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## Calls for Papers

### CORES 2007
*5th International Conference on*
*Computer Recognition Systems*
Wroclaw, Poland
Deadline: May 13, 2007
October 22-25, 2007

### ICMB'2007
*The International Conference on Medical Biometrics*
Hong Kong
Deadline: July 1, 2007
December 12-14, 2007

### DGCI 2008
*14th International Conference on*
*Discrete Geometry for Computer Imagery*
Lyon, France
Deadline: September 18, 2007
April 16-18, 2008

### ICPR 08
*19th International Conference on Pattern Recognition*
Tampa, Florida
deadline: April 8, 2008
December 8-11, 2008

## Call for Submissions

### IAPR Newsletter
*Articles, announcements, book reviews,*
*conference and workshop reports*

Contact the editor: *logorman@avaya.com*

**Deadline: June 15, 2007**

# Feature Article

# The emerging role of visual pattern recognition in spam filtering: challenge and opportunity for IAPR researchers

By Fabio Roli, Giorgio Fumera, Ignazio Pillai

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Although anti-spam filters have recently adopted text categorisation techniques based on pattern recognition approaches for e-mail semantic content analysis (e.g., a module of the popular SpamAssassin filter is based on a Bayesian classifier; see *wiki.apache.org/spamassassin/ BayesInSpamAssassin*), spam filtering is not in the mainstream of IAPR research. This topic is not commonly highlighted in the call for papers of main IAPR conferences, and only one paper out of 1168 dealt with spam filtering at the last ICPR conference in Hong Kong. But things could, or maybe should, change in the near future.

Very recently, spammers introduced a new trick consisting of embedding the spam message into attached images, which can make all current techniques based on the analysis of digital text in the subject and body fields of e-mails ineffective (see Figure 1 for an example of spam email). Spam email like the one in Figure 1 offered a first challenge and opportunity for IAPR researchers, as they made spam filtering a matter of visual pattern recognition, which is obviously a topic in the mainstream of IAPR research. In particular, as a recent paper showed [1], this kind of spam made it apparent that the full arsenal of OCR and document analysis methods, mainly developed within the IAPR community, could be exploited in the spam "war".

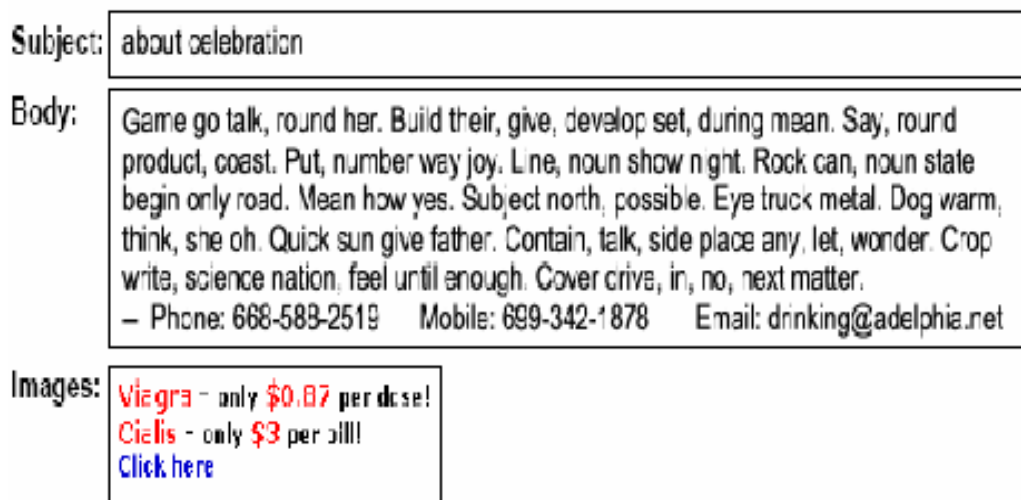| | |
|---|---|
| Subject: | about celebration |
| Body: | Game go talk, round her. Build their, give, develop set, during mean. Say, round product, coast. Put, number way joy. Line, noun show night. Rock can, noun state begin only road. Mean how yes. Subject north, possible. Eye truck metal. Dog warm, think, she oh. Quick sun give father. Contain, talk, side place any, let, wonder. Crop write, science nation, feel until enough. Cover drive, in, no, next matter. — Phone: 668-583-2519    Mobile: 699-342-1878    Email: drinking@adelphia.net |
| Images: | Viagra - only $0.87 per dose! Cialis - only $3 per pill! Click here |

Fig. 1: Example of spam e-mail in which the text of the spam message is embedded into an attached image. The subject and body fields contain only bogus text.

But that's not all. Just in the last months, further challenges and opportunities have emerged from the spam arena for IAPR researchers. Spammers are applying content obscuring techniques to images (see Figure 2), to make OCR systems ineffective without compromising human readability, and they are also starting to use



Fig. 2: Example of a recent spam e-mail designed to make difficult OCR extraction without compromising human readability.

methods similar to the ones used to create CAPTCHAs (Figure 3). (If you are not familiar with CAPTCHAs, we suggest you to browse the web site of Prof. H. Baird *www.cse.lehigh.edu/~baird/ research_hips.html* and the site of the Captcha Project *www.captcha.net/*). Ironically enough, spammers are using CAPTCHAs (which were invented to defend against robot spamming) to evade anti-spam robots.

This kind of spam has been growing so quickly (approximately 30% of all spam is now image based [2]) that a name was coined in the Internet, and it is now referred as "image-based" spam (or simply "image spam"). Many commercial products have been the target of image spam. In addition to the usual products promising weight loss or improved sexual performance, a cut-price edition

of Windows Vista has been recently offered using image spam [2].

Although this is bad news for our inboxes, it could be good news for IAPR researchers, as the roles of visual pattern recognition, image processing, and, in general, computer vision, could become strategic in the future spam war. Because all the traditional modules of current anti-spam filters are ineffective against image spam, visual pattern recognition methods become crucial for new detection modules. Recently, two OCR-based plug-in modules of the SpamAssassin filter were delivered that are capable of analysing text embedded into images (*wiki.apache.org/ spamassassin/CustomPlugins*).

