmva.ac.uk`.

Further details of the Sullivan Doctoral Thesis Prize can be found in the **Prizes** section of the Web pages, and completing PhD students and supervisors are invited to submit their dissertations for consideration. The prize may be awarded on an annual basis for important contributions in the broad areas of computer vision, including computational studies of natural vision.

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## BMVA Distinguished Prize

At its February meeting, the BMVA Executive Committee decided that the Association should each year award a special prize to the person who has contributed most significantly to the subject over an extended period, and who has made his or her own special mark on the subject. The prize will be awarded at the Annual Conference in September, and the Committee will take soundings over the previous 6-8 months to determine who will be the most appropriate recipient. It was decided that, to be eligible, the recipient should be resident and working in the UK, and that the scope of the work should fall within the normal remit of the BMVA. All members are therefore invited to send suggestions about possible recipients, at the latest by 30 April, to the Chair of the Association:

Maria Petrou
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It is recommended that any suggestions be accompanied by not more than 100 words (and maybe far fewer) giving reasons why the person in question is considered to be especially distinguished and worthy of the prize.

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## Sullivan Doctoral Thesis Prize

******** *Attention PhD supervisors* **********

*Submission Deadline : Friday 28th April, 2000*

The BMVA Executive Committee has established a prize to commemorate the contribution made by the late Professor 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 is awarded 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.

Submissions are requested from individuals who have successfully completed their doctoral degree during the last calendar year (1st January – 31st December, 1999). Electronic or paper submissions (two copies of the thesis) should be sent to the BMVA Secretary (see address below). Submissions should be supported by a 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 on the BMVA Web page (`www.bmva.ac.uk`).

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 July. The presentation will be made at the conference dinner of the British Machine Vision Conference, held this year at the University of Bristol, 11–15th September. The successful author will be encouraged to publish the thesis on the World Wide Web if copyright permission is granted.

BMVA Secretary: Dr. Tim Cootes, Dept. Medical Biophysics, University of Manchester, Stopford Building, Oxford Road, Manchester, M13 9PT. Email: `t.cootes@man.ac.uk`

Professor Maria Petrou
BMVA Chairman
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## EPSRC Update

EPSRC support for Machine Vision research has been thriving in 1999. Twenty one research grants (compared with eleven in 1998) have been awarded through the Systems Architecture "responsive mode" operation of IT & Computer Science programme, covering a wide range of research areas within machine vision and image processing (including texture analysis, document analysis, mammography and other medical applications). In total, over £3M worth of grants were awarded in this way. It is encouraging to note that four of these grants were funded under EPSRC's "fast stream" for first-time applicants (compared with two in 1998). Support for such young researchers is clearly important for the future of the UK research base in the field. Machine Vision and related subjects remain an active area for the use of EPSRC Quota Awards; there are currently almost 90 awards in these research areas, which constitutes over 10% of all IT&CS quota awards.

While Systems Architectures provides the main funding stream within EPSRC for generic machine vision research, Machine Vision and Imaging research remains an area that is strongly supported by the EPSRC as a whole. No fewer than 8 subprogramme areas supported grants in this area 1999, and this includes 2 managed programmes (Physics for Healthcare and Healthcare Informatics). All three of EPSRC's engineering programmes have supported Machine Vision research grants in 1999. Machine Vision researchers have been very successful in seeking funds through the Healthcare Informatics Programme, which is jointly sponsored by IT & Computer Science and Engineering for Infrastructure, the Environment and Healthcare Programmes. Almost £2M was awarded to 10 projects investigating a range of medical imaging research problems. However, involvement of industrial partners is disappointing for this research area. Not including grants awarded as part of managed programmes (where industrial collaboration is normally a requirement), only a handful of grants have any sort of industrial collaboration.

Total EPSRC commitment in 1999 to new grants relevant to Machine Vision was almost £7M. In light of the EPSRC's commitment to multidisciplinary research, it is heartening to note that no fewer than 21 Machine Vision-related projects received joint funding from more than one EPSRC programme area.

