

# **Proc. NCIP-2005**

**Proceedings of the  
National Conference on Image Processing  
March 23-25, 2005  
Venue: NIAS Auditorium, IISc Campus, Bangalore**

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**TIFAC-CORE in Digital Image Processing  
M. S. Ramaiah School of Advanced Studies  
Bangalore 560 054**

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## Editorial

The first announcement of the conference on image processing with focus on medical applications was sent out during October 2004. A three-day event of the conference was planned that included tutorials and invited talks. We were planning the event for about 40 papers. However, the response was overwhelming and we received more than hundred papers! We have received a couple papers from abroad thus giving the conference an international flavor. Consequently, the conference had to be re-organized into four days with a one-day pre-conference tutorials and three days of conference. The review team members took a critical and unbiased look at the contents of the papers. Thanks to their effort, the number of accepted papers was reduced to a manageable sixty papers. Neither the review team nor the editorial team has made any major changes to the contents of the papers. The papers reflect the contribution made by the authors. The tutorial and invited talks are not covered in the proceedings.

Interestingly, the majority of the papers were focused on the theme of the conference, viz., image processing for medical applications. The accepted papers have been grouped into sessions like Medical Imaging Basics (9), Medical Imaging-Applications (14), Image Processing – General (10), Image Processing – Database (6) and Image Processing – Compression (12) and Allied Topics and Aerial Image Exploitation (11).

‘Medical Imaging – Basics’ covers the image processing techniques such as volume rendering, feature extraction, reconstruction algorithms etc as applied to medical images obtained from different modalities like CT, MRI, fMRI and Ultra-sound. ‘Medical Imaging-Applications’ addresses a wide range of disorders: foot ulcers, pathology of blood, cervical smear, lung nodule detection, diabetic retinopathy, breast and skin cancer etc. ‘Image Processing - General’ has papers on feature extraction, segmentation and classification. ‘Image Processing - Database’ addresses the important emerging issues related to patient information management and retrieval. ‘Image Processing - Compression’ seems to have attracted the substantial attention of the engineers. Aerial Image Exploitation, area of strategic importance, has problems similar to those that arise in the area of medical image processing. Allied topics adds variety to an otherwise dominant theme of medical applications.

There is fairly a good representation of the various aspects of the image processing. We wish the readers an exciting tour through the panorama of the image processing arena.

Dr T. V. Ananthpadmanabha  
Mr Viswanath K. Reddy

## Preface

The idea to convene a national conference on image processing has been driven by several forces.

Medical Imaging and image processing are allied areas of research of vital importance in the area of health care. Physicists, mathematicians and engineers tackle the imaging problems to probe deep into a human being, albeit, non-invasively. Imaging techniques provide visuals, but not vision; provide sights but not insights. These skeleton images are to be made interpretable by a radiologist or a medical specialist. Image processing engineers step in to convert the skeletal medical images and dress them into visuals that are imaginative and interpretable. Hence the entire area of diagnosis based on medical imaging techniques is an inter-disciplinary challenge. Research is required not only to extract the full potential and effective use of the existing equipment but also to come up with novel solutions. A conference on image processing with focus on medical applications would be an ideal occasion to deliberate on these issues.

Department of Science and Technology, Govt of India, under its Mission REACH programme has identified several CORE areas of research so that the country emerges as a developed nation to meet the health care and economic prosperity for its people. One such CORE has been established at M. S. Ramaiah School of Advanced Studies in the area of Digital Image Processing. MSRSAS is involved in the frontier area of research related to medical image processing. One of the objectives of the CORE is to network with other industries, research centres and academic institutions. Mr Praveen Ganapthy, REACH monitoring chairman has been urging the CORE to achieve this networking. Convening a national level conference is an effective means of achieving this objective of networking.

TIFAC-CORE at MSRSAS has been constantly interacting with medical specialists. These medical specialists are not only having domain expertise but also a feel of the pulse of the end user, the patient. An in-house meeting of the Doctors and engineers was convened to identify the problems of urgent need and relevance. Dr S Kumar, Dr Naresh Shetty, Dr Srinath, Dr Sundaresh, Dr Chalam Mahadevan, Dr Kishore Alva of MSR Medical College and Teaching Hospital; The Principal and staff of MSR Dental College as well as Dr P N Jayakumar of NIMHANS participated in the deliberations. Also, a separate meeting was held with Dr Devi Shetty of Narayana Hrudalaya. These specialists expressed the satisfaction that the ice has been broken and the channels of communication between the professionals of different disciplines has been established. The medical professionals were delighted to note the practical and down-to-earth approach of the TIFAC-CORE. Also, a team from TIFAC-CORE visited Aravind Eye Hospital, Madurai, another TIFAC-CORE, to identify problems of mutual interest.

Bangalore is the hub of activity in the area of medical imaging equipment. Major players like GE, Siemens, Philips etc are located in and around Bangalore. TIFAC-CORE at MSRSAS has been interacting with these industries to identify problems of practical

importance through their academic collaborative programmes. We realize that there is no dearth of relevant and practical problems to be addressed. TIFAC-CORE at MSRSAS is not presumptuous to claim that it will by itself solve all the problems. These problems are related to general health care for humanity as a whole.