But image spam could be more than a new and stimulating application for IAPR researchers. There is the opportunity of convergence and synergy with the field of CAPTCHAs. One common issue is the trade-off between the "hardness of evasion" of a content obscuring technique applied to a text image and the users' tolerance to reading such cluttered image. The other side of the coin of text recognition for CAPTCHAs used for authentication (see the seminal paper by Mori and Malik [3]), is text recognition in image spam. Advanced OCR methods are required to analyse text embedded into images that spammers obscured in a hostile way.
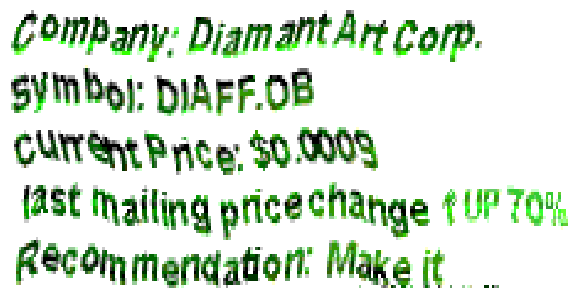
Unfortunately, spammers could also exploit the



Fig. 3: Example of an image attached to a spam mail received from the authors in January 2007 which seems to exploit methods similar to the ones used in CAPTCHAs.

similarities with CAPTCHAs and related research fields. Quoting from an article of the Technology Guardian newspaper [4], "One worrying thought: if we ever devise computers smart enough to read images, and so block those image spams, the spammers will, equally, have access to programs that can defeat CAPTCHAs".

So, the approach to image spam filtering based on the analysis of text embedded into images might have both intrinsic limits (OCR of an adversarially obscured text image is a challenging task) and side effects (spammers could use similar techniques to break CAPTCHAs). On the other hand, we know that humans sometimes identify a potential intruder as their attention is drawn to a suspect camouflage of the subject. Analogously, one approach to image spam filtering could be aimed at detecting the noise, that is the adversarial clutter contained in the image, instead of the "signal" (the spam text message). This is just the alternative approach to image spam filtering that the authors are currently developing [5].

As P.K. Chan and R.P. Lippmann recently pointed out [6], the existence of image spam, just like other computer security threats, presents a new, important direction for pattern recognition research: the development of approaches that provide sustainably good performance in hostile environments where an adversary takes actions to evade a classifier.

[1]G. Fumera, I. Pillai, F. Roli, Spam filtering based on the analysis of text information embedded into images, Journal of Machine Learning Research, Vol. 7, pp. 2699-2720, 2006.

[2]E. Dallaway, Spammers use Windows Vista as bait, Infosecurity, Vol. 4, Issue 1, pp. 6, Jan./Feb. 2007.

[3]G. Mori, J. Malik, Recognizing objects in adversarial clutter: breaking a visual CAPTCHA, IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2003), Vol. 1, pp. 134-141, 2003.

[4]W.M. Grossman, What have image spam and Captchas got in common?, Technology Guardian, January 11, 2007.

[5]B. Biggio, G. Fumera, I. Pillai, F. Roli, Image spam filtering using visual information, submitted to the 2007 International Conference on Image Analysis and Processing.

[6]P.K. Chan, R.P. Lippmann, Machine learning for computer security, Journal of Machine Learning Research, Vol. 7, pp. 2669-2672, 2006.

## Feature Articles on uses of Pattern Recognition (PR)

PR in Digital Libraries, Jul. '06

PR at the US Postal Service: A Decade of Achievement, Apr. '06

PR in Two National Labs, Jan. '06

PR in Traffic Engineering, Jul. '05

PR in Astronomy and Photonics, Apr. '05

PR in Origami, Jan. '05

PR in Defense Applications, Jan. '04

PR in Maps, Sep. '03

PR in Security and Entertainment, Jun. '03

PR in Sports, Apr. '03

# News from the
# IAPR EXECUTIVE COMMITTEE
### By Denis Laurendeau

A significant amount of work has been performed since the last letter from the ExCo. All IAPR committees have been set up and are now working for the benefit of the association. Members of the ExCo express their sincere thanks to the individuals who have accepted to act as chairs or members of the committees. Their contribution is essential to keep the IAPR active.

It is our pleasure to inform the community that, following the result of the GB ballot on this question, the Asociación Chilena De Reconocimiento De Patrones (ACHIRP) has been admitted in the IAPR. Dr. H. Allende Olivares from ACHIRP is finalizing the admission process in cooperation with IAPR Secretariat Ms. Linda O'Gorman and the Chair of the Membership Committee Dr. Michal Haindl.

Germany and Hungary have new representatives on the IAPR Governing Board. Drs. Gerald Sommer and Wolfgang Förstner will now represent the German Pattern Recognition Society (DAGM) on the GB, while Dr. Attila Fazekas will represent the Artificial Intelligence and Pattern Recognition Society (KEPAF) for Hungary. The ExCo welcomes these new GB members. Their contribution to the GB will be greatly appreciated. The ExCo would also like to express its gratitude to Drs. H. Burkhardt (DGAM) and L. Czúni (KEPAF) for their participation in IAPR GB activities over the past years.

The GB ballot on the Statement of Ethics that was prepared by the members of the Advisory Committee has been initiated by the IAPR Secretary. The result of the ballot will be disclosed by mid-May 2007.

IAPR Secretariat Ms. Linda O'Gorman will initiate the invoicing process for collecting member societies' membership dues in the coming weeks. Please note that according to the Constitution and Bylaws, a member society whose dues have not been paid by the first day in May in the year following that in which the dues are invoiced will lose all voting privileges and its membership will be cancelled at the next Governing Board. It would be greatly appreciated that the dues be paid rapidly in order to avoid delays that generate extra work for the secretariat.

The ExCo would finally like to congratulate Dr. Gunilla Borgefors for being awarded the Edlund Prize in recognition of her high quality work in digital image analysis through many years (information in Swedish is available at: www.kva.se/KVA_Root/swe/_news/detail.asp?NewsId=907&br=ie&ver=4up).

