

IAPR Newsletter

Volume 25 Number 3
June 2003

Pattern Recognition in Security and Entertainment

The genesis was a scene that any researcher knows well: an invited talk at a research lab, a few interested attendees, a few more attendees exhorted to attend by the host, polite applause at the end, most people quickly getting back to their offices, and the only follow-up being a comment or two at lunch to the effect that the talk was “interesting” or otherwise. However, there was a difference with this talk, something as prized by scientists as it is rare. Three people stayed in the room after the talk and discussed the topic late into the evening. At the end of the day they had come up with an idea that would lead to seminal technology, a ride on the dot-com roller coaster, and a date with Hollywood.

Ingemar Cox, Joe Kilian and Talal Shamoan were the scientists at NEC Research Labs in Princeton, NJ, who stayed after the talk. The subject was watermarking and the year 1995. Although watermarking itself is certainly not new, it was becoming evident that digital watermarking would be needed to ensure the flow of copyrighted content on the Internet. Without protection, authors would be hesitant to place their material there for fear of theft. Digital watermarking, just like paper and currency watermarking (see figure of U.S. \$50 bill) is a way to hide information in an image for security purposes. A well-publicized example of this is the watermarking technique developed at IBM that was applied to images of objects in the Vatican collection. This watermark is a visible, but unobtrusive, translucent rendition of the Vatican Library seal (see <http://www-3.ibm.com/software/is/dig-lib/vatican/manuscript.html>). However, the

NEC researchers were interested in a more challenging problem, placing an *invisible* watermark in the image.



They found that using spread spectrum processing and perceptual modeling to apply a watermark to an image would have the least visual effect on the image and would be most difficult to maliciously remove. Since there is a Hollywood component to the modern story, it behooves us to say that spread spectrum was first invented by Hollywood actress and inventor Hedy Lamer with co-inventor George Antheil during World War II. Their idea, that would become known as frequency hopping spread spectrum, was a way for torpedoes to be controlled by sending signals over multiple radio frequencies using random patterns. The spread spectrum watermarking idea does not include frequency hopping, but instead places a watermark signal into an image at many different frequencies at the same

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School on Soft Computing Approach to Pattern Recognition and Image Processing 2-13 December 2002, Kolkata, India

An International workshop called CIMPA-UNESCO-INDIA School on Soft Computing Approach to Pattern Recognition and Image Processing was organized at the Indian Statistical Institute, Kolkata by its Machine Intelligence Unit. The school was attended by about one hundred participants from various parts of the world including, USA, UK, Canada, Hong Kong, Singapore, Korea, Romania, Vietnam and India. The participants were post-graduate engineers, university faculty, personnel from R&D organizations, research scholars and managers of companies. The event had an inaugural session, a number of lecture sessions and a valedictory session.

The inaugural session was chaired by Prof. K. B. Sinha, Director of ISI, who welcomed the delegates. Dr. Ashish Ghosh, the Coordinator of the school, introduced the dignitaries to the audience. Chief Guest of this occasion was Shri. Buddhadeb Bhattacharjee, the Honorable Chief Minister of West Bengal; who talked about the long term policy that his government is taking for utilizing Information Technology and the Soft Computing concept for the development of West Bengal. The Guest of Honor of this occasion was Prof. V. S. Ramamurthy, Secretary, Ministry of Science and Technology, Govt. of India, who briefed the policies of India Government for using Information Technology. Prof. S. K. Pal, Scientific Director of the workshop and Head of Machine Intelligence Unit, gave an introduction describing the relevance of soft computing research, and the utility and objective of organizing such a workshop at the Indian Statistical Institute. These were

followed by the speech of Prof. Witold Pedrycz and Prof. Josef Kittler, distinguished speakers of the school. The session ended with Vote of Thanks by Prof. M. K. Kundu, Chairman of the local organizing committee.

The objective of this international school was to provide an opportunity to the researchers, students, teachers and R & D personnel to be acquainted with the emerging soft computing techniques of machine intelligence starting with an introduction to recent advanced topics with various real life applications. Particular attention was given to applying these tools to various pattern recognition and image-processing problems including data mining and bio-informatics with speakers from both academia and industry. The school also gave an opportunity to the young researchers to have interaction and establish contacts with well-known senior researchers of the field.

