Pattern Recognition in Maps

www.iapr.org

Here's the problem. You are in a small-engine plane flying in northern Canada. Visibility is poor. You're close to the magnetic north pole, so your compass is useless, but you do have a radio altimeter and a barometric altimeter. The difference between their readings is the elevation of the terrain below your flight path. And, you have an elevation-contour map. Now, navigate to a specified location.

In 1966, Herb Freeman and graduate student Steve Morse tackled this problem by applying pattern recognition methods to maps. Neither Herb nor Steve ever got into a plane to try out their methods but the results were well received. (Cold War spy reports had it that submarines used the method to navigate via the contours of the ocean floor.)

In the years that followed, Herb worked on many other pattern recognition tasks (including automatic reading of the license plates of passing cars), but often returned to those involving maps. Although map production became increasingly more automated, two tasks eluded computer cartographers. One was "generalization", generating a small-scale map from one of larger scale by eliminating less important features and simplifying those that were retained. The other was text placement, the labeling of the point, line and area features. Herb and Ph.D. student John Ahn took on this latter task and, after a couple of years, presented the results at a conference in Ottawa in 1983. When the audience of pattern recognition experts, geographers, and cartographers applauded upon seeing the automatically labeled maps, Herb and John knew they were on to something.

The Natural Resource Conservation Service (NRCS) of the US Agriculture Department, which maintains soil maps of the US for use by farmers, developers, and road builders, is one of the largest mapmakers in the world. Still, in the late 1980s, all of their maps were labeled by hand, though not for lack of attempts at automation. Contracts had been awarded to a number of companies but all had failed. In Herb's words, "The problem was perverse. There are problems that look easy and are easy. Other problems look difficult
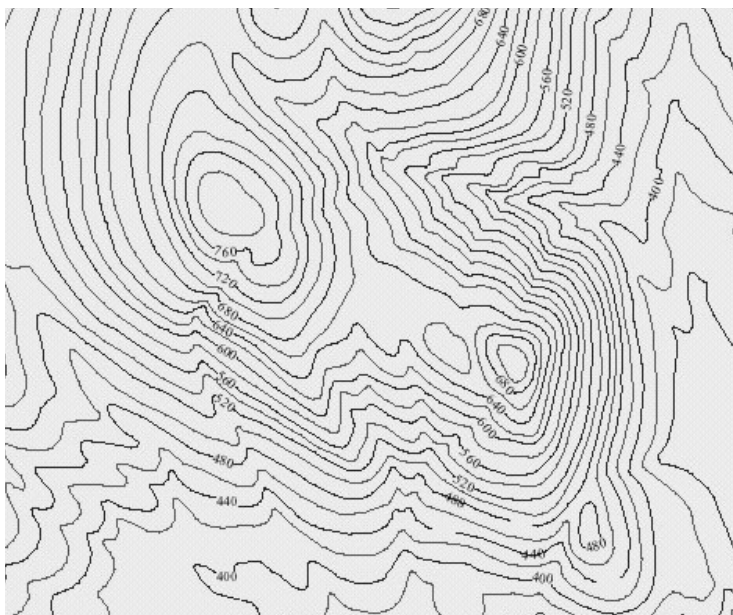
7th International Conference Pattern Recognition and Information Processing
21-23 May 2003, Belarusian State University, Minsk, Belarus

PRIP is jointly organized by the Belarusian State Univerisity and the Technical University of Szczecin (Poland) and is held in cooperation with other scientific establishments. PRIP 2003 was sponsored by the International Association for Pattern Recognition (IAPR), INTAS and some other international organizations. 119 papers from 22 countries were submitted, and 96 papers were selected for inclusion in the scientific program. 96 scientists from Belarus, Germany, Italy, France, UK, Poland, Australia, New Zealand, Brazil, and Russia took part in the conference. In addition, there were many students who participated without registration.

The conference was organized in 10 sessions with the main topics being Pattern Recognition Theory, Statistical Pattern Recognition and Data Analysis, Image Processing, Image Recognition, Architectures for Image processing, Knowledge-Based Systems, Applications of Pattern Recognition and Image Analysis. The program also included plenary presentations by R. Hodgson (New Zealand) Yu. Kharin (Belarus), V. Starovoitov (Belarus).