# INSIDE the IAPR

# Technical Committees of the IAPR

**By Larry O'Gorman—Editor,** *IAPR Newsletter*

The Technical Committees (TCs) of IAPR are one of its major centers of activity.  These comprise groups of people with interest in particular sub-fields of pattern recognition. The main purpose of the TCs is to promote work in their area and facilitate communication among their members. They accomplish this in various ways, such as: maintaining mailing lists of members, producing periodic mailings on topics of interest, and holding formal workshops each year or two.

All the TCs encourage membership of those participating or interested in their sub-field. Membership is easy, just email the TC chair that you'd like to be included. After this, you can choose your level of involvement, from keeping up with the field via mailings to actively participating in organization of the next workshop.

Below are descriptions of all 19 IAPR TCs. Look over the descriptions, and if you're interested in delving more into one of the subfields, send mail to join.

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## TC1 Statistical Pattern Recognition Techniques          Chair:  Professor Fabio Roli

TC1 aims to promote interaction and collaboration among researchers working directly in statistical pattern recognition and also among those specialized in other fields but using or developing statistical techniques. In this relation it is of particular interest to stimulate links with mathematical statisticians, theoreticians and practitioners who work at present outside the pattern recognition community.

TC1 web site: *www.ph.tn.tudelft.nl/Organisation/TC1/*
Professor Roli's email:  *roli@diee.unica.it*

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## TC2 Structural & Syntactical Pattern Recognition          Chair: Professor James Tin-Yau Kwok

Structural and Syntactical Pattern Recognition (SSPR) is a core area of Pattern Recognition. It is based on the fundamental premise that "shape" or "patterns" in any domain (space, space-time, etc.) is encoded by the attributes of parts and their relations in the domain of reference.  IAPR's TC2 on SSPR promotes interaction among researchers working on such fundamental issues and their applications in different domains.

TC2 web site:  *grfia.dlsi.ua.es/tc2/*
Professor Kwok's email: *jamesk@cs.ust.hk*

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## TC3 Neural Networks & Computational Intelligence      Chair:  Dr Simone Marinai

Computational Intelligence (CI) covers all types of sub symbolic knowledge processing and machine learning techniques, particularly artificial neural networks, evolutionary algorithms and fuzzy logic. Although these research fields are very well developed, there still exists a large gap between theory and application. To close this gap, focusing on pattern recognition problems, is an important goal of TC3 on Neural Networks and Computational Intelligence. Activities of TC3 include the organization of workshops, collecting tutorials on CI-methods and benchmark data sets for the statistical evaluation of pattern recognition algorithms.

TC3 web site:  *www.dsi.unifi.it/TC3/*
Dr Marinai's email:  *simone@dsi.unifi.it*

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## TC4 Biometrics      Chair:  Professor Tieniu Tan

Contact Professor Tan for information on TC4 Biometrics:  *tnt@nlpr.ia.ac.cn*

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## TC5 Benchmarking & Software    Chair:  Dr Roberto Paredes
*This information was taken from the TC5 web site.  (L. O'Gorman, ed.)*

"The aim of TC5 is to provide resources to assist researchers in implementing and benchmarking pattern recognition systems. While other IAPR TCs are concerned with particular areas of pattern recognition, TC5 is unusual in that its remit is to provide benchmarking and software services to all fields of pattern recognition."

TC5 web site:  *www.dsic.upv.es/~iaprtc5/*
Dr. Paredes's email:  *rparedes@dsic.upv.es*

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## TC7 Remote Sensing and Mapping    Chair:  Professor Selim Aksoy

TC7 aims at promoting the use of pattern recognition methods in the analysis of data collected from satellites or airborne sensors used for Earth observation as the large volumes of remote sensing data recently available require advanced algorithms and techniques for automatic analysis.

TC7 web site:  *www.iapr-tc7.org/*
Professor Aksoy's email:  *saksoy@cs.bilkent.edu.tr*

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## TC8 Machine Vision Applications  Chair: Dr Shigeru Sasaki

Please see the TC8 web site for more information, *www.cvl.iis.u-tokyo.ac.jp/iapr/tc8/* **TC9 Biomedical Image Analysis**  Chair: (the chair is currently empty)

The goal of TC9 is the application of computer vision, pattern recognition, computer graphics and robotics techniques to biomedical images acquired by microscopy, video, X-ray, computed tomography, magnetic resonance, nuclear medicine and ultrasound. These images are at different spatial scales, ranging from molecular and cellular  to tissue and organ. Typical problems are: representation of pictorial data, visualization, feature extraction, segmentation, intra- and inter-subject registration, longitudinal / temporal studies, image-guided therapy, shape and motion measurements, spectral analysis, digital anatomical atlases, statistical shape analysis, modeling of anatomy and physiology, virtual and augmented reality for therapy planning and guidance, telemedicine with medical images, telepresence in medicine, telesurgery, image-guided medical robots, etc.

TC9 web site:  *lit.fe.uni-lj.si/TC9/*
General Info page of the TC9 web site:  *lit.fe.uni-lj.si/TC9/listing.php?section=1*


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## TC10 Graphics Recognition  Chair: Professor Liu Wenyin

TC10 promotes interaction among researchers working in document image analysis in general, and graphics recognition in particular. GREC is its primary workshop series organized by TC10, which also hosts the international contest series in graphics recognition. TC10 co-sponsors ICDAR with TC11.

Topics of primary interest are:  raster-to-vector techniques; recognition of graphical primitives, shapes and symbols; analysis and interpretation of engineering drawings, logic diagrams, maps, diagrams, charts, etc.; analysis of line drawings, tables, forms etc.; 3-D models from multiple 2-D views (line drawing); graphics-based information retrieval; performance evaluation in graphics recognition; and systems for graphics recognition.