The course covered a balanced mixture of theory and practice including laboratory visits. The theoretical lecture schedule contained:

- * introductory lectures on pattern recognition, image processing and various soft computing tools such as fuzzy logic, neural networks, genetic algorithms, rough sets;

- * lectures demonstrating the different ways of applying these tools to various facets of pattern recognition/image processing, data mining and bio-informatics;

- * lectures on hybridized methodologies (a combination of two or more soft computing tools), and their application to the above mentioned tasks;

- * lectures on advanced topics like video image coding, content based image retrieval, granular computing, computational theory of perception, etc. concerned with pattern recognition and image processing problems.

Besides attending the theoretical lectures, the participants visited different laboratories and witnessed various demonstrations and research results on real life data like remotely sensed images, speech data, forensic data.

The schedule of the two weeks lecture sessions was very tight. It was divided into various sessions comprising forty-five lectures (each of duration 1 hour and 15 minutes). Renowned scientists both from India and abroad delivered the lectures. They are Prof. Josef Kittler, University of Surrey, England; Prof. Jacek Zurada, University of Louisville, USA; Prof. Witold Pedrycz, University of Alberta, Canada; Prof. Rudy Setiono, National University of Singapore, Singapore; Prof. Yuan Yan Tang, Hong Kong Baptists University, Hong Kong; Dr. Simon C. K. Shiu, Hong Kong Polytechnic University, Hong Kong; Prof. Sung-Bae Cho, Yonsei University, Korea; Dr. Tinku Acharya, Intel Corporation, USA; Dr. Hillol Kargupta, University of Maryland, Baltimore County, USA; Prof. Kalyanmoy Deb, Indian Institute of Technology, Kanpur, India; Prof. M Narasimha Murty, Indian Institute of Science, Bangalore, India; Prof. Santanu Chaudhury, Indian Institute of Technology, New Delhi, India; Prof. B. Yegnanarayana, Indian Institute of

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IAPR President, Rangachar Kasturi, has been selected by the IEEE Computer Society Board of Governors as one of the two candidates to run for the office of President-elect for 2004. If elected in the general election by CS members, he will serve as president during 2005, by which time his term as IAPR president will be over.

From the ExCo

IAPR activities concerning the important scope of practical applications of pattern recognition

had remained dormant for some years, but they have now been revived. The key point is for both academic and industrial researchers to get together and to communicate intensively with each other to promote this domain. In order to coordinate these interface efforts and to develop one research community, a new proposition for creating a Technical Committee 8 on Machine Vision Applications was proposed by a group of researchers under the leadership of Prof. Ikeuchi from the University of Tokyo, and has now been approved by a Governing Board vote.

In our efforts to enhance communication with all our members, we have now set up a web site open to all IAPR individual members (a simple registration is necessary). The web site, kindly hosted by the CEDAR, can be found at the following address (also linked from the IAPR web page): <http://www.cedar.buffalo.edu/IAPR/>, where the two last issues of the Newsletter can currently be found. In the future, this members-only web site will also provide other useful information to all the association's members.

Each individual member of the IAPR is entitled to receive his/her own copy of the Newsletter, either directly mailed from the printer, or redistributed within the member society, depending on the choice made by their member society. There have been some discussions on the preferred form for the newsletter distribution: paper version, as it is currently, or electronic. To prepare a possible discussion of this topic at the next Governing Board meeting, during ICPR'04, all individual members will be asked by their member society in the coming weeks to kindly answer a questionnaire, which will help us get a feeling of the main wishes of the membership at large. We thank you in advance for taking some time to answer this questionnaire. Your member society will report back to the Executive Committee with a summary of the answers collected.

The ExCo plans to meet in July in Göteborg, Sweden, for its annual meeting. One of the points to be discussed is the renewal of the initiative to offer travel stipends for the next ICPR. Expect more news on this and other topics in the next Newsletter.

CIMPA Workshop Report

(Continued from previous page)

Technology, Madras, India; Dr. Mohua Banerjee, Indian Institute of Technology, Kanpur, India; Dr. Raghu Krishnapuram, IBM Research Center, New Delhi, India; Prof. M. K. Chakraborty, Calcutta University, Kolkata, India; Prof. S. K. Pal, ISI, Kolkata, India; Prof. M. K. Kundu, ISI, Kolkata, India; and Prof. B. B. Bhattacharyya, ISI, Kolkata, India.