The conference was well organized and the quality of the questions and discussion at the sessions was excellent. The presence of the senior students was appropriate and welcome. The organizing committee are to be congratulated on their success.

The social program included a lavish banquet featuring national dishes and regional wines, sightseeing tours and attendance at the ballet "Creation of the World", music by A. Petrar. The visit to the Belarusian National Opera and Ballet theatre was an exquisite cultural experience.

The conference proceedings have been published in two volumes consisting of 513 pages. And are available from the organizers: prip@bsu.by.

The 8th International conference Pattern Recognition and Information Processing will be in Minsk in May, 2005. The host organization will be State University of Informatics and Radioelectronics.

Bob Hodgson

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4th International Conference on Audio and Video Based Biometric Person Authentication
9-11 June 2003, University of Surrey, Guildford, UK

AVBPA brings together researchers interested in multi-modal person authentication. A total of 120 participants from over 20 countries spent three sunny and enlightening days south of London for AVBPA 2003.

The program featured 39 talks and 72 posters not only in the typical biometrics areas of face and iris recognition or speaker verification, but also on innovative approaches such as writer and palm-print identification or dental biometrics.

There were three invited talks. Frederic Bimbot (INRIA) delivered an overview of speaker recognition. Takeo Kanade (Carnegie Mellon University) addressed the problem of automatic face recognition. And, Jerome Friedman (Stanford University) presented exciting new work on ensemble learning during a combined session with the collocated Workshop on Multiple Classifier Systems. (*See MCS report next page*).

Kieron Messer from the University of Surrey organized a face authentication contest. Similar to a contest held at ICPR 2000, the participants were asked to evaluate their systems on the XM2VTS database following the Lausanne protocol. Seven academic institutions submitted results. In the category of automatic registration, an algorithm proposed by Roberto Paredes from Universidad Politecnica de Valencia received top honors. For manual registration algorithms, the prize was awarded to Jacek Czyz and Luc Vandendorpe from Universite Catholique de Louvain. For both categories the performance increased by a factor of three compared to results achieved during the competition in 2000.

A panel on biometrics in the real world, chaired by Stan Price (a DTI Research Coordinator), brought together representatives from industry and academic research including Calum Bunney (International Biometric and Authentication Consulting Ltd.), Rama Chellappa (University of Maryland), Kenneth Jonsson (Fingerprint Cards AB), David McIntosh (OmniPerception Ltd), Jonathon Phillips (National Institute of Standards and Technology) and Marek Rejman-Greene (BT). The consensus of the panelists was that the use of biometrics will increase considerably. The lion's share of the market for person verification will be held by fingerprint systems, with face and iris recognition mentioned next. While the speakers pointed out many advantages of biometric systems over current practices, the panelists all agreed that the multifaceted privacy issues surrounding the widespread use of biometric systems have to be addressed.

Attendees were treated to a superb banquet with musical entertainment at the historic Tithe Barn at Loseley Park in Guildford. After the dinner the award for the best poster was given to Julian Fierrez-Aguilar and colleagues from the Universidad Politecnica de Madrid for their paper on the evaluation of fusion strategies for multimodal biometric verification. The conference organizers, Josef Kittler (University of Surrey) and Mark Nixon (University of Southampton), took the opportunity to recognize the tireless efforts of Rachel Gartshore as Conference Coordinator.

Ralph Gross

Workshop Report: MCS 2003

4th International Workshop on Multiple Classifier Systems
11-13 June 2003, Guilford, United Kingdom

This year's MCS workshop, like its predecessors, proved to be a hotbed of ideas exchange, bringing together researchers from pattern recognition, mathematics, artificial intelligence, and engineering. The invited talk by Jerome Friedman (Stanford University, USA) on "Importance Sampling: An Alternative View of Ensemble Learning", highlighted how several of the most popular techniques like Boosting, Bagging and Random Forests, could be seen under a common paradigm built around Monte Carlo methods and sampling distributions. An invited talk by Mohammed Kamel (University of Waterloo, Canada), described a framework of "Data Dependence in Combining Classifiers", dichotomizing the field into methods that can combine a set of pre-defined classifiers by either explicitly or implicitly making use of information contained in the original data.

