

# 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 20th September 1996.

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## Editorial

As ever, the vision calendar is jam-packed, and the evidence is given by all the meetings reported on in this issue. We describe two one day technical meetings which were co-sponsored in turn by the RSS and IEE. Then there are the calls going out for submissions for two more forthcoming BMVA technical meetings, titled: "Low Level Feature Extraction" and "New approaches to dynamic filtering". For those of you (like myself) unlucky enough to have missed the highly successful ECCV we bring you the cultural and technical highlights. While finally, just in case you felt like relaxing, there's an update on the approaching BMVC - it sounds like there's a busy program, and don't forget your T-shirt!

## Award

Professor Roy Davies has been awarded a DSc by the University of London for his work on the science of measurement including signal processing and machine vision.

## Image Understanding Environment (IUE)

The IUE is an object-oriented class library designed to support research in machine vision and image understanding. It is implemented in C++. The following background information can be found at the net site of Amerinex Applied Imageing (AAI), the US company who are responsible for the implementation of the IUE, reproduced here with kind permission of AAI.

### General Background Information

The Image Understanding Environment (IUE) project is a five year program, sponsored by ARPA, to develop a common object-oriented software environment for the development of algorithms and application systems. The primary purpose of the IUE is to facilitate exchange of research results within the Image Understanding (IU) community. The IUE will provide a platform for various demonstrations and tools for ARPA applications. These demonstrations and tools will become a primary channel for IU technology transfer. The IUE will also serve as a conceptual standard for IU data models and algorithms. The availability of standard implementations for basic IU algorithms will facilitate performance evaluation of new techniques and to track progress in algorithm improvements. The IUE is designed to support significant evolution of IU approaches and an effective programming environment for rapid prototyping. The ultimate goal of the project is to provide a software infrastructure of class hierarchies, user interface tools, and IU algorithms that are required to carry out state of the art research in image understanding.

The IUE is not currently designed as a real time system although tools will be provided for the simulation of real time applications such as navigation. The IUE will not directly support special hardware accelerators but a standard image processing interface will be provided. There is no intention to generate a design suitable for embedding in larger systems, although the individual object class components can certainly be used in the construction of new systems.

The goals of the IUE are to provide:

- **Research Productivity:** through a standard object-oriented interface for the development and sharing of IU software.

- **Technology Transfer:** via a platform for demonstrating the benefits of IU algorithms in the context of user application models.
- **Education/Development:** support by providing a consistent and standardized format for encoding IU algorithms which is suitable for teaching and as a base for further development of IU technology.
- **Computational Models:** that provide the basic data representations and associated operations which any IU architecture must support.

Amerinex Applied Imaging, Inc. leads the IUE development team, which has included ADS/Booz-Allen, Carnegie-Mellon University, and Colorado State University. The development plan is for a staged three year effort. In the first year, the development team revised the specification, integrated prototype code, and implemented the class hierarchy of the IUE Basics, a core IUE system in C++ that serves both as the development environment for the full IUE system and provides a vehicle for evaluation and testing of the IUE design.

The second year effort extended the IUE Basics into a more complete system called the IUE Core. This core is designed to provide an IU class hierarchy suitable for the development of sophisticated IU algorithms, a user-extensible graphical interface, data exchange tools, and control mechanisms for the application of complex algorithms in a research environment. IUEv1.1, the first public release of the IUE Core, is now available from Amerinex via anonymous ftp.

With the release of the IUE Core, the development team has begun the third year effort directed at the implementation of a wide selection of IU algorithms to be distributed with the IUE class hierarchy. These algorithms (the IUE Libraries) will be specified by the IUE Technical Committee in conjunction with Amerinex, and are intended to provide a broad collection of state-of-the-art tools to the IU research community. The third year also includes plans to extend and enhance the visualization and data interaction IUE Core.