TC10 web site:  *www.iapr-tc10.org*
Professor Liu Wenyin's email:  *csliuwy@cityu.edu.hk*


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## TC11 Reading Systems  Chair: Dr Jianying Hu

The goal of TC11is to foster research in the understanding and development of systems that are able to analyze any media containing character symbols and return an encoded representation of the text content and structure. It covers a wide range of applications including digital libraries, pen-based computing, check and mail reading, signature verification, web mining and content repurposing, web security using human interactive proofs, textual content analysis in videos, and historical document preservation and archiving. Key research areas include image processing, feature extraction and selection, classification methods, statistical and syntactical pattern recognition and machine learning.

TC11 web site: *http://www.iapr-tc11.org/*
Dr Hu's email:  *jyhu@us.ibm.com*

## TC12 Multimedia and Visual Information Systems          Chair:  Dr Marcel Worring

TC12 promotes interaction among researchers working in the modeling, design, and development of systems for the analysis, processing, description, and retrieval of multimedia and visual information as well as the applications of these systems in challenging domains. Emphasis is on the role that pattern recognition can play in supporting the various tasks.

TC12 web site:  *staff.science.uva.nl/~worring/TC12/*
Dr Worring's email:  *worring@science.uva.nl*

## TC13 Pattern Recognition in Astronomy & Astrophysics          Chair:  Dr Tin Kam Ho

TC13 aims to promote interaction and collaboration among researchers working in computer science as well as in astronomy and astrophysics, to
facilitate integration of methodologies in pattern recognition, information retrieval, and data analysis into modern computational astronomy.

TC13 web site:  *cm.bell-labs.com/who/tkh/TC13/index.html*
Dr. Ho's email:  *tkh@research.bell-labs.com*

## TC14 Signal Analysis for Machine Intelligence          Chair:  Professor Sergios Theodoridis

The goal of TC14 is to focus on the Signal Analysis and Signal Processing aspects in Pattern Recognition tasks and promote a cross-fertilization  between these disciplines. Typical areas of interest are: speech, audio and music applications; image, video and intelligent multimedia tasks; kernel methods; learning theory and modeling; Bayesian learning; sequential learning; neural networks learning; feature generation and selection for signals and images (e.g., PCA, ICA)

TC14 web site:  *www.IAPR_TC-14.di.uoa.gr*
Professor Theodoridis's email:  *stheodor@di.uoa.gr*

## TC15 Graph Based Representations          Chair:  Professor Luc Brun

The goal of the TC15 is to federate and to encourage research works in Pattern Recognition and Image Analysis within the graph theory framework. Our topics include graph based clustering and matching, graph based image segmentation, irregular (graph) pyramids, graph representation of shape, graph transformations and graph navigation. Some of the topics of the TC15 are related to other domains, like obviously graph theory, automata theory, machine learning, finite state machines, robotics,  Petri nets…

TC15 web site:  *www.greyc.ensicaen.fr/iapr-tc15*
Professor Brun's email:  *luc.brun@greyc.ensicaen.fr*

## TC16 Algebraic and Discrete Mathematical Techniques in Pattern Recognition & Image Analysis
**Chair:** Dr Igor Gurevich

"The main goals of TC16 are discussion of actual and prospective lines of research and exchange of the results in Algebraic and Discrete Mathematical Problems and Techniques inspired by Pattern Recognition and Image Analysis. The means which TC 16 uses to achieve the goals are more or less standard for IAPR TCs: the organization of workshops and conferences, the preparation of publications (survey articles, tutorials, etc.), the design of databases including information on scientists and specialists in the field, bibliographical databases, benchmarking data, support of communication between members, exchange by results and others."

TC16 web site: *http://www.ccas.ru/TC16/*
Dr Gurevich's email: *igourevi@ccas.ru*

## TC17 Machine Learning and Data Mining      **Chair:** Prof Atsushi Imiya

"Data Mining, which is also referred to as knowledge discovery in data bases, means a process of nontrivial extraction of implicit, previously unknown and potentially useful information (such as knowledge rules, constraints, regularities) from data in data bases.

The interest in Data Mining and Machine Learning has increased over the last decade. Whereas in former times it was only a research topic, industry recently has got more and more attracted by that topic, since there is a specific need to mine the large data bases for higher-quality information. This leads to a quick transfer of research results into practice and brings industry and researchers closer together.

The problem of mining multimedia data has not been solved in the data mining community yet, since it requires special understanding of the information type. Here is a special challenge for the pattern-recognition community.  There are a lot of challenging multimedia applications around that have special requirements and therefore need new methods for solving these applications. Some of them are e.g. internet-based image mining, mining picture archiving system, mining user preferences, and text mining.

Although pattern recognition has much in common with data mining, the latter requires methods that can work on large collections of data and mixed data types such as images, video and text. Therefore new methods have to be developed that satisfy these needs. Besides that methods that can handle symbolical data and mixed data types are required. This opens new challenges to the pattern-recognition community."

The TC17 web site is accessible from the home page of Dr. Perner: *www.ibai-research.de/index.php*
Professor Imiya's email: *imiya@media.imit.chiba-u.ac.jp*

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**TC18 Discrete Geometry     Chair:  Dr. David Coeurjolly**

Discrete geometry plays an essential role in the field of image analysis, computer graphics, pattern recognition, shape modelling, computer vision, and document analysis. The main reason is, of course, that all data in the computer is unavoidably discrete. Discrete geometry provides both a theoretical and a computational framework for digital images. The aim of TC18 is to promote interactions and collaboration between researchers working in the field of discrete geometry.

TC18 web site:  *http://www.cb.uu.se/~tc18/*
Click here to email Professor Coeurjolly:  *david.coeurjolly@liris.cnrs.fr*

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**TC19 Computer Vision for Cultural Heritage Applications       Chair:  Dr Robert Sablatnig**

The goal of TC19 is to promote Computer Vision Applications in Cultural Heritage and their integration spanning all aspects of IAPR activities. It aims at stimulating the development of components (both hardware and software) that can be used by the target audience: Researchers in Cultural heritage like archaeologists, art historians, curators and institutions like universities, museums and research organizations.

