INTERNATIONAL ASSOCIATION FOR PATTERN RECOGNITION

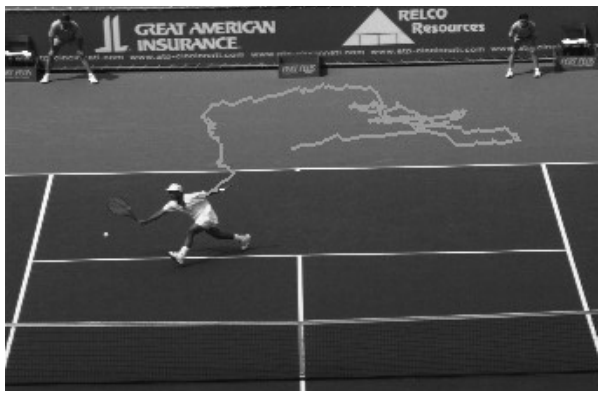
IAPR Newsletter

Volume 25 Number 2
April 2003

Pattern Recognition in Sports

In August of 2000, Gopal Pingali flew into Barcelona, picked up the Best Industrial Paper Award at the ICPR for a paper he, Yves Jean, and Agata Opalach had written, then promptly jetted back to New York for his scheduled television appearance in the US Tennis Open. No, it wasn't Gopal's tennis prowess that earned him a spot on the CBS network broadcast of this premier tennis event. It was pattern recognition.

The story began in December, 1996, at Bell Labs in Murray Hill, New Jersey. Under the cathedral ceiling of the cafeteria, they had removed tables and chairs to roll out a tennis court surface and string up a net. Two veteran ATP (Association of Tennis Professionals) players, Patrick McEnroe and Brian Gottfried, faced each other for the first-ever *Lucent Challenge*. The challenge, however, wasn't to the tennis players, it was to the scientists. As the players banged the ball from side to side, ATP and ESPN representatives explained that they had come to Bell Labs to ask its scientists to suggest technologies to make tennis broadcasts more exciting to the viewers. They also wanted technologies that would signal out-of-bounds balls. For the newly-formed Lucent, this was a golden public relations opportunity.



Many of the scientists, including physicists, chemists, and computer scientists, rose to the occasion and submitted suggestions for technology improvements. All were innovative. Some were less practical than others: a radioactive ball that could be tracked more easily (but watch out if they ever bounced into the audience!), a court surface that bounced out-of-bounds balls with high energy (but that players should avoid stepping on), and elaborate electronic equipment to be fitted to tennis racquets, shoes, and balls to record every movement. One suggestion stood out for both innovation and practicality: Gopal and Yves suggested extending their people tracking and visualization work to tennis. Gopal and Yves were invited to ATP headquarters in Florida to present their ideas. For this presentation, they applied their work to a taped tennis broadcast. They were able to demonstrate their ability to track a player's movement around the court during a match, to determine statistics from these trajectories, and to show them graphically. In the age of voluminous sports statistics, they conjectured that viewers would appreciate the new statistics and that the graphical display would be more entertaining than the traditional screens of tabular data. They foresaw broadcasters speaking about a tendency for one player to play the baseline and another to play the net and backing up their analyses with court density illustrations showing that player X spent 80% of his time behind the baseline, and player Y spent 70% of her time volleying. The ATP loved it.

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Workshop Report: MVA 2002

International Workshop on Machine Vision Applications

11-13 December 2002, Nara, Japan

The IAPR 2002 Workshop on Machine Vision Applications (IAPR MVA2002) was held at Nara-ken New Public Hall, Nara, Japan. The workshop was co-sponsored by IAPR, Nara Institute of Science and Technology, Information Processing Society of Japan, Kansai Chapter, and Nara Convention Bureau. We had 226 participants from 21 foreign countries, including about 170 domestic people.

Nara is a beautiful, ancient city of World Heritage and a city of cultural and historical importance in Japan, having been the capital of the country in 710-784 A.D. There are numerous temples, shrines, statues, carvings and paintings, many of which are well-preserved and designated as important cultural assets and national treasures. The workshop site, Nara-ken New Public Hall, is situated in Nara Park, where we could also find famous historical buildings such as Todai-ji Temple, Koufuku-ji Temple, and Kasuga Grand Shrine. Nara park is also famous for its thousands of tame deer that roam freely. The participants were able to enjoy these traditional sites while acquiring valuable knowledge in advanced research studies.