### What The IUE Core Will Contain

The Core will contain the usual containers (arrays, lists, sets etc). They are based on the Standard Template Library (STL) but provide functionality consistent with other IUE classes. It will also contain

- images (2d,3d, Nd)
- spatial objects (geometry and topology) in 0,1,2,3,Nd)
- co-ordinate systems
- sensors, including camera models
- data exchange (DEX)
- GIU (interaction, viewers, browsers)

The DEX classes will allow applications to exchange data in a platform-independent fashion and between IUE and non-IUE software systems. For detailed information on the other classes you need to obtain or browse the IUE documentation which is available from any of the sites listed below. There is an overview manual and a primer which discuss the philosophy underpinning the design and examples of IUE application programming.

## Public Domain

You can use IUE code inside your applications and sell or give it to someone else without licensing problems. This means that the IUE has to use public domain software itself where needed. It uses STL as a basis for generic containers, Fresco for the GUI, and SLAPack for numerical mathematical support.

## Object-Oriented, Written in C++

To understand the IUE you must be familiar with the C++ programming language. In particular, IUE extensively uses inheritance and abstract classes to implement sub-types and polymorphism. It advocates a generic style of programming (in common with STL) in which algorithms are written at an appropriate level of abstraction so that they become as widely applicable as possible.

## Release Status

Core V1.1 has been released and is available via ftp from AAI (see below). There will be 3 quarterly releases throughout 1996 and V2.0 will be released in Feb 1997. In V1.1 there are no display facilities but this will be addressed in the next minor release which is imminent. I received the following mail from AAI this week (July 5th):

“The next release of the IUE (v1.2) is nearly ready. This release will support gcc 2.7.2 (the port to

2.7.2 is what is holding up the release). It will have smaller libraries (on SunOS4 the libraries are 50MB rather than 122MB in v1.1), the alpha GUI based on Fresco96 (able to display basic 2D spatial-objects, images, and image-features), tools to construct Khoros glyphs for IUE functions, example tasks and cantata desktops, improved documentation, and more classes. We plan to release v1.2 by the end of next week.”

## The UK IUE Project

The potential benefits for the UK Image Understanding community to exchange code and results by adopting a common environment has not been missed by EPSRC. A UK evaluation project has been funded which will attempt to ensure that the IUE will provide the functionality needed by UK vision research groups. A number of sites (including Manchester) will be funded to implement vision research applications using the IUE. You may have seen the call for applicants on the net in recent months. The primary goal is to assess the IUE design and thus contribute to the design and implementation of the IUE. UK requirements will be identified and new IUE-compatible classes will be added to the IUE as a result. Manchester will also adopt a co-ordinating role, to prevent duplication of effort and to provide assistance and support for UK users. This role will begin in August '86.

The IUE will be a large environment containing many well-known vision algorithms and, we hope, well-designed data structures. It is still undergoing design changes. The best way to ensure that it will contain what you may need for your applications is to try and use it and give feedback to the developers at AAI. So, even if you are not involved in the UK project, and if you think that the IUE may be of benefit to your research in the future then you are strongly recommended to install it and try it out. You will need a reasonably powerful machine, eg a Sparc20/UltraSparc with 1Gb disc and 64Mb memory. IUE will also run on a suitable PC using Linux.

## AAI addresses (USA):

<http://www.aai.com>

AAI's WWW page, for general doc and html class reference pages

[iue-info@aai.com](mailto:iue-info@aai.com)

For more information about the IUE send a message (with subject "help").

`iue-request@aai.com`

Requests for additional info, releases and documentation.

`iue-help@aai.com`

Assistance with installation and use

`iue-registration@aai.com`

Register as an IUE user, and be placed on the mailing list

`ftp.aai.com`

FTP address from which to obtain releases, doc etc

## European Addresses:

[http://s10d.smb.man.ac.uk/Wolf\\_vis.html](http://s10d.smb.man.ac.uk/Wolf_vis.html)

Medical Biophysics at Manchester University WWW page. Follow the IUE link. This page will contain assistance for users setting up an IUE environment for the first time. It also contains the HTML class reference documentation. It's much faster (in the UK) to access than the AAI site. At the moment it's a bit thin but in the future as the UK-IUE project develops it will contain more useful information. Postscript documentation is available from here.