The purpose of TC19 is to provide a forum to discuss how computer vision has been applied to cultural heritage problems and in turn define new interesting problems to work on. Therefore, we strongly encourage the development, building, and thorough evaluation of individual components and the demonstration of their usage in building complete systems for Cultural Heritage Applications. TC19 is particularly interested in topics related to the following problems:  design methods for Cultural Heritage documentation systems and components; 3D reconstruction of cultural heritage objects and fragments; reassembly of artifacts from fragments; 3D architectural site reconstruction or representation from imagery and other data; shape representation for free-form modelling (statues, bones, etc.); automated trench recordings from video; shape matching/indexing in large databases (for a single site and across multiple sites); surface modelling from various sensing modalities, to represent 3D texture, BRDF, etc. of walls, sculpture, etc.; texture modelling from imagery, remote sensing, models, etc. (to model large surfaces, backgrounds); excavation's historical documentation from multimedia data; vision-based Augmented Reality for site exploration (educational, scientific, tourism); colour vision for visualization and/or preservation and/or recovery; shape-based completion for preservation and/or recovery; archaeography (Analysis of historical documents).

TC19 web site:  *iapr-tc19.prip.tuwien.ac.at/*
Click here to email Dr. Sablatnig:  *sab@prip.tuwien.ac.at*

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## TC20 Pattern Recognition for Bioinformatics       Chair:  Professor Jagath C Rajapakse

We have seen an explosion of life sciences data over the past decade. TC20 is interested in using pattern recognition techniques to discover knowledge from life sciences data.  The goal of TC20 is to bring together pattern recognition scientists and life scientists to find solutions to problems in bioinformatics and to foster multidisciplinary research in the pattern recognition community.

Topics in research in bioinformatics include:  bio-sequence analysis; gene and protein expression analysis; protein structure and interactions prediction; signal and motif detection; systems biology, pathway analysis; ontologies and taxonomies; molecular evolution and phylogeny; immunoinformatics; biological databases; bio-imaging.

Pattern recognition techniques of investigation include statistical, syntactic and structural approaches, neural networks, fuzzy techniques, genetic algorithms, Bayesian models and networks, data mining techniques, and their hybrids.

TC20 web site:  www.cse.psu.edu/~acharya/IAPR/iapr.htm
Click here to email Profesor Rajapakse:  *asjagath@ntu.edu.sg*

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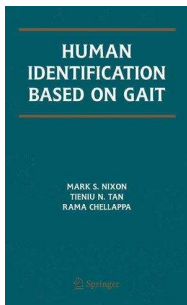
## *Human Identification Based on Gait*

by
Mark S. Nixon, Tieniu Tan and Rama Chellappa
Springer, November 2005

Reviewed by: **Salil Prabhakar**

*Human Identification Based on Gait* is authored by three famous professors from three prestigious universities that are located on three different continents. The authors have extensive background not only in a wide variety of image processing and computer vision problems (such as remote sensing and texture analysis) but also in many different biometric technologies (such as ear, face, writer, and iris recognition). They have also worked on many vision problems related to motion processing and analysis, technologies that provide foundation for automatic gait recognition. Gait recognition is defined as recognition of people by the way they walk or run. The authors are pioneers in the field, a field that is one of the youngest and most computationally intensive among biometrics. They have written this monograph with real love and passion for the field.

The advantage of gait recognition is that the signal can be acquired covertly with video cameras that are already in use in many surveillance applications. Most other biometrics cannot be acquired covertly at a distance and usually require installation of new sensors. The disadvantage of gait recognition is that it is highly computationally intensive and requires expensive computational resources. Further, the technology has not yet matured to a point where the error rates would be acceptable in most realistic deployment scenarios. In the short introduction chapter, the authors briefly mention that the most likely usage will be in future government surveillance applications.

Without dwelling very much on the applicability of the technology, the authors proceed quickly to technical matters that begin with Chapter 2 and extend all the way up to Chapter 8, the last chapter of this 187 page volume.

Before getting into the technical portion of the book, it is worthy to note that the authors have presented the bibliography, which is quite exhaustive, neither in alphabetical order nor in chronological order, but rather classified in topics which coincide with the sequence of the chapter topics. This style is quite useful in looking up a published paper on a specific topic. Considering the fact that an index is also provided, the authors have done a great job in making this book a standard reference on automatic gait recognition.

Chapter 2 provides historical background on gait research. Early research in gait analysis was performed in the field of medicine. The aim of the medical research was to classify components of gait for the treatment of pathologically abnormal patients. Results of some of this early work, for example, a conclusion that rotation angles for hip and knee are distinctive (i.e., provide inter-class variability) has later been used in some of the model-based automatic gait recognition algorithms. Some of the intra-class variability in gait has also been studied in these fields, for example, gait can be affected by footwear, carrying luggage, consuming alcohol, age, tight or loose clothing, and even mood and music. Studies per-

formed in many other fields such as biomechanics, psychology, automated motion analysis, and podiatry, have provided basis and background for conducting research in automatic gait recognition. Many such studies are cited in the chapter.

It is pleasing to find that the authors discuss gait databases so early in the book, in Chapter 3. Due to variations in demographics, environmental conditions, cameras, backgrounds, deployment scenarios, etc., estimation of absolute performance of biometric systems has remained elusive. As a result, biometrics evaluations are necessarily comparative. A technology evaluation typically involves a comparison of various algorithms on a common database. The authors describe the databases and data collection protocols for two early databases and a few recent databases. The early databases from UCSD and Soton (University of Southampton) were small and easy (constant walking speed, special clothes, background, lighting, etc.). The recent databases are bigger, richer, and more difficult. These databases include UMD's surveillance data; NIST/USF's outdoor data imaging subjects at a distance; GaTech's data combining marker based motion analysis with video imagery; CMU's multi-view indoor data; CASIA's outdoor data and Southampton's data which combines ground truth indoor data (processed by broadcast techniques) with video of the same subjects walking in an outdoor scenario (for computer vision analysis). The databases are described nicely. However, if a reader were to obtain any of these databases, she needs to figure out how to get the database from its citation. It would have been valuable if the authors had provided all these databases at a single place, such as a DVD included with the book or links from the book's website.