Recently the area of vision applications has been growing in factory automation, medical diagnosis, security, intelligent transport systems, geographic information systems, human computer interaction, and wearable computing. From the more than 190 extended abstracts received from 24 countries, 40 oral and 116 poster presentations were selected. In addition to the accepted papers, three distinguished researchers were invited to give talks. Two papers from the 1992 workshop were given awards for being the most influential to the Machine Vision research field in this decade.

The MVA2004 workshop will be held at Tsukuba, Japan, around December 2004. We are looking forward to having excellent papers and seeing many researchers here again.

Mikio Takagi and Masatsugu Kidode, Co-Chairs, and Hiroyasu Koshimizu, Program Chair, MVA2002

Conference Report: ICVGIP 2002

3rd Indian Conference on Computer Vision, Graphics and Image Processing

16-18 December 2002, Ahmedabad, India

The Space Applications Center (ISRO), Ahmedabad, was privileged to organize the 3rd Indian Conference on Computer Vision, Graphics, and Image Processing (ICVGIP). More than 220 delegates from premier Academic Institutions, Government Departments and R & D Labs, and Foreign Universities and Industries participated in the conference, with representation from USA, Canada, UK, France Germany, Italy, Israel, Hong Kong, Singapore and Sri Lanka.

Dr. K.L. Majumder, General Co-chair, and Prof. S. Chawdhuri, Program Co-chair, gave introductory addresses. Dr. K.N. Shankara, Director, SAC and Patron, in his inaugural address stressed the need for active participation of Space Scientists/ Engineers from ISRO/DOS to benefit from the conference. He has also emphasized the need for joint activities between in Academic institutions and Scientists/Engineers from DOS for better application of Space Technologies. Dr. B. Kartikeyan, Local Organizing Chair, proposed a vote of thanks to all participants, including the organization for their sponsorships and supports.

The conference had organized five plenary talks, one invited talk, six Oral presentation sessions, three Poster sessions and exhibitions by eight industries. The total programme for the conference was web-cast (by GNFC Online) and viewed globally through the Internet.

Mr. A.S. Kiran Kumar, Group Director, Sensors and Systems Group, SAC, gave the first plenary lecture on Satellite Imaging Sensors. He covered various aspects of satellite sensors, including types of data acquisition, data processing issues etc. He compared the space programs of ISRO with other contemporary systems. He pointed out typical image processing challenges that one would encounter with high-resolution satellite data.

Dr. Steve Sullivan, Industrial Light & Magic, USA, who has done an extensive study on special effects in computer vision, explained current research in 3-D computer vision and, in particular, the graphics animation needs of the film industry. He showed various models to generate these special effects. With clips from many videos, he took the audience to a wonderful world of animation.

Prof. Larry Davis, University of Maryland, USA, explained how detection and tracking of people under severe occlusion has created interest in the computer industry and showed his approach using a multi-camera system. In the talk, he proposed to segment people into color components by their clothing and hair to track them easily as they roam around the room. As with Dr. Sullivan, he ended his presentation with animations that made his work very appreciated.

Prof. Oliver Faugeras, Research Director, INRIA, France, presented variation methods in computer vision. He addressed the problem in two different domains: classification and tracking. In classification, he spelled out correlation, correlation ratio and mutual information for generalizing locally estimated densities. In tracking, he discussed projections of articulated models for visual and captured visual media. This was arranged as the Prof. B.N. Chatterjee Plenary Lecture to honor Prof. Chatterjee's sixty years of research.

Prof. Steve Seitz, University of Washington, USA, gave the last plenary lecture, "Beyond Perspective". He started from fundamental concepts of vision such as differences of perspective and general imaging and compared satellite push-broom imaging and computer vision's epi-polar imaging through what he called path imaging. He described how perspectives of sequential frames of 3-D scene can make use of generating a perspective cube and how slicing this cube would result in different perceptive views of the image. He also showed, with video demonstrations, the impact of this approach for visualizing cameras undergoing linear, circular paths and in circular stereo.