<http://www.inria.fr/robotvis/projects/iue/main.html>

A new page about IUE has been created at INRIA (France) where you will find a mirror of the html-specifications, source-code and binaries (SunOS4 and SunOS5) of the release v1.1 and information about an European IUE-Summer-Camp on the Riviera!

## STL (Standard Template Library)

STL is a general-purpose library of generic algorithms and data structures (containers) that are designed to work together. IUE containers are based on STL and you are recommended to read the following tome:

“STL Tutorial and Reference Guide”,  
D.R. Musser, A. Saini,  
Addison Wesley, ISBN 0-201-63398-1.

The library uses the notions of Adaptors, Iterators, Allocators and Function Objects. These, and many other class structures are described in general terms in:

“Design Patterns”, E. Gamma *et al.*,  
Addison Wesley, ISBN 0-201-63361-2.

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## Intelligent Image Databases

A full programme of 15 presentations provided value for money to the 40 or so attendees at the colloquium on ‘Intelligent Image Databases’ held at Savoy Place on 22 May 1996. The event was organised by E4 and cosponsored by the BMVA. Technology has advanced such that digitisation of imagery, both still and video, from a variety of sensors is now within the reach and cost of many users and applications. This has brought with a potential data deluge and the attendant problem of how to handle and access this imagery data in a meaningful and efficient way.

Presentations from Middlesex and City Universities by Lichun Wang, University of W of England by Peter Macer and from Abington Partners by David Crellin addressed database issues relating to temporal images and video sequences. Peter Macer entertained on how to summarise a ‘Wallace and Grommit’ video sequence into a set of automatically produced stills each extracted from between edit cuts. With a different slant Dhiraj Mighlani presented methods to segment document images into regions of interest based on texture, graphics or mixed entities enabling such images to be summarised for indexing and retrieval using ‘high level’ descriptions.

A number of papers addressed issues relating to image indexing and annotation. Both Benoit Huet (York U) and Sadegh Abbasi (Surrey U) introduced techniques for shape representation, the former statistically based for line images and the latter using curvature scale space. The joint paper from DRA and Oxford University given by Paul Ducksbury covered a number of different techniques to aid in the generation of image content descriptors. The use of belief networks was presented for combining several region segmentations into a best segmentation. Stephanie Fountain (Reading U) presented a semi-automatic approach for object selection by region growing based on colour and texture measures. Results presented were impressive. Other techniques which featured included n-tuples, from Simon Lucas of Essex University using chain-code strings and from Jim Austin of York using neural associative

memories for molecular databases. Similarly colour as a means to segment and label showed favour, Rick Rickman (Brunel U) used colour n-grams (again n-tuples to lesser mortals) and Graham Finlayson (York U) used colour texture and discussed the effects of colour of illumination on colour indexing.

Presentations were given by Colin Bird and by John Ibbotson from IBM UK. The first addressed the issue of user interface design for a textile designer application using the IBM QBIC system. The second covered issues concerned with content driven navigation of large image databases. Exemplars based on Oil Exploration and Cultural Heritage were presented.

John Eakins (University of Northumbria) described their work on ARTISAN (Automatic Retrieval of Trademark Images by Shape Analysis). After initial segmentation into lines and arcs, regions were created and grouped into either proximal families (on proximity, parallelism and concentricity) or shape families (shape similarity). These were used as the bases for database storage of trademark images. A new trademark query causes the features, regions and families to be created and used to index the database for similarity.

Judging by the comments, discussions and reticence of many to leave at the end of the event the colloquium can be considered to be a considerable success. The papers and presentations were of high quality and the colloquium digest should provide a useful reference work.