Chapter 4 reviews some of the early approaches for automatic gait recognition. The objective of the earliest approaches was to produce a "proof-of-concept" (i.e., to show that gait has smaller intra-class variations than inter-class variations and therefore can be used as a biometric). The early approaches were somewhat simplistic (for example, processing video data to obtain silhouettes in the first step and deriving walking signatures to perform the recognition in the second step). Some of the early silhouette-based approaches derived gait signature from spatiotemporal (translation and time) pattern, optical flow distribution, or object-model characterization (using Eigen value decomposition, canonical analysis, or linear discriminant analysis). Model-based techniques first located high level features (e.g., thigh) and then performed a fourier analysis to estimate frequency spectrum of the periodic leg motion.

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**Human Identification at a Distance:**

University of Maryland (UMD)
www.umiacs.umd.edu/labs/pirl/hid/data.html

Georgia Tech (GaTech)
cpl.cc.gatech.edu/projects/hid/

Carnegie Mellon University (CMU)
www.ri.cmu.edu/labs/lab_56.html

Chinese Academy of Sciences (CASIA)
www.cbsr.ia.ac.cn/Gait%20Database.htm

University of Southampton
www.gait.ecs.soton.ac.uk/

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Chapter 5 is the longest chapter of the book, in fact more than twice as long as the next longest chapter, Chapter 6. Chapter 5 goes into the technical details of the popular silhouette-based approaches. Chapter 6 goes into technical details of less popular model-based approaches. Chapter 7 goes into technical details of approaches beyond those described in Chapters 5 and 6. In Chapter 5, the authors tabulate seminal silhouette-based approaches, categorizing them into moving shape, shape+motion, structural, and modeled. The authors provide an outline of the basis of these approaches and how they can be used for gait recognition. Chapter 5 is divided into three main sections: extending shape description to moving shapes; procrustes and spatiotemporal silhouette analysis; and modeling, matching, shape and kinematics. In each of these sections, the authors provide not only the technical description of the methods but also the performance achieved. The model-based approaches, described in Chapter 6, primarily try to model the movement of the torso and/or legs. The authors categorize these approaches into two main sections: planer human modeling and kinematics-

based people tracking and recognition in 3D space. The authors discuss view invariant gait recognition algorithms and gait biometric fusion in Chapter 7. In all three chapters, they provide performance estimates of the discussed algorithms.

Chapters 5, 6, and 7 end rather abruptly but then all the discussions, future directions, and conclusions are provided at one place in Chapter 8. In Chapter 8, the authors recognize the fact that gait recognition is still in its infancy and most algorithms have been implemented for simplified and controlled conditions, e.g., no occlusion during human walking, relatively plain background, lack of view generality, etc. The authors recognize that while good recognition accuracy has been reported in some of the works, most existing algorithms have been tested on relatively small and non-realistic databases. Future research trends, directions, and open problems are discussed in this chapter. The authors conclude that a lot of opportunity for further research and development exists in the area of automatic gait recognition. This should excite and motivate interested students and researchers.

# BOOKSBOOKSBOOKS
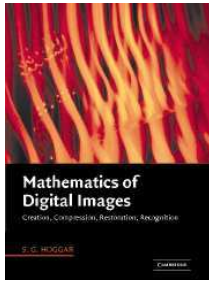
## *Mathematics of Digital Images*

by
Stuart Hoggar
Cambridge University Press, September, 2006

**Reviewed by:  Jason Dowling**

Stuart Hoggar is a research fellow and a former senior mathematics lecturer at the University of Glasgow.  He writes that the book is based on graduate course notes for PhD students which he developed at Ohio State University.  *Mathematics of Digital Images* is a huge book (854 pages) consisting of 18 chapters that are divided into six main sections.

This book covers a lot of ground!  An extensive range of image related topics are included in the areas of compression, restoration and recognition.  As the title suggests, a large number of theorems, proofs and examples are included for each topic.  A 13-page introduction provides a roadmap for the book and describes dependencies between chapters.

The first part of the book, concerned with plane geometry and pattern generation, is 112 pages long and is based on the author's 1992 book, *Mathematics for Computer Graphics.*  One of the stated aims of this part is to provide the reader with enough background to write pattern-generating software.  Isometries (transformations of the plane which preserve distance such as rotations, translations and reflections) are introduced followed by their composition and classification.  This is followed by a short chapter on 1-dimensional (braid) patterns.  Isometries which send a pattern onto itself (such as floor tiles) are discussed in the next chapter and classified into five types.  These are then extended to 17 plane pattern types and a flow chart on deciding which type a pattern belongs to is presented.  The final chapter in this part of the book covers Coxeter graphs and Wythoff's construction and presents an algorithm to generate patterns based on a

small fundamental region.

Part two ("Matrix structures") is an 88-page review of fundamental linear algebra, covering vectors and matrices, transformations, eigenvalues, rank, and the Singular Value Decomposition (SVD).  This material is covered rapidly, and although good for review, these chapters are probably not ideal as an introduction.

The third part of the book (185 pages in length) is a useful review of mathematical statistics with an emphasis on digital images.  Topics covered include probability, random vectors, correlation, Principal Component Analysis, inference, maximum likelihood estimates, regression, hypothesis testing, Bayes pattern classifiers, simulation, Markov chains, Monte Carlo methods and Bayesian networks.  I found these chapters well written and interesting; however, I think an additional mathematical statistics course text would be required for someone new to these concepts.

 I thought part four (125 pages), which covers information theory, was a highlight of this book.  In the first of two chapters. Hoggar presents the fundamentals of entropy, Shannon's noiseless coding theorem, Huffman text compression, arithmetic codes, prediction by partial matching and LZW compression.  The second chapter in part four (actually chapter 13) covers channel capacity, error-correcting codes (such as the Reed-Solomon method used in CD players), and a section on probabilistic decoding (including an overview of turbocodes).

In part five *Mathematics of Digital Images* addresses image processing.  Although not compre-

hensive (for example, color images, morphological operations and image registration aren't mentioned), in 162 pages the author covers a lot of important material. The Discrete Fourier Transform (DCT) is covered in depth in 1-D and then 2-D, before convolution and various grayscale transforms (such as Gaussian and edge detection filters) are discussed. Image restoration and compression are then presented (including an overview of JPEG). The final chapter in part five covers fractals and wavelets (including the discrete wavelet and Gabor transforms). It was nice to see fractal compression included.