The special sessions began with a paper "Boosting with Averaged Weight Vectors" by Nikunj Oza - an elegant enhancement to the AdaBoost algorithm producing decorrelated errors between all pairs of base models instead of just the previous one in the Boosting chain. Much needed theoretical analysis of classifier combination rules followed in papers on linearly combined classifiers (Giacinto and Roli), and on the popular Behavior Knowledge Space Fusion method (Raudys, pictured here, and Roli). A paper by Brown and Wyatt analyzed a learning technique for linear combinations. With a single parameter, it blended smoothly between learning as a single large classifier and learning an ensemble system of smaller classifiers. The joint session with AVBPA 2003 (*see report on previous page*) as well a diverse application and poster session later provided for idea-swapping around a number of topics including biometrics, OCR, word recognition, and network intrusion detection.

The workshop enjoyed an exceptionally lively Discussion Forum, and raised the controversial subject of how to construct a taxonomy for the field. Vigorous debate ensued on how, or if, we should go about this at all. A vote amongst workshop attendees marked out several priority research topics that are likely to be followed in the coming year, including model interpretation, theoretical models of performance, error diversity, empirical evaluation practices, and learning from non-stationary distributions. This latter hot topic again highlighted how interdisciplinary our field can be when discussions emerged on portfolio optimization theory and robot learning.

There seem to be two welcome recurring events in this workshop series: theoretical analysis of these meta-learning machines we create and a flurry of researchers from different areas discovering that they are tackling the same problem of combining classifiers. I personally relish the extraordinary enthusiasm and world-class expertise brought together here, and look forward to next year's MCS, to be held in Sardinia, June 2004.

Gavin Brown

From the ExCo

The IAPR ExCo held its annual meeting in Göteborg, Sweden, on July 1, 2003. Let us use this opportunity to thank the organizers of SCIA'03 for very efficiently hosting this meeting. Excerpts of the minutes of this meeting, with the main points discussed and the main decisions made, can be found in the "ExCo news" section of the IAPR web site. Let us just point out the most important matters here.

Progress has been made on online services to the membership, with the Members Only site set up. The ExCo feels that by moving more towards distribution of electronic information, many practical issues can be made easier for all of us. We will once again encourage members to register on the IAPR Members Only website (www.cedar.buffalo.edu/IAPR/) to take advantage of the online services that will be progressively made available there.

The ExCo is pleased to announce that it intends to renew the travel stipend operation for ICPR'04. In coordination with the organizers of ICPR'04, the acceptance letter for papers will be accompanied by a note that a limited number of stipends are available. The amount of each stipend will remain at the level of 500 USD.

Discussions are under way with Springer Verlag on enhancing the visibility of the Pattern Recognition field within the publisher's publications. One idea is to identify tutorial matters for publication as Lecture Notes in Computer Science (LNCS) tutorials. Springer might also be interested in starting a hard-covered book series with IAPR. The appropriate standing committees will work with the ExCo on these issues.

As a service to the community at large, the ExCo sends out email approximately once a month, with short announcements of scientific events in areas of interest to IAPR members. This email is sent to all Technical Committee chairs and all Governing Board members, with the request to forward it to all members of their respective societies or committees. To avoid this being perceived as additional spam, rather than as a service, the ExCo's general policy is to keep each announcement short and to only send one single announcement for each event. The ExCo reserves the right to make exceptions to this general rule in specific cases (e.g., for major IAPR events such as the ICPR).

Last, but not least, we are pleased to announce that the IAPR Governing Board recently approved by email ballot the admission to membership to the IAPR of a special interest group on pattern recognition from the Brazilian Computer Society, our 39th member society. We extend our warmest welcome to this new member.

PR in Maps

and are difficult. But the automatic labeling problem is perverse because it looks easy but is frightfully difficult." Knowing of Herb's research experience in the area, first at Rensselaer Polytechnic Institute, then at Rutgers University, the NRCS decided to award a contract to his group. A couple years later, the group delivered fully functioning software, ALPS (Automated Label Placement Software), for the automatic labeling of soil maps. This marked the end of hand-labeled soil maps.