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## Report on ECCV96

**Cambridge, England, April 14th–18th 1996**

The fourth in the series of European Vision conferences, held bi-annually since 1988 (Antibe, Santa Margharita, Stockholm), was held in Cambridge from the 14th to the 18th April. The conference, for which the BMVA was the host organisation, was co-chaired by Bernard Buxton (University

College London), and Roberto Cipolla (University of Cambridge, and local organiser). The conference has adopted the model of the BMVC annual conferences, running a single track of podium presentations over four full days. This year some 43 podium presentations were scheduled, and a total of 80 poster papers were available to delegates.

The conference proved to be something of both a scientific and cultural tour de force, with a well structured and coherent program of talks and posters representing a good selection of the best in current computer vision research in both Europe, the USA and world-wide. The conference program was organised into subject areas associated with structure from motion, geometry, stereo, texture and features, tracking, grouping and segmentation, colour, optics and applications. In addition, the main conference was prefaced by a one and a half day workshop on "Object representations in computer vision", and concluded with four one day workshops on: "Computer vision in man machine interfaces", "Conceptual descriptions from images", "Performance characteristics and vision algorithms", and "The image understanding environment". The latter four events took place on Friday 19th April.

The pace of the conference proved both relaxing and congenial for attendance of the podium presentations, and a leisurely stroll around the poster presentations. In fact one of my few criticisms of the organisation of the conference was the lack of space afforded to the posters, which were heavily attended, resulting in some overcrowding. However, overall the facilities provided within the conference venue (the Faculty of Music Concert Hall) proved in the most part, excellent.

As a cultural aside to the main scientific activities of the conference, Roberto had organised a string of musical performances. This began on the first evening of the conference at a reception in the grounds of Robinson College with a string quartet. Later in the evening after dinner, came a recital back in the Faculty of Music concert hall, where for an hour and half we were entertained with music from Schubert and Dvorak, played as a piano duet by two young Italian pianists. The evening's program was completed by an encore from the string quartet. In addition, on the Wednesday evening, preceding the conference banquet in the Hall of St Johns' College, was an organ recital in St Johns' Chapel. The Banquet itself was interspersed with singing by the St Johns' Choir, who completed the evening with a range of popular songs.

On the technical aspects of the conference the ma-

major theme emerged as the analysis of image sequences, particularly for motion estimation. Given this theme, there were surprisingly few video clips demonstrating any working systems. The BMVA collated a number of video submissions to the conference, and these were compiled onto a VHS tape by Tim Trew (Philips Research) and made available for sale at the conference at £10 per copy. (Copies of the video are currently available from John Illingworth at Surrey University).

Punctuality became a byword for the session chairman, where a traffic light system (based on red, orange and green lights) was used to signify ten and five minute warnings to the presenters. The lights were rather intrusive (especially in a darkened auditorium) and served to distract several of the initial speakers. John Aloimonos demonstrated his ability to adapt to new situations by eventually deducing the significance of the lights, and hence demonstrating the effectiveness of an intelligent adaptive mobile vision system.

The conference banquet was used as an opportune moment to present the award for the best scientific paper of the conference. The organising committee, who select the paper were unable to decide between two and hence a joint prize was awarded. This went to Michael Isard and Andrew Blake from the University of Oxford with a paper entitled "Contour tracking by stochastic propagation of conditional density", and Tat-Jen Cham and Roberto Cipolla from University of Cambridge with a paper entitled "Geometric Saliency of curve correspondences and grouping of symmetric contours".

The proceedings fill two large softback volumes (over 1500 pages) and are available from Springer in the Lecture Notes in Computer Science series, numbers 1064 and 1065.

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## BMVC96 Update

**D**id you realise that 1991 was the last year that BMVC visited Scotland? We did in Scotland, as we have had to pay for train tickets since then. But it is now time for delegates to jump on the northbound train again (well, the southbound train for some),

and catch the last glimpses of this capricious British summer in the beautiful city of Edinburgh between the 9th and the 12th of September.