Dr. P. Anandan of Microsoft Research, USA, gave an invited talk on interactive rich media. This covered synthesizing video frames with available sets of video sequences. He also demonstrated with video clips how to find unusual objects, such as a whale, in a video sequence.

The next ICVGIP will be organized by the Indian Statistical Institute in Kolkata, December 2004.

K.L. Majumder, General Co-Chair

From the ExCo

At the Governing Board meeting in Quebec City last August, many changes to the Constitution and Bylaws (C&B) were approved. While working on incorporating these changes into the C&B, it became apparent to the C&B Committee that the C&B had become a patchwork, where things had been added from time to time without due consideration of previous contents. There were also some minor typos. The C&B committee and the ExCo agreed that it would be a good idea to "clean up" the C&B, and a fairly large list of suggested changes was prepared and submitted to approval by the Governing Board (GB). It must be noted that none of these changes alters the sense of the C&B in any way, as it was only thought to make our C&B easier to read and understand, with consistent notation and correct incorporation in the whole C&B of decisions already taken by various GB meetings. The GB email ballot came to an end on January 25, 2003, and the proposed changes were approved by an overwhelming majority. You will very soon find the updated version of the C&B on the IAPR web site.

This is the second issue of the Newsletter since we changed newsletter editor and switched printing operations from the UK to the USA. We are aware that there have been some unexplainable shipping delays for some of our members, and we are working on solving this. In addition, the ExCo wants to check with IAPR individuals whether they would be willing to transform the Newsletter into an electronic journal, or have both paper and electronic versions. A survey will be made on that point very soon.

In the last Newsletter, we announced that we would provide an online discussion forum for the GB before ballots, the electronic equivalent of the interaction at a plenary meeting. This was implemented and tested with a proposition for creating a new TC8 on machine vision applications. There were very few contributions to this debate, but the concept was proven to work, at least. This debate has been followed by the usual GB email ballot, which is still ongoing at the time of writing. We will report on the result of this vote in the next newsletter.

As you know, the IAPR is an association working in a network of other associations. Our members are other societies and associations, and this network can bring you benefits you may not be aware of. For example, in addition to the reduced rates you can get for the IAPR affiliated journals, IAPR members can also get Sister Society rates for publications by the IEEE Computer Society. The IAPR is also itself member of IFIP, the International Federation for Information Processing. In addition to having a representative at the IFIP (the second vice-president of the IAPR, Prof. Shirai), we can be represented in various IFIP Technical Committees. We were recently asked to nominate a representative of the IAPR to IFIP TC12 (on Artificial Intelligence), and the ExCo is happy to announce that Dr. Petra Perner, chair of IAPR TC17 on Machine Learning and Data Mining, agreed to be our representative in this Technical Committee.

As a final note, let us remind all of you who appear in the online IAPR directory that we would appreciate being notified of any changes in postal or email address. We are aware that it is not always easy to remember all those who need to know that we have changed contact information, but maybe it is a good opportunity to check right now if your contact information in the IAPR online directory is still valid. If not, please send an email to the IAPR secretary (susanmduff@aol.com).

PR in Sports

(Continued from page 1)

The researchers were able to mount such a compelling demonstration by applying their background and expertise to this new problem. Gopal had developed people tracking technology that was being used in a market research application to track the path of retail customers through a store. As a customer entered into the view of a store camera, image processing algorithms would sense movement against a static background. Pattern recognition algorithms would then distinguish this activity as that of a human customer (versus a shadow or sun highlight or some other noisy event). The centroid of the customer's image would be determined and tracked from one video frame to the next to plot the trajectory. These algorithms worked very well for the store application, but Gopal knew that there would be challenges in adapting his methods to the speed and special conditions of tennis. Ball tracking would be even more challenging for similar reasons.

Yves had expertise in graphics and 3-D visualization. He believed that broadcast tennis could be enhanced to the point that it might even have some advantages over actually being at the match. Using multiple cameras to capture data, graphics renditions of the court and players, and VRML (Virtual Reality Modeling Language) controls, his methods could enable the viewer to virtually change seats in the stadium to obtain the best view. Although the tennis application was built on their technical work, in Yves' words, "This was not about the technology, this was about producing entertainment, telling a story."