It was another US government agency that ultimately pushed this technology to market. In the mid-1990s, the US Census Bureau was preparing for the 2000 census. They approached Herb about developing a system for the automatic labeling of census maps. This would be a huge undertaking, but more worrisome was the unyielding deadline. Herb's Rutgers group accepted the challenge and managed to prove technical feasibility by 1997. Technical feasibility was only part of the solution. It was obvious that a task on which the success of the entire census might depend could not be left to a group in academia but required the commitment only a commercial company could provide. This was the genesis of MapText, Inc. Herb retired from Rutgers and started the company in 1997. Their first contract was from the Census Bureau, and, before the deadline year, 2000, their software had successfully placed the text for over 20 million maps!

Map-making and labeling combine many technical fields such as expert systems, pattern recognition, database technology, image processing, visual perception, optimization, and human interface design. Along with the science there is also an art that is necessary to create maps that both efficiently convey information and are visually
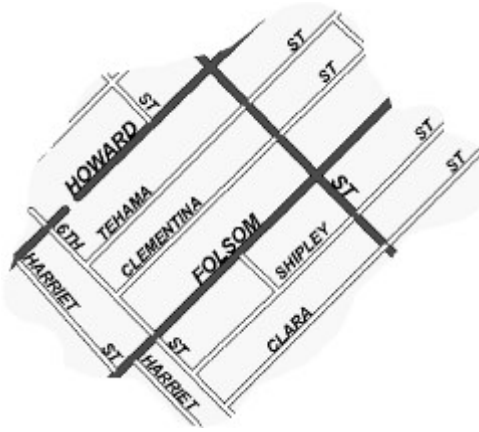
pleasing. Of course, the primary labeling rule is to not overlap labels. But avoiding overlap is only one of the text placement issues. Text must be placed to conform to the

curvatures of a winding road. It must span the extent and conform to the shape of a large area. And it should always be clear to what feature a label refers. All these cases must be handled, while maximizing the precision of placement, respecting the underlying geography, and achieving placements that are visually easy to comprehend.

MapText's software recognizes that map reading also has a subconscious component. Swiss cartographer, Eduard Imhof, wrote the "bible" of map labeling in 1942. He wanted map labels not only to identify individual geographic features but also to be intuitive. Here are some examples. If a city is on the coast, its name should be placed in the water; however, if it is only close to the coast, the label should never be in the water. For a contour map, the elevation numbers should be

aligned and should read monotonically upward on the map for a mountain and downward for a crater. If a town lies on the east side of a river or highway, its name must also be placed on the east side, because the reader is more likely to remember where the text was placed rather than where the town symbol was located. For small-scale maps, such as, say, a map of North America, the constant-latitude lines are usually shown curved. In that case, the names of towns and areas should be angled to lie tangent to the curvature of the constant-latitude lines. MapText's software implements these rules plus a multitude of others promulgated by Imhof, by other cartographers, and by their own experience over the years.

Today Herb's company consists of about a dozen people, mainly software developers and computer cartographers. MapText's customers include government agencies from the US and from places as far away as New Zealand. But governments and the traditional mapmakers are not the only producers of maps. Many corporations also need maps. Parcel delivery services, real estate companies, and insurance companies are obvious ones. And MapText-labeled maps also help get your pizza to you while it's still hot. The Papa Johns Pizza restaurant chain is a user of their software.

Continuing geopolitical changes demonstrate that map-making is not a static business with respect to content. The ongoing work at

Document Image Analysis for Digital Libraries
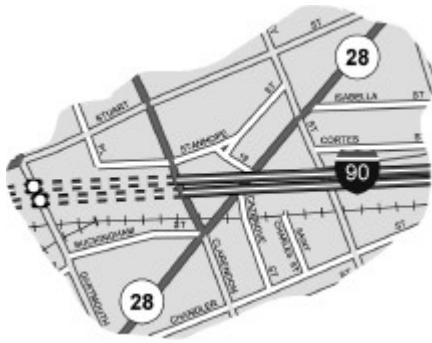
MapText shows that map technology is changing as well. So the next time you order a pizza – and it gets to you hot – you can thank the almost 40 years of work that Herb Freeman has put into maps.

[For more information on MapText, see www.maptext.com.]