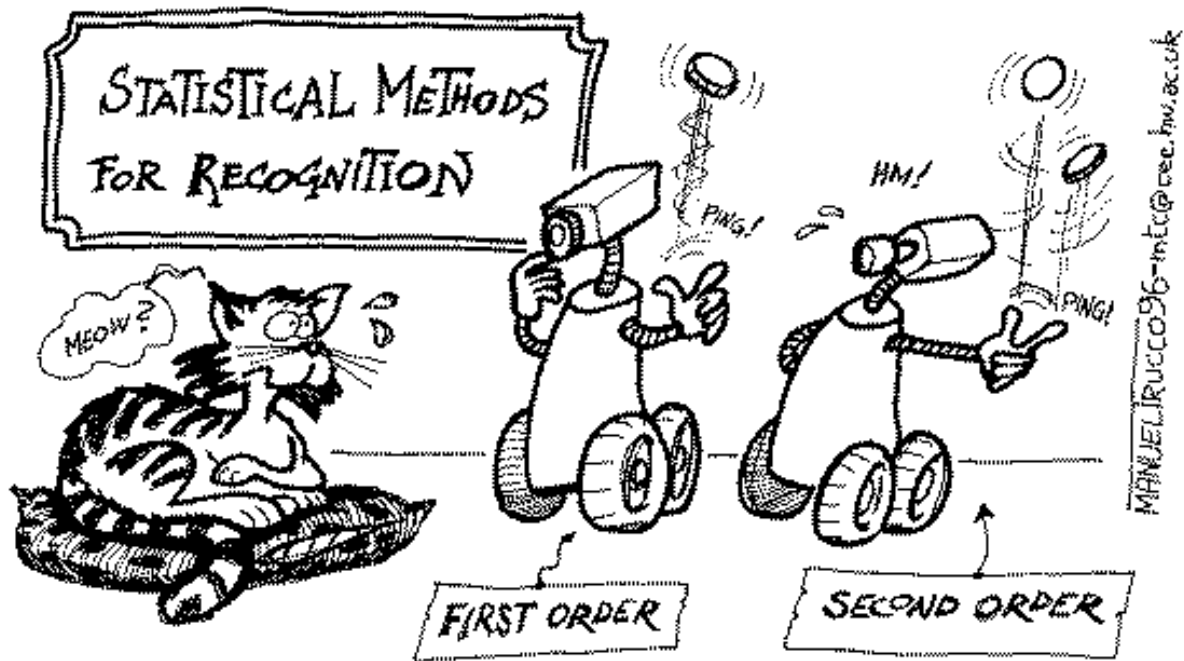
However I am sure that the Scottish late summer wasn't the main reason which attracted the 156 papers submitted to BMVC96, a significant increase since last year in spite of the many other conferences of 1996 (CVPR, ECCV, ICPR, ICIP). The many papers submitted by non-UK research groups, of which 13 will feature in the conference proceedings, are an indication of the international interest for and reputation of BMVC. The quality of most submissions made paper selection a difficult task; sadly, some good papers could not be included in the final 39 oral presentations and 36 poster presentations. There will be two poster and ten oral sessions covering recognition and matching, shape, segmentation, model fitting, motion analysis, deformable models, tracking, active vision, faces and applications. As customary, extended versions of the best contributions will appear in a special issue of the Image and Vision Computing Journal.

What other attractions should you expect at BMVC96, apart from interesting talks, good crack, and hot weather (you can decide afterwards which one was the joke)? First, two invited talks from distinguished speakers, Prof Jan-Olof Eklundh of the Swedish Royal Institute of Technology ("Attention and figure-ground segmentation in active vision"), and Prof Aaron Bobick of the MIT Media Lab ("Computers seeing action"). Second, an intriguing and informative tutorial on "Vision through optimisation", given by Dr Neil Thacker of Sheffield University and Dr Tim Cootes of Manchester University. Last but not least, I am proud to report that BMVC96 is baldly breaking new ground in producing a (insert your favourite advertising jingle now) *conference T-shirt!* Not only can you preview this unique sample of contemporary Italian art at the BMVC96 WWW site, you can book it (yes! yes!) when returning your registration form.