To tell a story for the broadcasting application meant real-time, on-site capture and display of data. The researchers "joined the Tour" beginning with the Cincinnati

Open, where they found that it's not all glamour in the television business. They had to lug their own SGI workstations, set up their own cameras (one trained on each player), run their own cables, and find their own power sources. They learned things they don't teach in graduate school, like maximum cable lengths before amplifiers were required to maintain the signal and how to protect computing equipment from rain in outside conditions (tarps and duct tape). In the end, they were able to use their two cameras to capture the data that they needed to further develop their algorithms back in the lab.

Their on-air debut was the 1998 ATP tournament in Stuttgart, Germany. On-site, there were many production trucks. Unfortunately, theirs was the smallest of the trucks, and they found themselves located over an open sewer. They were there, working in 12-hour shifts, for nine days. They set up, hooked into the local production equipment, and madly hacked software to get their work to air. After the semi-finals, they were ready. It was arranged that Yves would hit a button that would patch their graphical display of player tracking to the broadcast where an announcer would use it in his interview with the winner, Richard Krajicek. Maybe it was exhaustion, perhaps feelings of nausea from inhaling sewage for so many days, or perhaps it was just miscommunication between the German production crew and the non-German speaking researchers, but after the director said, "Lucent ready!" Yves prematurely hit the button. So, when the director eventually said, "Go!" the analysis was already in progress. In any case, they had finally gone on-air. In Gopal's words, "Winning the Best Paper Award was a great honor, but that moment of finally reaching fruition of the labor of years was the most exciting moment of my technical career!"

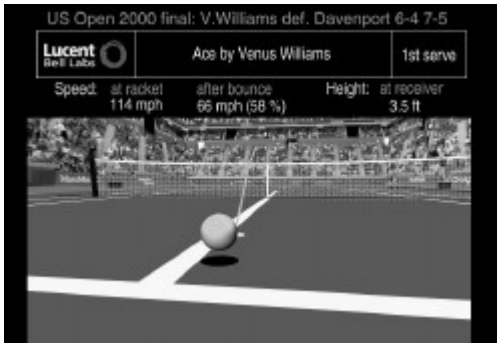
In March, 1999, they were joined by a third researcher, Agata Opalach. The three of them continued to improve the graphics and interface, add new features, and wrestle with old problems. The major continuing problem was lighting in outdoor events. Sometimes the tracking would be fooled by shadows and highlights. In addition, they wanted to get to the next stage—the scientists and the ATP both wanted to graduate from the 2-camera system to a faster, more versatile one that could also track balls. For this, they decided that a 6-camera system with progressive-scan (64 frames per second) cameras would be required. Logistically, this was like starting another project.

The 1999 tennis season proved to be their busiest. Their tracking and visualization system was taken on the ATP's Super Nine tour and to the ATP World Championship. Now they enjoyed not only better truck positioning, but also a dedicated production crew and regular airtime. The commentators were learning how to better use the system. They found that the visualization was especially revealing for break points—what did a player do wrong or differently on a break point to win or lose a set? The players, too, began to appreciate the system. After being introduced to it for a first time in interviews, they began to ask how the technology could help with their game. They requested it for their training.

Toward the end of 1999, at the last of the Super Nine tournaments, the researchers got the ball tracking to work. This was the second major technical accomplishment in the

project, and they were rewarded accordingly. It was used at the Paris Open in which Agassi beat Safin in the finals. After the match, Safin was given a printout of service ball placement from the match. Whereas Safin's serves fell conservatively within the service box, Agassi's hit only the corners. When Safin saw this, he commented that it was no wonder Agassi was the world champion.

The pinnacle of the project came at the end of 1999 at the World Championships, held in Hannover, Germany. The full system was in place and functioned flawlessly for the entire tournament. ESPN broadcast the games and used the system, whose results were seen around the world. After this season, marketing issues superceded



technological ones and the system was not used again—except one last, glorious time at the 2000 US Open, broadcast by CBS. The researchers searched within Lucent to continue the project, but the company was engaged in much larger concerns with the downturn in the telecommunications business.

The researchers moved on, eventually leaving Bell Labs: Gopal is now at IBM Research in New York, Yves is at Avaya Labs Research in New Jersey, and Agata is at Accenture Labs in France. Derivative work lives on: pattern recognition, visualization, and graphics methods that were pioneered by them are now commonly used in sports broadcasting. This novel work won glory on the stage of the ICPR and on televisions throughout the world.