During the valedictory session (Chairperson: Prof. K. B. Sinha and Chief Guest: Prof. Michel Jambu, Director of CIMPA), the speakers, participants and guests felt that the event, which is the first of its kind in India, was an enriching, and rewarding memorable experience. Prof. Jambu categorically mentioned that the present school was one of the best-organized, highly technical schools that he has ever seen. The participants expressed their desire to hold similar meeting at regularly to witness and promote the growth of the discipline. It became also evident that soft computing research will not only continue to remain in the forefront in computer science and information technology for the coming years; but will also play a key role in the development of future technology including future generation computer systems.

Besides CIMPA (International Center for Pure and Applied Mathematics), Indian Statistical Institute and the Department of Science and Technology, Govt. of India, various funding agencies including industries came forward to sponsor this international meeting in order to make it a success. The International Association for Pattern Recognition (IAPR) and Indian Society for Fuzzy Mathematics and Information Processing (ISFUMIP) co-sponsored the event.

In this connection a book titled "Soft Computing Approach to Pattern Recognition and Image Processing", (Eds. Ashish Ghosh and Sankar K. Pal), World Scientific Press, Singapore, 2002, has been brought out and distributed free among the participants of the school. It contains sixteen chapters written by most of the speakers of the school and some other pioneering leaders (e.g., Prof. A. Rosenfeld, Prof. A. Skowron, Prof. V. Gesu) in the field.

*S. K. Pal, Scientific Director
A. Ghosh, Coordinator*

PR in Security & Entertainment

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time. This is done by multiplying the narrow-band watermark by a wide-band code signal, equivalent to convolving the two signals in the Fourier domain, thus spreading the watermark widely over the image frequencies. Since this spread watermark signal manifests itself like relatively weak noise, it is invisible to the user, and since it is spread in a way only known to the watermark originator (via the code signal) it is virtually undetectable and difficult to remove by an attacker. The group, which also included Tom Leighton of MIT, published a paper on the web in late 1995 and received a large response, especially from other corporate researchers. This indicated they had come upon a field that was both technically interesting and commercially important.

In the mid 1990's there were two main reasons that copyright owners were concerned about content security. One, as previously mentioned, was the Internet. The other was the upcoming introduction of the DVD. When movies were distributed on DVD rather than VHS, content owners feared widespread, digitally perfect replication. Although Napster, which facilitated peer-to-peer distribution of music for free, would not appear until 1999, trading of CD-quality music was already becoming popular, and the motion picture industry feared similar activity with resulting economic loss when film became digital. Because of this, means for content protection was a major topic of the consortium developing DVD technology, which formed the DVD Copy Protection Technical Working Group (CPTWG). Members included the Motion Picture Association of America (MPAA), the Recording Industry Association of America (RIAA), consumer electronics manufacturers, and information

technology companies. The NEC participants in this group proposed that the researchers focus not just upon still images but also upon movies. In May of 1996, Ingemar was invited to present a watermarking talk to the CPTWG. The talk was met with much interest and this began the next phase of their research work.

The original algorithm needed to be modified for this new task of watermarking digital video. A major change was that, instead of applying spread spectrum to the entire image, it was applied to 8x8 pixel DCT (Discrete Cosine Transfer) blocks, which were used in MPEG2 video coding. And, at the pattern recognition end, the watermarking needed to be detected from either coded or decoded video. A further constraint was that the decoding needed to be performed using fewer than 50,000 gates on an integrated circuit and cost less than 5 cents. Welcome to the real world. Along with Ingemar, fellow researcher Matt Miller and colleagues at NEC Japan, worked feverishly on solving this problem, while Ingemar in addition flew cross-country monthly to attend consortium meetings and present progress reports. In 1997, their work reached fruition: they successfully demonstrated real-time, low-cost spread-spectrum watermarking of digital video. While this meant the consortium was convinced of the viability of watermarking, this did not mean they instantly chose the NEC method. The Data-Hiding Sub-Group (DHSG) was formed, which issued a Call for Proposals (CFP).

In 1997, NEC spun off the watermarking work into a company named Signafy. NEC maintained control of this spin-off and Ingemar became CTO. His role at Signafy involved much travel and many hats. He wore the hat of a diplomat on trips to Hollywood, a technologist at NEC's electronics design headquarters in Japan, and a researcher when presenting papers on continuing watermarking research at conferences around the world. He

and his company set to work to develop watermarking methods not just for DVD content protection but also to monitor broadcasting programs for royalty payment and advertisement verification for contract fulfillment. "The demands that disparate industries placed on us drew more innovative solutions than if we had just remained in the Ivory Tower," commented Ingemar in describing the difference between his job change from NEC Research to Signafy.