Larry O'Gorman

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

logorman@avaya.com

While Digital Libraries (DLs) are growing rapidly worldwide, promising to offer more people access to larger document collections and at a far greater speed than physical libraries, they still serve many types of media poorly, including scanned images of printed and handwritten documents. Ideally, the DL user experience should be equally easy and comfortable across all media types and formats, including paper documents and other human-legible but non-digital media, in multiple languages, and from many historical periods.

Bridging this digital divide between symbolically encoded data and the vast legacy (and modern) collections of paper documents is an important challenge facing the Document Image Analysis (DIA) and DL research communities. Several research issues must be addressed at the end-user level as well as at the content provider level. For end users this means providing intelligent search, retrieval, navigation, organization and presentation tools and interfaces; for content and collections providers this means new information types, structures, document encoding and metadata for enhancing context. There are other non-technical issues that must also be resolved as well: guaranteeing the authenticity of documents, proper management of intellectual property rights, and policies on citations and editorial control are some examples.

The International Workshop on Document Image Analysis for Libraries (DIAL 2004, Palo Alto Research Center, January 23-24, 2004, www.cedar.buffalo.com/DIAL2004, dial2004@cedar.buffalo.edu) is being organized to bring together DL and DIA researchers, practitioners, and users to describe the state of the art, identify urgent open problems, and discuss approaches to meet the above-mentioned challenges.

Henry Baird and Venu Govindaraju
Chairs of DIAL2004

Conference Report: VI 2003

16th International Conference on Vision Interface
11-13 June 2003, Halifax, Nova Scotia, Canada

Vision Interface is Canada's premiere Computer Vision conference. The conference had 40 oral presentations and 20 poster presentations in total. All papers were refereed by 3 members of the program committee. There were a diverse set of topics covered by the papers, ranging from HCI to Robotic Vision to Shape representation to Structure from Motion. The conference also featured three invited talks by Terry Caelli (*A Bayesian Approach to Image Understanding: From Images to Virtual Forests*), Gustavo Deco (*The Role of Attention in Visual Perception: A Computational Neuroscience Model*) and David Fleet (*Bayesian Inference of Visual Motion Boundaries*). The best

paper award was won by Hellward Broszio, Thorsten Thormahlen and Patrick Mikulastik for their paper titled *User-Friendly Integration of Virtual Objects into Image Sequences with Mosaics* while the best student paper was won by Dana Cobzas (student), Martin Jagersand and Hong Zhang for their paper titled *A Panoramic Model for Remote Robot Environment Mapping and Predictive Display*.

VI is always held in conjunction with GI (Graphics Interface) and AI (Artificial Intelligence) and attendees are free to attend talks at any of the three conferences. A common banquet dinner (lobster) was enjoyed by all.

The proceedings for VI2001,

VI2002 and VI2003 can be downloaded from the CIPPRS (Canadian Image Processing and Pattern Recognition) webpage at www.cipprs.org. VI 2004 will be held in London, Ontario, May 17-19, and promises to be another intellectually stimulating conference. A call for papers is available either at www.cipprs.org or www.visioninterface.org.

John Barron

5

Year 2002/2003 Report

Technical Committee 7 has changed quite a bit in the last year.

First of all, after a long service as Chairperson of this Committee, Maria Petrou stepped back last September, and the new Chairman is now Paolo Gamba, from the University of Pavia. Of course, everyone wishes to thank Maria for the work she carried out so efficiently and effectively in the past years, and her help was essential for Paolo to start his duty.

The TC7 web site has a new address and has also been redesigned to be more actively a centre for distribution of recent information about papers, activities, workshops and news on pattern recognition and remote sensing. Work on the educational links page work is still in progress, and the need to find a better organization as well as to complete the list is still evident.

A very important improvement of the new web site is the availability of information about data sets and algorithms, and the possibility to download those ones that we share with sister societies.

The number of TC7 members has increased from 11 to 37 in the past months, representing 15 countries.

Following a well-established tradition, TC7 organizes a one-day workshop just after or before ICPR. Next year, the International workshop on Pattern Recognition in Remote Sensing (PRRS'04) will be held in Kingston upon Thames, UK, on August 27, 2004. The workshop web site is currently being developed, and its present version is now available, www.prrs.net. The workshop is technically sponsored by IEEE, and extended versions of a selected number of the papers presented will be published in a special issue of Pattern Recognition Letters.