Larry O'Gorman

If you have suggestions for other interesting pattern recognition stories, please email these to the editor.

logorman@avaya.com

ICDAR2003

7th International Conference on Document Analysis and Recognition
3-6 August 2003
Edinburgh, Scotland
http://www.essex.ac.uk/ese/icdar2003/index.htm

The Seventh International Conference on Document Analysis and Recognition (ICDAR2003) will take place on 3-6 August 2003 in Edinburgh, Scotland at the Edinburgh Conference Centre.

This is an international forum for furthering the state-of-the-art in document recognition, understanding, management and retrieval, including multimedia documents, handwriting recognition, and OCR.

It brings together researchers and practitioners from diverse fields such as Computer Vision, Pattern Recognition, Machine Learning, and Information Retrieval, to identify important problems, explore novel applications, and exchange ideas for developing robust solutions.

The conference opening address on *Digital Libraries and Document Image Analysis* will be given by Henry Baird, and the following Keynote addresses are also scheduled: *Recognition of Cursive Roman Handwriting—Past, Present and Future* (Horst Bunke); *Making Documents Work: Challenges for Document Understanding* (Andreas Dengel); *Progress in Camera-Based Document Image Analysis* (David Doermann); *Document identity, authentication and ownership: The future of biometric verification* (Michael Fairhurst); *Analysis and Recognition of Asian Scripts—the State of the Art* (Ching Suen, et al.); and *Graphics Recognition—from Re-engineering to Retrieval* (Karl Tombre)

200-250 research papers on all aspects of document analysis will be presented orally or as posters. A programme of satellite workshops and tutorials are scheduled for the weekend preceding the conference. The conference also includes competitions on page segmentation, table segmentation, cursive script segmentation, robust reading, robust word recognition, character recognition, and text location.

A full social programme includes a welcome reception and conference dinner held at Murrayfield, the home of Scottish Rugby. The conference immediately precedes the Edinburgh International and Fringe Festivals, the world's premier annual cultural festival, that runs from 10-30 August 2003.

On-line registration will be available from April with early-bird savings if registration is made before 12 May. Reduced registration rates are available for IAPR members and students.

Upcoming IAPR Sponsored Conferences

4th International Conference on Audio-Visual Biometric Person Authentication

9-11 June 2003
Guildford, UK
http://avbpa2003.ee.surrey.ac.uk/

We were pleased to see a surge of interest in AVBPA, receiving many more submissions than for previous conferences. This reflects not just the good work put in by previous organisers and participants, but also the increasing world-wide interest in biometrics. With grateful thanks to our programme committee, we have distilled the submissions into what appears to be a fine programme indeed.

The sessions cover established and emerging areas of biometric research. The face recognition papers will show advances in recognition technique, in application capability and covariate analysis (now with inclusion of time as a recognition factor), and even in synthesis to evaluate wider recognition capability. The fingerprint analysis will include study of the effects of compression, and on new ways for compression together with refined study of holistic vs. minutiae and feature set selection which are areas of interest to the biometrics community as a whole, not just in fingerprint analysis. The gait presentations will focus on new approaches for temporal recognition together with analysis of performance capability and new approaches to improve generalisation in performance.

The speech papers will reflect the wide range of possible applications together with new use of visual information. There were quite a few submissions on data fusion, which will be of interest to attendees at the conference in multi-classifier systems that will run concurrently with AVBPA.

But it is not just the more established areas that will be of interest at AVBPA. There are always new ways to recognise people as reflected in papers on on-line writer identification and palm print analysis, perhaps to buttress hand geometry. Iris recognition and face and person extraction in video are also represented.

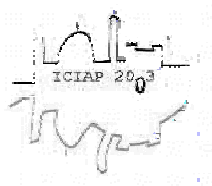
The increasing industry in biometrics is reflected in presentations with a specific commercial interest: there will be smart cards, wireless devices, architectures and implementation factors, all of considerable consequence in the deployment of biometric systems.

Any newcomers to the area might like to attend the International Summer School For Advanced Studies on Biometrics: Authentication And Recognition, to be held in Alghero, Italy just before the conference.

A competition for the best face authentication (verification) algorithms will take place in conjunction with the conference, and the results of this will be reported in the Proceedings.