We felt a need to bring together the medical specialists, radiologists, physicists, and engineers to exchange ideas and build up synergy to identify and address relevant problems. TIFAC-CORE at MSRSAS can act as a nodal agency amongst the various institutions and take all the research groups and industries together to achieve excellence in the area of medical image processing.

We conducted a seminar on digital image processing and its applications (DIPA) during Nov 2003. The seminar was well attended and had excellent speakers covering all major areas of image processing. Amongst the audience we had medical specialists, signal processing engineers, Physicists etc. This gave us an impetus and confidence to plan an inter-disciplinary national level conference.

It is conceptually simple to think of a conference. But, realizing the dream and executing all the practical nitty-gritty details requires full cooperation from various professionals. I am pleased to note that the technical committee members and review committee members came forward with their full-hearted participation and guidance to make the concept a reality. As noted in the editorial we received an overwhelming response in terms of contributed papers. Our requests for tutorial talks, invited talks and participation in panel discussion received warm response. We got sponsorships from industries and business enterprises. We got technical recognition from IEEE EMBS and Signal Processing societies. Our guests readily accepted our invitation to participate in the associated functions.

Director, MSRSAS has taken quick and apt decisions and delegated the responsibilities to the staff members who have most enthusiastically participated in the activities. All these tangible and in-tangible factors have made the convening and execution of the conference an enjoyable and stimulating experience. I am deeply indebted to all the persons who have contributed to this endeavor.

Physics, while delving deeper and deeper into the structure of matter and energy, has come face to face with the issue consciousness. Perhaps the desire to delve deeper and deeper into human structure and physiology in medical imaging may unravel mysteries of biology, hitherto unknown to humanity.

I wish all the participants a very pleasant and memorable stay at Bangalore and an intellectually stimulating conference.

*T. V. Ananthapadmanabha*  
Conference Chair, NCIP-2005  
Bangalore, March 23, 2005

## TECHNICAL PROGRAMME

### Tuesday 22<sup>nd</sup> March 2005: Pre-Conference Tutorial

Time	Event	Speaker
8.30 A.M. – 9.00 A.M	Registration for a) Tutorial & Conference b) Tutorials only	
9.00 A.M. – 10.00 A.M	Tutorial Inauguration Function	
10.00 A.M. – 10.15 A.M	High Tea	
10.15 A.M. – 10.45.A.M	<a href="#"><u>“Image Processing – A Clinical Radiologist’s perspective”</u></a>	Dr M G Srinath, Prof and Head, Radiology, MSR Medical College & Teaching Hospital
10.45 A.M. – 11.00 A.M	<a href="#"><u>“Advanced Topics in Ultrasound Imaging”</u></a>	Dr Dipali Wahi, Siemens Info Systems
11.00 A.M. – 11.30 P.M	"MI in Cardiology"	Dr Chalam Mahadevan, Associate Professor, MSR Medical College & Teaching Hospital
11.30 A.M. – 11.45 A.M	Tea	
11.45 A.M. – 12.15 P.M	<a href="#"><u>"MI in Orthopaedics"</u></a>	Dr D C Sundaresh, Professor and Head, Orthopaedics, MSR Medical College & Teaching Hospital
12.15 A.M. – 12.45 P.M	<a href="#"><u>"MI in Pathology"</u></a>	Dr Kishore Alva, MSR Medical College & Teaching Hospital
12.45 A.M. – 1.00 P.M	<b>Discussion</b>	
1.00 P.M. – 1.45 P.M	Lunch	
1.45 P.M. – 2.00 P.M	<a href="#"><u>“Introduction to Image Processing”</u></a>	Dr R B Lokesh, Honeywell
2.00 P.M. – 2.45 P.M	<a href="#"><u>“Introduction to Image Enhancement, Registration, Mosaicing”</u></a>	Dr Jharna Majumdar, ADE, DRDO
2.45 P.M. – 3.05 P.M	<a href="#"><u>“Texture Analysis”</u></a>	Dr R B Lokesh, Honeywell
3.05 P.M. – 3.35 P.M	<a href="#"><u>“Image Segmentation and Classification”</u></a>	Dr Jharna Majumdar, ADE, DRDO
3.35 P.M. – 3.50 P.M	Tea	
3.50 P.M. – 4.10 P.M	<a href="#"><u>“Introduction to Medical Image Analysis”</u></a>	Dr Lalitha, Honeywell
4.10 P.M. – 4.50 P.M	<a href="#"><u>“Medical Image Registration, Morphology, CBIR”</u></a>	Dr Pinaki Ghosh, Consltant
4.50 P.M. – 5.00 P.M	<b>Discussion</b>	