So, get those registration forms filled in now: we are looking forward to seeing you all in Edinburgh. Of course, especially you.

For up-to-date information on BMVC96 (including registration forms, programme, papers, local arrangements, maps, Edinburgh festivals): <http://www.dai.ed.ac.uk/BMVC96/bmvc96.htm>, or contact [bmvc96@aifh.ed.ac.uk](mailto:bmvc96@aifh.ed.ac.uk).

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## RSS/BMVA One Day Meeting

The Research Section and the British Machine Vision Association held a one-day meeting on May 29th, 1996 at Errol Street, London on the topics of 'higher order statistics and shape representation in signal processing and image analysis'. This was the second joint meeting between the societies, following that in December, 1995 on robust vision and robust statistics. The chairmen for the meeting were Josef Kittler (Surrey) and Ian Dryden (Leeds) and about 40 people attended.

The first session of the meeting included talks by Steve McLaughlin (Edinburgh) on the use of bicoherence in speech analysis; Paul White (Southampton) on the use of higher-order statistics for the detection of non-linearities in mechanical systems; and John Soraghan (Strathclyde) on higher-order statistical based speech processing and higher order cepstral based blind equalisation. An engineering viewpoint was given by all three speakers who emphasized practical issues for the detection of non-linearities in signal processing. Some quantities of particular interest were the bicoherence, tricoherence and their Fourier transforms - the bispectrum and trispectrum. The bicoherence is a normalized measure using third order cumulants of a signal at different lags and can be used to detect the phenomena of quadratic phase coupling. The tri-coherence involves fourth order cumulants. Ways to estimate the quantities, graphical display and computational issues were highlighted.

A recurring theme was that a great deal of data needs to be recorded in order to estimate these higher-order statistics. An example of this problem is in speech analysis where subjects may be required to utter particular sounds for uncomfortably large periods in order to obtain reasonable estimates.

Andrew Walden (Imperial College) spoke about the use of kurtosis in deconvolution, describing his experience of using kurtosis for the deconvolution of seismic traces recorded from seismic surveys in the search for oil and gas. The model for seismic traces involves the seismic waveform convolved with reflection coefficients (which indicate the properties of the underlying rock). A stable approach for deconvolving the seismic trace is to carry out spectral whitening followed by maximizing kurtosis to calculate a phase correction. Using the trispectrum a rather strong condition was given for this procedure to work.

In the second half of the meeting the emphasis changed to high level image analysis. Representation of shape in image analysis has traditionally used higher-order statistics such as moment invariants (Hu, 1962). The four remaining talks involved object recognition involving shape and geometrical measures, of which moment invariants are one particular type.

Darren Toulson (King's College) described an automatic target recognition system which uses moment invariant shape statistics as some of the fea-

tures for discrimination. There are two stages in the procedure - detection and confirmation - and the idea is to locate and track objects in the field. The Bayesian discrimination procedure used canonical variate analysis on the features to reduce dimensionality and a multilayer perceptron for classification. Prior modelling for the weights in the neural network prevents overfitting and reduces the false alarm rate.

Ian Craw (Aberdeen) described face recognition including content-based retrieval from a large collection of human face images. In face recognition care has to be taken with various invariances, such as rotation, expression, lighting, aging etc. By using some landmarks on the face principal component analysis of the registered landmark locations from an image data base enables each face to be coded in a low number of dimensions. Some matching results were described and the pattern of errors of the machine based system turns out to be similar to that of human observers.

Kanti Mardia (Leeds) discussed Bayesian object recognition using deformable templates. In particular, methods for detecting an unknown number of objects were described, applied to an image of mushrooms. The prior distribution for the objects incorporates an ordering of overlapping objects as well as shape and location information, and this is combined with a shading model for the image (likelihood) to give the posterior distribution. The use of Markov chain Monte Carlo (MCMC) methodology enables simulation from the posterior distribution of the mushrooms in the image, and for example the posterior mode could be used to locate the objects in the image. Throughout the talk comments were made about what is 'Art' and what is 'Science' in the modelling procedure. Connections were also made between various procedures used in vision and statistics, for example the 'snake' can be formulated as an improper Gaussian Markov random field of second order.