Papers were submitted from all over the world. They will be complemented by invited presentations by Takeo Kanade (Carnegie Mellon University), Jerry Friedman (Stanford University) and Frederic Bimbot (INRIA). All in all, it promises to be very exciting. Guildford is just a short hop from Gatwick, Heathrow and London, as such it is very easy to get to. We are certainly looking forward to the conference, and to welcoming its delegates in June.

Josef Kittler and Mark Nixon
Co-chairmen, AVBPA 2003.



12th International Conference on Image Analysis and Processing

17-19 September 2003
Mantova, Italy
http://iciap2003.unipv.it/

GIRPR, the Italian group of researchers affiliated with the IAPR, organizes the12th issue of the International Conference on Image Analysis and Processing. The event will be located in Mantova, home to the Gonzaga dinasty of rulers of the Renaissance period and rich in historical memories.

Invited speakers are J. Bigun, Signal Analysis Chair, Halmstad University; Shih-Fu Chang, Department of Electrical Engineering, Columbia University; and H.P. Seidel, Max-Planck-Institut Informatik, Saarbruecken.

Proceedings will be published by Computer Society Press, and the best paper by a young author will be offered the Caianiello Prize. *Marco Ferretti, Conference Chair, and Maria Grazia Albanesi, Conference Vice Chair*

Upcoming

Image and Vision Computing New Zealand
26-28 November 2003
Palmerston North, New Zealand
http://sprg.massey.ac.nz/ivcnz/

IVCNZ is New Zealand's premier conference for innovations in computer vision and image processing. Held annually, it attracts an international forum of scientists and researchers from over a dozen countries. It began in 1986 with the First New Zealand Image Processing Workshop and was expanded in 1993 to become a full conference. It now covers all aspects of image processing, computer vision, computer graphics, visualisation, and applications.

This year IVCNZ 2003 will be hosted by Massey University's Institute of Information Sciences and Technology in Palmerston North. Massey University is one of New Zealand's leading educational institutions, with campuses in Palmerston North, Wellington and Auckland at Albany. There are some 19,000 local and international students studying on campus and over 18,000 students studying by distance education.

IVCNZ 2003 will include tracks on technical papers, posters, and invited speakers. Submissions for technical papers are invited in all areas of Computer Vision, Image Processing, Visualization, and Computer Graphics. Research papers in science, engineering, sports, and medicine are welcome, as is any contribution that reports on new or exciting findings or demonstrates new industrial applications of vision or graphics technologies. The posters program offers a unique opportunity to showcase case studies, work-in-progress, student projects, or non-traditional research. Posters will be displayed for one full day with time for the presenters to have one-on-one dialogue with attendees. *(see Call for Papers, same page).*

Donald Bailey

More Conferences & Workshops listed on last page.

erratum

I a p r d i r e c t o r y

Spain's representative to the IAPR Governing Board was inadvertently left out of the IAPR Directory published in the Winter 2003 Newsletter. Prof. Alberto Sanfeliu is the representative from Spain. A current directory is available at www.iapr.org.

Call for Papers

Image and Vision Computing New Zealand
26-28 November 2003
Massey University
Palmerston North, New Zealand

Contributions are invited for topics including, but not limited to:

- Automated visual surveillance
- Calibration techniques
- Computer graphics and virtualised environments
- Data mining and data fusion
- Enhancement of video and still images
- Feature detection and feature extraction
- High-precision 3D measurements
- Image compression and coding
- Image analysis and understanding
- Mesh acquisition and simplification
- Motion tracking and analysis
- Novel algorithms or techniques
- Object recognition
- Pattern recognition, clustering, and classification
- Reconstruction from uncalibrated camera systems
- Scientific visualization
- Signal processing
- Sonar and acoustical imaging
- Statistical inference and characterisation
- Stereo analysis
- Shape recovery from multiple images
- Visualization of temporal sequences and data
- Wide-area scanning technologies

Further information:
Email: Donald Bailey, D.G.Bailey@massey.ac.nz
Website: http://sprg.massey.ac.nz/ivcnz/index.html

Submission deadline: **22 August 2003**
Acceptance notification: **19 September 2003**

IAPR Newsletter

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The deadline for submission of material for the next issue is 30 May 2003.