Paolo Gamba, Chairman

Conference Report: MLDM 2003

3rd International Conference on Machine Learning and Data Mining
5-7 July 2003, Leipzig, Germany

MLDM 2003 was held in Leipzig, the old and fascinating Saxon city in the centre of Germany where J.S. Bach spent half of his life and the first book was printed. The conference was sponsored by IAPR and IAPR TC17 on Machine Learning and Data Mining (www.ibai-research.de/html/tc17.htm) and was co-chaired by Petra Perner from the Institute of Computer Vision and Applied Computer Science (IBaI) in Leipzig, Germany, and Azriel Rosenfeld from the University of Maryland, USA.

About 50 researchers from 15 different countries participated in the conference. The topics addressed can be grouped into nine areas: support vector machines, pattern discovery, decision trees, clustering, classification and retrieval, case-based reasoning, Bayesian models and methods, association rules, and applications.

The conference included two keynote invited talks. The first was given by Susan Craw from the Robert Gordon University in Aberdeen (Scotland, UK) and focused on case-based reasoning systems. In particular, Susan described an approach to capture directly from the cases stored in the system some knowledge about how to retrieve relevant cases and how to adapt them to solve new problems. The second invited talk was given by Horst Bunke from the University of Bern (Switzerland). Horst provided a survey on algorithms devoted to graph matching and clustering. Their usefulness for object representation and recognition is well established in disciplines such as structural pattern recognition. However, the data mining field also can take great advantage of such graph-based tools, especially when the objects to be mined exhibit a spatial structure which cannot be adequately represented by a linear feature vector.

The technical program was complemented by a very pleasant social program. In particular, participants and accompanying persons had the opportunity to attend one of the famous "Sommerkonzerte" (summer concerts) performed in the St. Thomas Church, where J.S. Bach served as Kantor" (i.e., church music director) for more than ten years. The conference banquet took place in the "zum Arabischen Coffe Baum", one of the oldest restaurants in Leipzig, where we had the chance not only to taste saxonian dishes but also to visit the "Coffee Museum" which demonstrates the saxonian passion for this drink.

The proceedings of the conference have been published by Springer in the series "Lecture Notes in Artificial Intelligence" (LNCS/LNAI 2734, ISBN 3-540-40504-6).

The next International Conference on Machine Learning and Data Mining will take place in 2005 in Leipzig. For further information please visit http://www.ibai-research.de link MLDM.

Petra Perner, Co-chair, MLDM 2003

ICPR 2004

**17th Conference of the International Association for Pattern Recognition
23-26 August 2004
Cambridge, UK**

The ICPR2004 Theme will be "Pattern Recognition in the Digital World", and will be a multi-track international forum for discussions on recent advances in the fields of:

* Computer Vision and Robotics
* Pattern Recognition
* Neural Networks
* Document Analysis
* Image and Signal Processing
* Biomedical, multimedia and e-commerce applications

Further information:
Email: icpr04@surrey.ac.uk
Website: www.ee.surrey.ac.uk/icpr2004/

Submission deadline: **15 December 2003**
Acceptance notification: **15 March 2004**

S+SSPR 2004

**Joint International Workshops on
Syntactical & Structural Pattern Recognition
and
Statistical Pattern Recognition
18-20 August 2004
Lisbon, Portugal**

Topics of interest include, but are not limited to:

SSPR Topics	SPR Topics
Structural matching	*General methodology*
Syntactic pattern recognition	*Density estimation*
Image understanding	*Multiple classifiers*
Shape analysis	*One-class classifiers*
Graph-based methods	*Neural networks*
Probabilistic and stochastic structural models	*Support vector machines*
	Statistical learning
Structural learning in spatial or spatio-temporal signals	*Active learning*
	Clustering and quantization
Supervised and unsupervised learning	*Spectral methods*
	Feature reduction
Intelligent sensing systems	*Hybrid methods*
Spatio-temporal pattern recognition	*Contextual pattern recognition*
	Comparative studies
SSPR methods in computer vision	*Applications*
Multimedia signal analysis	
Image document analysis	
Structured text analysis and understanding	
Applications	

Further information:
Email: ssspr2004@lx.it.pt
Website: www.ph.tn.tudelft.nl/Organisation/ssspr2004/