Marie-Colette van Lieshout (Warwick) concluded the day by describing some uses of stochastic geometry models in high-level vision. The use of spatial Markov processes for object location modelling was emphasized and in particular the pairwise interaction model provides a rich class of models. Again MCMC methodology is employed to simulate from the posterior distributions. Applications were given to Bayesian object recognition and spatial cluster detection (again with an unknown number of objects/clusters).

The two themes of the meeting - higher-order statis-

tics and shape representation - are clearly of interest to both the engineering/vision and statistics communities. This second joint meeting has been very useful for highlighting research issues, establishing connections and finding common interests.

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## Forthcoming BMVA Technical Meetings

### Low Level Feature Extraction

Detecting and describing low level image features and primitives is a vital part of any vision system, and has continued to attract much attention over the years. The BMVA will be holding a one day Technical Meeting at the BIR, London on 16th October 1996, titled "Low Level Feature Extraction". The deadline for contributions is 6th September. Prospective contributors should submit a short abstract describing their current work in this area to the organiser Dr. Paul Rosin by email at: [Paul.Rosin@brunel.ac.uk](mailto:Paul.Rosin@brunel.ac.uk).

### New approaches to dynamic filtering

"New approaches to dynamic filtering" will be the subject of a 1-day BMVA meeting to be held on 15 January 1997. The meeting will present new methods of filtering and new applications of filtering to computer vision. It will begin with a short tutorial on traditional methods of filtering and the theory which underlies them. Potential contributors may contact the organiser Dr. Steve Maybank by email at: [S.J.Maybank@reading.ac.uk](mailto:S.J.Maybank@reading.ac.uk)

## Replies to Andrew Stoddart on IEE Charges

In reply to your letter in the most recent issue of BMVA News, I would like to correct some factual errors, and explain why IEE Colloquia are more expensive than those organised by BMVA. I speak as a member of IEE Professional Group Committee



E4 (Image Processing), which is responsible for organising IEE events in the Computer Vision/Pattern Recognition field, and also as a BMVA member.

First, your statement on relative costs is 'economical with the truth'. While it is generally true that IEE events are more expensive than those organised by the BMVA, registered PhD students can attend IEE colloquia at a cost of only £5, and so should not be deterred by cost. Industry, academic and research staff normally have access to a research budget to help them pay for attendance.

Second, IEE Colloquia normally include a published and bound digest of the papers presented, whereas BMVA meetings usually do not. The cost of preparing this digest is a significant factor in the overall registration fee charged by the IEE. IEE Colloquium papers are abstracted and indexed in all the standard abstract journals, can be purchased afterwards from the IEE, and so can be considered to be genuine research publications.

Finally, IEE and BMVA make strenuous attempts to collaborate in their respective programmes by organising complementary rather than competing events. There is an official BMVA representative on IEE PGC E4 (currently it is John Illingworth) and several IEE members on the BMVA committees. Planned programmes of events are circulated between the two organisations, and, where possible and appropriate, are co-sponsored. Co-sponsorship means that the event is publicised by both organisations to reach a wider audience, and that members of either organisation can attend at the members rate (£45 rather than £76 in the case you quoted).

In my experience, IEE and BMVA meetings are quite different in style, but both have a distinct and useful role in publicising research in Computer Vision and Pattern Recognition.

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I think you will find that PhD students are admitted free of charge to IEE colloquia if they are student members of the IEE. Student non-members are admitted at considerably lower rates than you quoted.