In keeping with the concept of the multidisciplinarity of Machine Vision research, the EPSRC will be holding a Machine Vision Theme Day in 2000. The purpose for holding a Theme Day – and the EPSRC holds approximately 5 a year – is to look at a subject area that spans a number of different EPSRC programme areas by evaluating a range of grants funded in this area over a fixed time period. Additionally, the Theme Day will provide a review of the Integrated Machine Vision Programme and the Imaging Understanding Environment (IUE) programme. Further details on these policy initiatives will be released as plans are finalised later in the year.

Further information on EPSRC support for Machine Vision research can be found through our web site `http//:www.epsrc.ac.uk`. Any specific queries you might have can also be addressed to me by phone, fax or email. I look forward to hearing from you. On a

final note, the IT&CS programme will be undergoing a reorganisation and modernisation as of 1st April, 2000. This will have the effect that Machine Vision (Image and Vision Computing) research proposals currently considered by the Systems Architectures theme, will be considered as part of the new Software Technologies theme; I will remain the EPSRC contact.

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# Industrial Inspection

On the 1st of December, the BMVA technical meeting on Industrial Inspection was held in association with UKIVA and IEE/E4 in London chaired by M. Mirmehdi of the University of Bristol. Nine talks were presented covering a wide variety of industrial inspection applications, system design methods and optical technologies.

## Applications

Prof. Davies of the Royal Holloway College of the University of London described the development of algorithms for real-time inspection of grain contaminants. A robust method based on linear feature detection masks was developed and implemented on a general purpose computer meeting the required inspection rate of 3 kg of grain in 3 minutes. On the other hand, the vegetable defect detection system presented by A. Ripke of the University of Aberdeen made use of computationally intensive adaptive Markov random field cluster segmentation which was implemented on a field-programmable gate array and transputer card fitted in a general purpose computer.

M. Evans from the University of Bristol discussed the development of a vision system for the automatic detection of defects in the bodywork of vehicles using several cameras for vehicle imaging. Camera images were aligned by an affine transform to a template image of the vehicle from the respective viewpoint and the transformed image was frame differenced from the template image to reveal candidate defect regions. By extracting features from each potential defect region and using a small set of heuristic rules to reject non-flaw regions, the false alarm rate was reduced.

## Vision System Design

A number of talks were concerned with vision system design aspects. G. Awcock of the University of Brighton emphasised the need to impose, or take advantage of, scene constraints which include: material characteristics, such as opacity; inherent features, such as the isolation of printed text; models, such as product CAD designs; and context, such as postcode structure. It was shown how control of object features, object position in the scene and illumination can be used to impose scene constraints to make the inspection solution feasible.

From the University of Cardiff, M. Daley presented a remotely operated prototyping environment for automated visual inspection which is being developed to aid prototyping and diagnosis of inspection systems at remote locations via the world wide web. The system allows the control of a flexible inspection cell that has different object lighting and viewing facilities. This enables the interaction of a machine vision specialist with a non-specialist at a remote location to diagnose, or prototype, a vision inspection system for the required components in the environmental conditions of the remote site.

A general theoretical framework for the analysis of rigid body transformations in two and three dimensions was presented by M.A. Rodrigues of the University of Hull. This is the initial necessary step for the camera calibration in a system being developed to inspect 3D manufacturing components which, in this particular case, included air filter components.

The problem of selecting the smallest number of views to adequately view a 3D object was discussed by A.D. Marshall of Cardiff University. A visibility graph – which could be generated directly from the object CAD model – was used where nodes correspond to object faces and arcs connect nodes satisfying similar viewing constraints. The viewpoint planning strategy proposed was then based upon grouping nodes into sets having common viewpoints.

## Optical Technologies

Two presentations demonstrated the applicaton of different optical technologies for specific tasks. V.