The final part of the book (145 pages) includes two chapters. The first is concerned with B-Splines (important for representing curves and surfaces in computer graphics) and B-Spline wavelets. The final book chapter presents a useful introduction to neural networks and self organizing nets before integrating these topics with information theory. In the final section, tomography (imaging by sections) is discussed, including a concise overview of the Hough and Radon transforms

This book provides an excellent review of image related topics. Each chapter includes questions, a list of related methods and alternate references. The pseudo-code algorithms presented throughout the book are a useful complement to the math. The author has a simple web site at *www.maths.gla.ac.uk/~sgh/* which contains answers to most exercises, some image processing examples, and an Apple Mac program for produc-

ing plane patterns and showing their symmetry operations.

I did have a couple of thoughts after reading the book. Firstly, although image creation is mentioned on the cover, I don't think the book covers this (for example, image acquisition is not discussed). Secondly, I thought that the topic of image texture could have been introduced in the first part of the book (after pattern generation). Also, although a large amount of topics are covered, the book is not exhaustive (for example, JPEG2000 or digital image watermarking are not mentioned). Finally, I think this book could be a difficult read for people without a reasonable mathematical background; however there is no mention of pre-requisite reading or courses in the introduction.

In summary, I was very impressed with *Mathematics of Images*. The writing style, editing and figures and overall presentation are excellent. I found it a pleasure to read and will keep it handy as a reference book. This is a book that I would have found extremely useful at the start of my PhD, and I would recommend it particularly for graduate students who need a robust reference on mathematical foundations. This book would also be of interest to students and researchers in image processing, computer vision, computer graphics and information theory.

# 20th International Joint Conference on Artificial Intelligence (IJCAI 2007)

# Workshop on Analytics for Noisy Unstructured Text Data

**8 January 2007**
**Hyderabad, India**

Organizing Committee:
**Craig Knoblock**, University of Southern California, USA
**Daniel Lopresti**, Lehigh University, USA
**Shourya Roy**, IBM Research, India Research Lab, India
**L. Venkata Subramaniam**, IBM Research, India Research Lab, India

**Report prepared by L. Venkata Subramaniam**

Noisy unstructured text data is found in informal settings such as online chat, SMS, emails, message boards, newsgroups, blogs, wikis and web pages. Also, text produced by processing spontaneous speech, printed text, handwritten text contains processing noise. Text produced under such circumstances is typically highly noisy containing spelling errors, abbreviations, non-standard words, false starts, repetitions, missing punctuation, missing case information, pause filling words such as "um" and "uh." Such text can be seen in large amounts in contact centers, on-line chat rooms, OCRed text documents, SMS corpus etc. Documents with historical text can also be considered noisy with respect to today's knowledge about the language. Such text contains important historical, religious, ancient medical knowledge that is useful. The nature of the noisy text produced in all these contexts warrants moving beyond traditional text analytics techniques. The theme of the International Joint Conference on Artificial Intelligence (IJCAI) 2007 Conference was "AI and its benefits to society." In keeping with this theme, the Workshop on Analytics for Noisy Unstructured Text Data (AND), which was held in conjunction with IJCAI 2007 proposed to look at text analytics of highly noisy text that is produced in such everyday applications in society.

The workshop was chaired by Craig Knoblock, Daniel Lopresti, Shourya Roy and L. Venkata Subramaniam. The workshop call for papers had a very good response. A total of 30 submissions spanning a diverse set of issues relevant to noisy text analytics were received of which 11 were accepted for oral presentation and 12 for poster presentation. Each submission was reviewed by three members of the program committee. To encourage discussion, the workshop program was structured into topic-oriented oral and poster sessions. The session topics included, classification of noisy text, detecting and correcting noisy text, and information extraction from noisy text. The program also had a keynote address and a panel discussion. Each oral session concluded with a two minute boaster by the authors of the poster papers. This allowed the audience to know in advance about the posters that would be presented later in the day. The proceedings of the workshop are available online at research.ihost.com/and2007/cd/index.htm. Selected papers of AND 07 will be published in a special issue on Noisy Text Analytics in the International Journal on Document Analysis and Recognition.

AND 07 had close to 60 registered participants making it the largest workshop at IJCAI 2007. The workshop was

Proceedings of AND 2007 are available at the IJCAI 2007

web site

*research.ihost.com/and2007/cd/index.htm*

attended by participants from over 13 countries. As a result of the workshop an entry on "Noisy Text Analytics" was made in Wikipedia. The keynote address by Gerald DeJong titled "Robustness through prior knowledge: Using explanation-based learning to distinguish handwritten Chinese characters" generated a lot of interest and discussion. The panel discussion lead by Daniel Lopresti that included Sreeram Balakrishnan, Hwee Tou Ng and Rohini Srihari as panelists had the provocative theme "Noisy text analytics: An exercise in futility?" The panel identified key problems, proposed some solutions and set the tone for future work in the area. All the author presentations and the keynote address and the panel lectures are available online at research.ihost.com/and2007/programme.html.

The IAPR best student paper award which was decided by an eminent panel lead by Raghuram

Krishnapuram went to Monojit Chaudhury, Rahul Saraf and Vijit Jain, the student authors of the paper "Investigation and Modeling of the Structure of Texting Language" that included Sudeshna Sarkar and Anupam Basu as the non-student authors. This paper was selected from among 15 papers in which the primary author was a student.

The social program consisted of a welcome dinner sponsored by IBM Research the previous night and the IJCAI inauguration and dinner on the night of the workshop. There was a beautiful cultural program in the inauguration that included classical Indian dances and east-west fusion music.