One such demand was the following. How do you enable a person to copy a movie once for her own purposes, but not allow it to be recopied for distribution to many others? This problem led to rephrasing the watermark technology in communications theory terms, that the content (e.g., movie) is not noise, as it had traditionally been treated, but instead more closely resembles communications with side information, a configuration originally described by Shannon. The consequences of this are profound, in particular, that the information bits that can be hidden in an image are potentially very large. The *informed watermarking* topic grew from this work and is the "hot topic" in watermarking today.

Meanwhile, the DVD process moved slowly. In 1998, NEC/Signafy and IBM joined forces to compete for the DHSG CFP, and in 1999 Pioneer, Hitachi, and Sony joined them to form the Galaxy group. Competing against them was the Millennium group consisting of Macrovision, Digimarc, and Philips. Besides the issues of cross-company differences, there were differences in goals of the involved industries. The goal of the content industry was to place controls on DVDs such that their material could not be copied. However, the electronics manufacturers' aim was to make DVD players easy and inexpensive for their users. In 2000, Galaxy and Millennium merged, but such a long period of time had elapsed that

another CFP was issued.

To date this story has no ending. No digital watermarking method has been accepted nor is any in use for DVDs. Instead an analog protection scheme, originally developed by Macrovision for VHS tapes, is used for DVDs, along with an encryption method, Content Scrambling System (CSS). Of course, watermark researchers will tell you that, since content must be decrypted to be viewed, no encryption scheme can prevent copying at the viewing stage. That is the reason for watermarking.

In 1999, NEC chose to privatize Signafy. Ingemar decided to step back from the industry and write a book on watermarking. He has since left NEC and is BTEExact Technologies Chair of Telecommunications in the Departments of Computer Science and Electronic & Electrical Engineering at the University College London.

To read more about watermarking, see the text, *Digital Watermarking*, by Ingemar Cox, Matthew Miller, and Jeffrey Bloom, published by Morgan Kaufmann, 2001.

Larry O’Gorman

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

logorman@avaya.com

S + SSPR 2004

Joint IAPR International Workshops on Syntactical and Structural Pattern Recognition and

Statistical Pattern Recognition

18-20 August 2004

Lisbon, Portugal

<http://www.ph.tn.tudelft.nl/Organisation/ssspr2004/main.html>

A satellite event of the International Conference of Pattern Recognition, ICPR 2004

The International Association for Pattern Recognition (IAPR) and its technical committees on Statistical PR (TC1) and Syntactical and Structural PR (TC2) are organizing a Joint workshop in Lisbon prior to the next ICPR in Cambridge, UK. The workshop aims at promoting interaction and collaboration not only among researchers working directly in the areas covered by TC1 and TC2 but also among those specialized in other fields who use statistical, syntactic or structural techniques. We welcome mathematicians, statisticians, researchers in machine learning and practitioners alike who, at present, work outside the pattern recognition community.

General Chair

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Also of interest to IAPR members...

IEEE Transactions on Pattern Analysis and Machine Intelligence seeks original manuscripts for a Special Issue on Syntactic and Structural Pattern Recognition. Guest Editors are Mitra Basu, Horst Bunke and Alberto Delbimbo.

17th Conference of the International Association for Pattern Recognition

23-26 August 2004, Cambridge, UK

<http://www.ee.surrey.ac.uk/icpr2004/>



ICPR2004

ICPR2004 is the 17th conference of the International Association for Pattern Recognition (IAPR). Started in 1973, ICPR is a major biennial event aimed to stimulate research, development, and the application of pattern recognition. ICPR2004 will be hosted by the British Machine Vision Association (BMVA) and will take place in Cambridge, in the heart of the UK, between 23rd - 26th August '04.

Participants will have the opportunity to meet colleagues working in the same research areas, to attend technical talks on the above topics and to exchange ideas during poster sessions.

In addition to the technical program, participants can also enjoy the City of Cambridge (near London) with its culture and tradition. This historic city with its world-renowned university is within easy traveling distance from main international airports in London and is extremely well served by rail and coach services. For more info on Cambridge see local information.

General Chair

Josef Kittler, j.kittler@surrey.ac.uk

Technical Chair

Maria Petrou, m.petrou@surrey.ac.uk

Program

Like previous years the conference will follow an established format of parallel tracks. The structure of which is shown below. 2004 will see the introduction of a specific focus on selected application areas with a dedicated chairman for each associated track.