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IAPR SPONSORED CONFERENCES & WORKSHOPS

Please check updated information on: http://www.iapr.org

2003	Event	Location	Deadlines		Contact
1-3 April ICVS'03	3rd International Conference on Computer Vision Systems	Graz Austria	Abstract Final Manuscript	*Deadlines passed*	**vm@itee.uq.edu.au http://dib.joanneum.at/ICVS03**
21-23 May PRIP'2003	7th International Conference on Pattern Recognition and Information Processing	Minsk Belarus	Abstract Final Manuscript	*Deadlines passed*	**Fax: +375 17 226 5548 VKrasnoproshin@mmi.unibel.by http://www.prip.bsu.by**
4-6 June IbPRIA'2003	1st Iberian Conference on Pattern Recognition & Image Analysis	Mallorca Spain	Abstract Final Manuscript	*Deadlines passed*	**IbPRIA@uib.es2003 http://dmi.uib.es/IbPRIA2003/homepage.html**
9-11 June AVBPA 2003	4th International Conference on Audio & Video Based Biometric Person Authentication	Guildford UK	Abstract Final Manuscript	*Deadlines passed*	**Fax: +44 (0)1483 259554 avbpa@eim.surrey.ac.uk http://www.avbpa2003.ee.surrey.ac.uk**
11-13 June ICVI'03	16th International Conference on Vision Interface	Halifax Canada	Abstract Final Manuscript	*Deadlines passed*	**barron@csd.uwo.ca http://www.visioninterface.org**
25-27 June ICISP	International Conference on Image & Signal Processing	Agadir Morocco	Abstract Final Manuscript	*Deadlines passed*	**nouboud@uqtr.ca http://www.uqtr.ca/~nouboud/icisp**
29 June-2 July SCIA'2003	13th Scandinavian Conference on Image Analysis Bridging Continents and Millennia	Goteborg Sweden	Abstract Final Manuscript	*Deadline passed* 08/05/2003	**SCIA2003@gbg.congrex.se http://www.hh.se./scia2003**
5-7 July MLDM'2003	International Workshop on Machine Learning and Data Mining in Pattern Recognition	Leipzig Germany	Abstract Final Manuscript	*Deadline passed* 01/05/2003	**ibaiperner@aol.com http://www.ibai-research.de/MLDM2003**
7-9 July EMMCVPR'03	4th International Workshop on Energy Minimization Methods in Computer Vision and Pattern Recognition	Lisbon Portugal	Abstract Final Manuscript	*Deadlines passed*	**Fax: +34 93 4015782 anand@cise.ufl.edu http://www.emmcvpr.org**
3-6 Aug ICDAR'2003	7th International Conference on Document Analysis	Edinburgh UK	Abstract Final Manuscript	*Deadline passed* 02/05/2003	**http://www.essex.ac.uk/ese/icdar2003/**
25-27 Aug CAIP'2003	10th International Conference on Computer Analysis of Images and Patterns	Groningen Netherlands	Abstract Final Manuscript	*Deadline passed* 09/05/2003	**caip@cs.rug.nl http://caip.cs.rug.nl**
12-13 Sept ANNPR'03	IAPR International Workshop on Artificial Neural Networks in Pattern Recognition	Florence Italy	Abstract Final Manuscript	*Deadline passed* 15/07/2003	**simonw@dsi.unifi.it http://www.dsi.unifi.it/ANNPR03**
17-19 Sept ICIAP2003	12th International Conference on Image Analysis and Processing	Mantova Italy	Abstract Final Manuscript	*Deadline passed* 30/05/2003	**marco.ferretti@unipv.it http://iciap2003.unipv.it/**
19-21 Nov DGCI'2003	11th International Conference on Discrete Geometry for Computer Imagery	Naples Italy	Abstract Final Manuscript	*Deadline passed* 30/07/2003	**dgci@dgci.cib.na.cnr.it http://dgci.cib.na.cnr.it/**
26-28 Nov IVCNZ'03	Image and Vision Computing New Zealand 2003	Palmerston New Zealand	Abstract Final Manuscript	22/08/2003 17/10/2003	**D.G.Bailey@massey.ac.nz http://sprg.massey.ac.nz/ivcnz/index.html**