Smutny of the Czech Technical University of Prague showed how laser range-finding was used to obtain the profile of samples of rolled products. The contour was then matched to a CAD model of the product using an iterative closest point algorithm. Salient profile dimensions were then measured achieving an accuracy of ±0.05mm in 100mm in approximately 20 seconds.

The use of X-ray machine vision for on-line poultry inspection was discussed by M. Graves of Intelligent Manufacturing Systems Ltd. where a system to detect the presence of bones in poultry meat was developed. Image analysis was particularly difficult since meat pieces could be lying on each other resulting in a cluttered image. To detect bones robustly the system relied on grey-scale morphology and neural network classification trained for the size and shape of poultry bones. Rejects were manually inspected and the result of manual inspection was compiled into a knowledge base and used to improve the vision system performance and reduce false rejects.

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## Image Processing, the Fundamentals

by M. Petrou and P. Bosdogianni

Wiley, Chichester, England, 1999, ISBN 0-471-99883-4 pp. xx+333

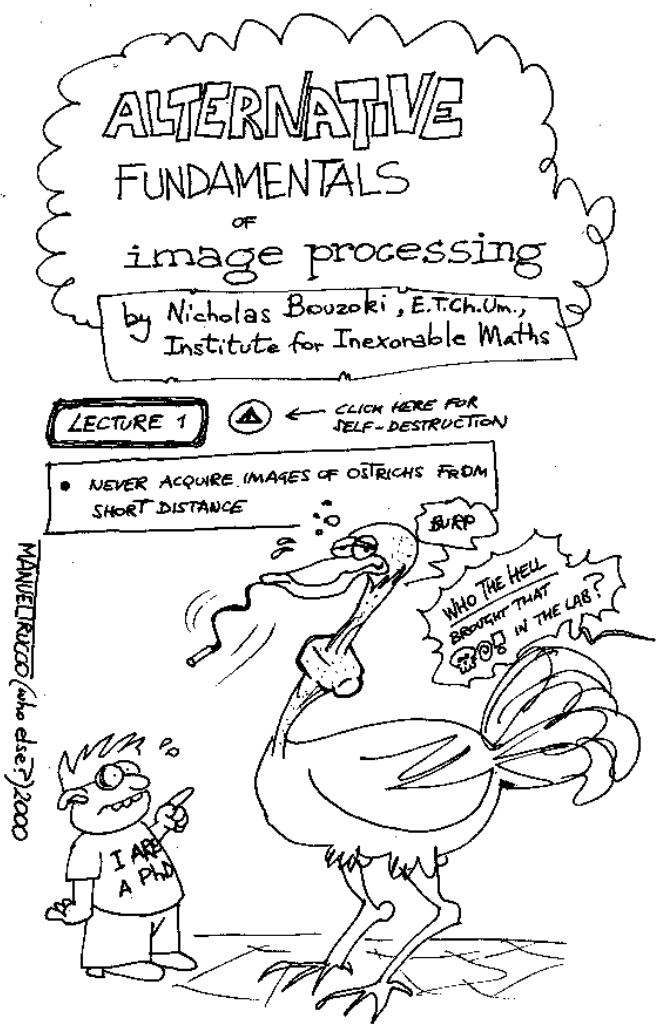


Image processing is now becoming a mature subject, and is at the core of a number of disciplines ranging from remote sensing to computer vision, artificial intelligence, robotics, industrial inspection, surveillance and forensic science, to name but a few. Indeed, it is difficult to see how high-level vision concepts and applications can be discussed in the absence of profound knowledge of image processing techniques. It turns out that many of these techniques are mathematical in nature, their rigorous treatment stemming naturally from application of calculus, geometry and trigonometry in a continuum, on the one hand, to application of matrix manipulation methods, statistical descriptions and transformations in a discrete lattice on the other (with all the sampling and related problems involved in relating these two disparate aspects). This fundamental dependence on mathematics poses many problems for the lecturer, as there are relatively few students, even at MSc level, who are completely happy with mathematical manipulations – a factor that is all the more serious when learning a new subject, as the emphasis then falls naturally on the latter. The present volume recognises these facts and aims to impart rigorously mathematically based knowledge and understanding to those on relevant (particularly MSc) degree programmes, though it is also highly relevant to engineers and scientists practising applications of image processing.