22 August	Tutorials				
23 August Day 1	Computer Vision	Pattern Recognition and Neural Networks	Architecture and Tools	Multimedia Systems	Image and Signal Processing
24 August Day 2			Medical Applications	Image and Video Databases	
25 August Day 3					
26 August Day 4	Machine Vision				



Calls for Papers



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: <http://www.ee.surrey.ac.uk/icpr2004/>

Submission deadline: 15 December 2003
Acceptance notification: 15 March 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

- Structural matching*
- Syntactic pattern recognition*
- Image understanding*
- Shape analysis*
- Graph-based methods*
- Probabilistic and stochastic structural models*
- Structural learning in spatial or spatio-temporal signals*
- Supervised and unsupervised learning*
- Intelligent sensing systems*
- Spatio-temporal pattern recognition*
- SSPR methods in computer vision*
- Multimedia signal analysis*
- Image document analysis*
- Structured text analysis and understanding*
- Applications*

SPR Topics

- General methodology*
- Density estimation*
- Multiple classifiers*
- One-class classifiers*
- Neural networks*
- Support vector machines*
- Statistical learning*
- Active learning*
- Clustering and quantization*
- Spectral methods*
- Feature reduction*
- Hybrid methods*
- Contextual pattern recognition*
- Comparative studies*
- Applications*

Further information:

Email: ssspr2004@lx.it.pt
Website: <http://www.ph.tn.tudelft.nl/Organisation/ssspr2004/>

Submission deadline: 15 January 2004
Acceptance notification: March 2004



Image & 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](mailto: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



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The deadline for submission of material for the next issue is 22 August 2003.

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IAPR SPONSORED CONFERENCES & WORKSHOPS

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

2003	Event	Location	Deadlines	Contact
29 June-2 July	13th Scandinavian Conference on Image Analysis	Göteborg	<i>Deadlines</i>	SCIA2003@gbg.congrex.se
SCIA 2003	Bridging Continents and Millennia	Sweden	<i>Passed</i>	http://www.hh.se/scia2003
5-7 July	International Workshop on Machine Learning and Data Mining in , Pattern Recognition	Leipzig	<i>Deadlines</i>	ibaiperner@aol.com
MLDM 2003	Mining in , Pattern Recognition	Germany	<i>Passed</i>	http://www.ibal-research.de/MLDM2003
7-9 July	Fourth International Workshop on Energy Minimization	Lisbon	<i>Deadlines</i>	mff@lx.it.pt
EMMCVPR 2003	Methods in Computer Vision and PR	Portugal	<i>Passed</i>	http://www.emmcpvr.org
3-6 August	7th International Conference on Document Analysis	Edinburgh	<i>Deadlines</i>	
ICDAR 2003	ICDAR 2003	UK	<i>Passed</i>	http://www.essex.ac.uk/ese/icdar2003/
25-27 August	10th International Conference on Computer Analysis of Images and Patterns	Groningen	<i>Deadlines</i>	caip@cs.rug.nl
CAIP 2003	Images and Patterns	Netherlands	<i>Passed</i>	http://caip.cs.rug.nl
12-13 September	IAPR International Workshop on Artificial Neural Networks in Pattern Recognition	Florence	<i>Passed</i>	simonw@dsi.unifi.it
ANNPR 2003	Networks in Pattern Recognition	Italy	15/7/2003	http://www.dsi.unifi.it/ANNPR03
17-19 September	12th International Conference on Image A, nalysis and Processing	Mantova	<i>Deadlines</i>	marco.ferretti@unipv.it
ICIAP 2003	Processing	Italy	<i>Passed</i>	http://iciap2003.unipv.it/
19-21 November	11th International Conference on Discrete Geometry for Computer Imagery	Naples	<i>Passed</i>	dgci@dgci.cib.na.cnr.it
DGCI 2003	Computer Imagery	Italy	30/07/2003	http://dgci.cib.na.cnr.it/
26-28 November	Image and Vision Computing New Zealand 2003	Palmerston North , NZ	22/08/2003	D.G.Bailey@massey.ac.nz
IVCNZ 2003	Image and Vision Computing New Zealand 2003	North , NZ	17/10/2003	http://sprg.massey.ac.nz/ivcnz/index.html
26-29 November	8th Biometric Congress on Pattern Recognition	Havana	<i>Passed</i>	rrm@icmf
CIARP 2003	8th Biometric Congress on Pattern Recognition	Cuba	01/09/2003	