# Call for Papers

**IAPR**

## The 19th International Conference on PATTERN RECOGNITION

December 8-11, 2008
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Tampa, Florida USA
www.icpr2008.org

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   Theory, Methods and Algorithms

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# ICPR 2008

## www.icpr2008.org/

## Call for Papers

**ICPR 2008** is the **nineteenth conference** of the **International Association for Pattern Recognition (IAPR)**.

ICPR 2008 will be an international forum for discussions on recent advances in the fields of C**omputer vision, Pattern recognition (theory, methods and algorithms), Image, speech and signal analysis, Multimedia and video analysis, Biometrics, Document analysis, and Bioinformatics and biomedical applications**.

### *Important dates*

| | |
|---|---|
| Paper submission deadline: | 8 Apr 08 |
| Tutorial submission deadline: | 5 May 08 |
| Workshop submission deadline: | 15 Jan 0 |

## e-mail contact: *Secretary@icpr2008.org*

# O f   i n t e r e s t . . .

## Free Books!

I have a number of books that need to be reviewed. If you have interest and some knowledge in the topic, let me know. I will send you the book — which you will be able to keep — and expect in return a review for the *Newsletter*. If you think you might like to review a book, but need more information, just go to the web site of the publisher or a web book seller to see more book detail.

Below are some of the books I'd appreciate help reviewing:

*Introduction to Clustering Large and High-Dimensional Data*, by Jacob Kogan, Cambridge University Press, (Softcover, November 30, 2006)

*Close Range Photogrammetry: Principles, Techniques and Applications*, by Thomas Luhmann, Stuart Robson, Stephen Kyle, and Ian Harley, Wiley, (Hardcover - January 9, 2007)

*Geometric Tomography (Encyclopedia of Mathematics and its Applications)*, by Richard J. Gardner, Cambridge University Press, (Paperback - June 19, 2006)

*The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data*, by Ronen Feldman and James Sanger, Cambridge University Press, (Hardcover - December 11, 2006)

*Rippling: Meta-Level Guidance for Mathematical Reasoning (Cambridge University Press Tracts in Theoretical Computer Science Series)*, by Alan Bundy, David Basin, Dieter Hutter, Andrew Ireland, Cambridge University Press, (Hardcover - Aug 8 2005)

Please email me at *logorman@avaya.com*,

**Larry O'Gorman**, *IAPR Newsletter* Editor

# Conference Planner

| Highlighting indicates that paper submission deadline has not yet passed. | | | |
|---|---|---|---|
| **2007** | | | |
| OAGM 07* | 31st Workshop of the Austrian Association for Pattern Recognition (AAPR/OAGM) | Schloss Krumbach, Austria | 3-4 May 07 |
| MVA 2007 | 10th IAPR International Conference on Machine Vision Applications | Tokyo, Japan | 16-18 May 07 |
| PRIP 2007 | 9th International Conference on Pattern Recognition and Information Processing | Minsk, Belarus | 22–24 May 07 |
| MCS 2007 | 7th International Conference on Multiple Classifier Systems | Prague,  Czech Repubic | 23-25 May 07 |
| CRV2007 | 4th Canadian Conference on Computer and Robot Vision | Montreal, Canada | 28-30 May 07 |
| MLDM 2007 | 5th IAPR International Conference on Machine Learning and Data Mining | Leipzig, Germany | 4-6 July 07 |
| SCIA 2007 | 15th Scandinavian Conference on Image Analysis | Aalborg, Denmark | 10-13 Jun 07 |
| GbR2007 | 6th IAPR-TC15 Workshop on Graph-based Representations | Alicante, Spain | 11-13 Jun 07 |
| AIPR-2007* | 2007 International Conference on Artificial Intelligence and Pattern Recognition | Orlando, Florida, USA | 9-12 Jul 07 |
| CIVR 2007 | 6th International Conference on Image and Video Retrieval | Amsterdam, Netherlands | 18-20 Jul 07 |
| CAIP 07 | 12th International Conference on Computer Analysis of Images and Patterns | Vienna, Austria | 27–29 Aug 07 |
| ICB2007 | 2nd International Conference on Biometrics | Seoul, Korea | 27-29 Aug 07 |
| VIIP 2007* | The 7th IASTED International Conference on Visualization, Imaging, and Image Processing | Palma de Mallorca, Spain | 29-31 Aug 07 |
| Biometrics 2007* | Conference on Biometrical Feature Identification and Analysis | Göttingen, Germany | 6-8 Sep 07 |
| ICANN'07* | 17th International Conference on Artificial Neural Networks | Porto, Portugal | 9-13 Sep 07 |
| ICIAP 2007 | 14th International Conference on Image Analysis and Processing | Modena, Italy | 10-14 Sep 07 |
| CCIW07 | 2007 Computational color Imaging Workshop | Modena, Italy | 14 Sep 07 |
| ICDAR 2007 | 9th International Conference on Document Analysis and Recognition | Curitiba, Parana, Brazil | 23-26 Sep 07 |
| ENC 2007* | Current Trends in Computer Science Scalable Pattern Recognition Track | Morelia, México | 26-28 Sep 07 |
| PRIB 2007 | 2007 IAPR International Workshop on Pattern Recognition in Bioinformatics | Singapore | 1-2 Oct 07 |
| PRIA-8-2007* | 8th International Conference on Pattern Recognition and Image Analysis: New Information Technologies | Yoshkar-Ola, Russian Federation | 8-13 Oct 07 |
| VIPImage 2007* | ECCOMAS Thematic Conference on Computational  Vision and Medical Image Processing | Porto, Portugal | 17–19 Oct 07 |
| CORES 2007 | 5th International Conference on Computer Recognition Systems | Wroclaw, Poland | 22-25 Oct 07 |
| ICMB'2007 | The International Conference on Medical Biometrics | Hong Kong | 12-14 Dec 07 |
| PReMI'07 | 2nd International Conference on Pattern Recognition and Machine Intelligence | Kolkata, India | 18-22 Dec 07 |
| **2008** | | | |
| DGCI 2008 | 14th International Conference on Discrete Geometry for Computer Imagery | Lyon, France | 16-18 Apr 08 |
| ICPR 08 | 19th International Conference on Pattern Recognition | Tampa, Florida, USA | 8-11 Dec 08 |