Submission deadline: **15 January 2004**
Acceptance notification: **March 2004**

DIAL 2004

**International Workshop on Document Image Analysis for Libraries
23-24 January 2004
Palo Alto, California, US**

DIAL2004 will bring together Digital Library (DL) and Document Image Analysis (DIA) researchers, practitioners, and users who are interested in new technologies that assist the integration of imaged documents within DLs so that, ideally, everything that can be done with symbolically encoded data can also be done with scanned hardcopy documents. Topics of interest include, but are not limited to:

*Document Image Analysis (DIA) methods useful in Digital Libraries (DLs)
*Challenging DL open problems requiring new DIA research strategies
*End-user requirements for document images provided via DLs
*Case studies of DLs that serve document images well
*Imaging & compression standards for document preservation, analysis, etc
*Automatic quality control during document image capture
*Content & metadata extraction, recognition, analysis, tagging, linking, etc
*Parallel tagging of images, transcripts, and other document layers
*Information extraction from images of tables, graphs, mathematics, etc
*Searching/querying, retrieval, summarizing/condensing of document images
*Presentation & legibility of document images via GUIs, eBooks, PDAs, etc
*On-line & web-based navigation within/among document images
*Personal & interactive DLs: e.g. capture, correction, reading/browsing
*Historical/archival DIA; original-medium quality challenges
*Inter- & multi-national DLs: e.g. languages, scripts, translations
*Guaranteeing authenticity of document images; rights management
*Citation and editorial control of image-based data
*File formats & representations of document images & results of analysis
*Multimedia document analysis, including audio & video
*Proposals for DIA/DL database collection, truthing, benchmarking, etc
*Government-sponsored projects (e.g. The Newton Project, American Memory)
*Critical surveys of the state of the art of DLs & DIA

Further information:
Email: dial2004@cedar.buffalo.edu
Website: www.cedar.buffalo.edu/DIAL2004

Regular Papers
Submission deadline: 15 October 2003
Acceptance notification: 20 November 2003
Abstracts of Remarks
Submission deadline   1 December 2003
Acceptance notification   15 December 2003

IAPR Newsletter

Published in association with the IAPR website, **www.iapr.org**

The deadline for submission of material for the next issue is 7 November 2003.

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IAPR SPONSORED CONFERENCES & WORKSHOPS

Please check updated information on: www.iapr.org

2003	Event	Location	Deadlines	Contact
19-21 Nov DGCI'2003	11th International Conference on Discrete Geometry for Computer Imagery	Naples Italy	Deadlines passed	dgci@dgci.cib.na.cnr.it dgci.cib.na.cnr.it/
26-28 Nov IVCNZ'03	Image and Vision Computing New Zealand 2003	Palmerston New Zealand	Deadlines passed	D.G.Bailey@massey.ac.nz sprg.massey.ac.nz/ivcnz/index.html
26-29 Nov CIARP 2003	8th Biometric Congress on Pattern Recognition	Havana Cuba	Deadlines passed	rrm@icmf.inf.cu cirp.ci.ulsa.mx/
10-12 Dec DICTA 2003	Digital Imaging Computing Techniques and , Applications	Sydney Australia	Deadlines passed	Dicta2003@csiro.au www.tip.csiro.au/dicta2003/index.html
2004	**2004**	**2004**	**2004**	**2004**
13-14 April PRIS 2004	4th International Workshop on Pattern Recognition in Information Systems	Porto Portugal	Abstract 15/12/2003 Final Manuscript 15/02/2004	workshops@iceis.org www.iceis.org/workshops/pris/pris2004-cfp.html
18-20 Aug, S+SPR 2004	Joint IAPR International Workshop on Structural and Syntactical Pattern Recognition	Lisbon Portugal	Abstract 15/01/2004 Final Manuscript 02/04/2004	ssspr2004@lx.it.pt www.ph.tn.tudelft.nl/Organisation/ssspr2004
23-26 Aug ICPR 2004	17th International Conference on Pattern Recognition	Cambridge UK	Abstract 15/12/2003 Final Manuscript 15/05/2004	Icpr04@surrey.ac.uk www.ee.surrey.ac.uk/icpr2004/