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## BMVA Teaching Survey

The following presents a set of results from a survey of teaching Machine Vision Courses across UK Higher Educational Establishments. The survey was distributed over the period late 1993 to mid 1994, and was sent in the BMV mail shots, and as special mail shots to each Higher Educational Institute in the UK. A total of 67 completed questionnaires were received covering a total teaching population of some 54 academic staff members at 39 separate institutions, covering 54 departments with 81 Image Processing and Vision related courses. The courses were taught predominately in Computer Science/Computing Departments (28) and Electrical, Electronic Engineering Departments (19), with smattering of Maths (4), Physics (4), Engineering (3), and a smaller number of other Departments (Cognitive Science, Physiology, Artificial Intelligence).

The survey was mainly concerned with the time spent in particular subject areas within vision, on the practical laboratory aspects of vision teaching (ie. Software Packages and Hardware Platforms) and on the level to which the course was taught (ie. Undergraduate or Masters).

In terms of Machine Vision teaching, the hardware platforms, quite predictably, were spread between Unix-based workstations running X-windows (43), and PC-based systems (14). In terms of software packages, the greater proportion of people used home grown packages, or simply relied on a programming language (i.e. C++). Of those using packages, HIPS, Khoros, Poplog, and Visilog were the most popular.

The range of different subject categories was fairly wide, covering the Human Visual System, Mathematics, Sensors, Coding, Restoration, Enhancement, Segmentation, Morphology, Measurement, Classification, 3D Properties, Model-based methods, Model Representation, System Applications and Methodologies. As a general summary, most spent between one and two hours covering a subset of these topics in course modules that ranged from ten to thirty hours in the majority of cases.

The survey indicated that people used a wide range of different course text, though the most popular were those of Gonzalez and Woods, and Sonka, Hlavac and Boyle. These two books represented some fifty percent of the "votes" on returns from the survey, though a total of 39 different texts were used overall.

The results of the survey were presented during a BMVA technical meeting held in April of 1995. The

meeting included an overview of a more recently introduced tool (HIPR) for tutorial teaching of Image Processing concepts developed by University of Edinburgh. The HIPR software is a hypertext document with a large number of exemplar images which guides the student through the technical description of a wide range of Image Processing algorithms using a range of images to demonstrate the algorithms operation. Other items include description of Software Environments for Image Processing, and a discussion on the needs of industry for vision-aware graduate and postgraduate students.

As an alternative to presenting the full data associated with the survey within the pages of this newsletter, it has been decided that they will be made available on the pages of the worldwide web site maintained by Dr Adrian Clark at the University of Essex (peipa.essex.ac.uk). Whilst the information available from the survey provides a valuable overview of the teaching of image processing and computer vision within the UK higher education community, maintaining this information in an up-to-date form would be beneficial but time consuming. Hence one of the benefits of making this information available within the BMVA home page on PEIPA would be to encourage regular up-dating of entries, as well as the inclusion of new courses. In addition, it is anticipated that hot links back to the web page of the homesite associated with each course would allow further exploration of the course material.

The survey has been a valuable exercise in revealing a significant uniformity over the courses as taught in HEI's. However, its continuing value will only be fully realised if such information can be maintained and kept up-to-date via the PEIPA database.

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## Real-Time Imaging

In 1997, Real-Time Imaging is to run a Special Issue devoted to "Real-Time Visual Monitoring and Inspection". This topic will be interpreted broadly to include industrial inspection and monitoring, surveillance, security and access control, medical and biostatus monitoring, sensors and data fusion, related architectures, and descriptions of working systems. Potential contributors should contact

the editor Professor Roy Davies as soon as possible at:

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## Position Available

Professor Roy Davies is seeking a Research Assistant to complete a food product inspection project in which the prime aim is to locate insects and other contaminants in grain and cereals. The main intellectual challenge is to optimise detection sensitivity using the latest techniques, including artificial neural networks. For further details of the position, please contact Professor Davies by email at: [E.R.Davies@rhbnc.ac.uk](mailto:E.R.Davies@rhbnc.ac.uk). See also Professor Davies' WWW page:

<http://www.rhbnc.ac.uk/uhap041/>

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