At xx+333 pages, the volume is substantive and its seven chapters concentrate on providing a sound founding on image transformations, statistical descriptions of images, image enhancement, 2D filters, image restoration and image segmentation, including edge detection. Within these chapters I found a

somewhat unusual emphasis on the more mathematical topics and treatments (especially those based on matrix manipulations), though this is perhaps natural in a book which aims to provide incisive views on how the mathematics of the subject should be approached: it is also perhaps a reaction to other texts which play down such aspects.

In general the subject matter is covered in a 'nuts and bolts' manner, showing the student both why the mathematics is the way it is, and how to approach it to obtain the required answers. This is achieved by including many worked examples (in boxes) – often using small images or small windows on the images – which give a mathematically sufficient and useful approach to many relevant points. In addition, the mathematics is arranged in two levels – a moderately low level accompanying the general narrative, and a higher level in which (grey) boxed material contains the more advanced and rigorous mathematical treatments. However, these are not the only tools which are used to help with teaching. In fact, the Contents immediately reveals to the reader that this is a book with a difference: each chapter heading in the Contents is followed by some 30 to 40 questions which will be answered within the chapter. In fact, the whole treatment is question-answer orientated. This gives a certain feel which takes some time to get used to, but the authors make it work and certainly the result is a book which is able to get the student right into the mathematical core of the subject, and to face difficulties head-on. While this is generally an advantageous approach, I have one or two personal misgivings: the Contents necessarily appears rather unstructured, and this throws more emphasis than usual on the use of the Index, which is, incidentally, well compiled; secondly, there is less in the way of pure narrative than in other books on the subject, so much material having been hived off and appearing in the question sections, the example boxes and the grey advanced mathematics boxes. On the whole, I would have preferred a more extended narrative, with perhaps half the number of questions, these being placed where really involved material is dealt with. However, this is largely a personal preference, and a very great deal depends on the readership: for example, in a closely cosseted MSc course, the lectures themselves would supply the narrative, and the difficult questions could be left to this volume. Similarly, for a reader possessing both this and a more conventional text, this book could provide the answers to many crucial questions. It should also be remarked that the relative lack of references to the literature – 30 in fact – will in general necessitate use of a more conventional text to provide the huge body of applicative information required by MSc and *a fortiori* PhD students and practitioners of the subject.

Such are my teaching and research interests that I welcomed the inclusion of detailed treatments on matrix manipulation, SVD, K-L transforms, eigenimages, linear programming, and such topics as the La Vallee Poussin theorem; and also boxes and questions on Lagrange multipliers, ergodicity, optimal edge detectors and Rice's formula relating to zero crossings of filtered noise. To some extent I was disappointed to see very little on median and rank-order filters, and nothing on mathematical morphology or Hough transforms (though the latter can be taken to be an intermediate level vision technique and mathematical morphology is also used to mediate intermediate level tasks). However, these are again personal matters, and in any case, it has to be recognised that a single book cannot nowadays take in the whole subject without dying a death of superficial coverage of vast lists of topics. Really, a book of this type must be judged in its own terms, which in this case relate to scope (pure image processing), level (MSc), emphasis (mathematical), style (didactic, via numerous questions, excellent worked examples and boxes of advanced material). In this context, it is of no little importance that each chapter ends with a 'take home' message containing very sharp, pertinent points. Finally, it should be remarked that the book clearly has an unannounced side aim of breaking new ground in the teaching of mathematical subjects, and this is definitely to be applauded.

Overall, I am thoroughly impressed by the presentation, rigour and readability of the book, and can recommend it unreservedly for students who find its subject matter matches the courses they are taking. There will also be many practitioners who will want to have this book on their shelves to answer at relevant moments the vital questions that lie between its covers.

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