### Wednesday 23<sup>rd</sup> March 2005: First Day of the Conference

Time	Event	Comments
8.30 A.M. – 9.00 A.M.	Registration: Conference Only and Late Arrivals	
9.00 A.M. – 10.30 A.M.	<b>Inauguration of NCIP 2005</b>	
10.30 A.M. – 10.45 A.M	High Tea	
10.45 A.M. – 11.20 A.M.	<b>Key Note Talk: “<i>Medical Imaging: Past, Present and Future</i>”</b>	Dr Arya BYT, Chief Radiologist, Manipal Hospital, Bangalore
11.25 A.M. – 1.35 P.M.	<a href="#">Session - MIB : Medical Imaging – Basics</a>	
1.35 P.M. – 2.15 P.M.	Lunch	
2.15 P.M. – 2.50 P.M.	Invited Talk: “ <i>Digital Morphology</i> ”	Dr. Sahasrabudhe, Professor, IIT Mumbai
2.55 P.M. – 4.15 P.M	<a href="#">Session – MIA : Medical Imaging Applications-1</a>	
4.15 P.M. – 4.30 P.M.	Tea	
4.30 P.M. – 6.15 P.M.	<a href="#">Session – MIA : Medical Imaging Applications-2</a>	

### Thursday 24<sup>th</sup> March 2005: Second Day of the Conference

Time	Event	Comments
9.00 A.M. – 9.35 A.M.	Invited Talk: “ <b>Viewing Mandibular Canal in CT Images</b> ”	Dr S Manivannan
9.40 A.M. – 11.10 A.M	<a href="#">Session – IPG : Image Processing - General-1</a>	
11.10 A.M. – 11.25 A.M.	Tea	
11.30 A.M. – 1.15 P.M.	<a href="#">Session - IPG : Image Processing - General-2</a>	
1.15 P.M. – 2.00 P.M.	Lunch	
2.00 P.M. – 2.35 P.M.	<b>Invited Talk:</b> <a href="#">“Challenges in Medical Image Processing”</a>	Dr. Jayakumar, NIMHANS
2.40 P.M. – 4.10 P.M	<a href="#">Session – IPD : ImageProcessing - Database</a>	
4.15 P.M. – 4.30 P.M.	Tea	
4.30 P.M. – 5.30 P.M.	<b>Session-ALD:</b> POSTER: <a href="#">Allied Topics</a> <b>Session-AIE :</b> <a href="#">Aerial Image Exploitation</a>	

## Friday, 25<sup>th</sup> March 2005: Final Day of the Conference

Time	Event	Comments
9.00 A.M. – 9.35 A.M.	<b>Invited Talk:</b> “Converting Atoms into Bits”	Dr Devi Shetty, Narayana Hrudayalaya, Bangalore
9.40 A.M. – 10.15 A.M.	<b>Invited Talk:</b> “New Frontiers in Medical Imaging”	Dr Sundararaman, Philips Medical Applications, Chennai
10.15 A.M. – 10.30 A.M.	Tea	
10.30 A.M. – 12.00 A.M	<a href="#"><u>Session – IPC : Image Processing - Compression -1</u></a>	
12.05 A.M. – 1.35 A.M.	<a href="#"><u>Session – IPC : Image Processing - Compression -2</u></a>	
1.35 P.M. – 2.15 P.M.	Lunch	
2.15 P.M. – 3.30 P.M.	<b>Panel Discussion :</b>  “Role of Industry in Medical Image Processing Research”	<b>Moderator:</b> Prof L M Patnaik. <b>Panelists:</b> Dr Sundararaman Dr P N Jayakumar Dr A G Ramakrishnan Mr. Amjad Jabbar Dr Rajesh Menon
3.30 P.M. – 4.00 P.M.	High Tea	
4.00 P.M.	Valedictory Function	

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PHILIPS MEDICAL SYSTEMS, BANGALORE

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NATIONAL REMOTE SENSING AGENCY, HYDERABAD.

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L. GANESAN, GOVERNMENT COLLEGE OF ENGINEERING, TIRUNELVELI.

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ADARSH GOLIKERI, THE UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, CANADA  
PRASHANT PRAHLAD, THE UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, USA

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MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL, KARNATAKA

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HIRAL M DESAI , AJAY I TRIVEDI, M.S.UNIVERSITY, VADODARA  
MEHUL S RAVAL, ARVAJANIK COLLEGE OF ENGG. & TECH., SURAT

**IPD.04 : HIERARCHICAL BIT PLANE HISTOGRAM MATCHING FOR CONTENT BASED MEDICAL IMAGE RETRIEVAL**

K. N. MANJUNATH, A. RENUKA AND N. HARISHCHANDRA HEBBAR, MANIPAL ACADEMY OF HIGHER EDUCATION, MANIPAL.

**IPD.05 : IMAGE RETRIEVAL BASED ON CONTEXT-DEPENDENT SEGMENTATION AND MATCHING**

PRABHAKARA RAO, JNTU COLLEGE OF ENGINEERING, KAKINADA,  
M. RANGA RAO, GUDLAVALLERU ENGINEERING COLLEGE, GUDLAVALLERU

**IPD.06 : REGION BASED FUZZY FEATURE MATCHING FOR MEDICAL IMAGE DATABASES USING CBIR**

PRASHANT V. INGOLE, COLLEGE OF ENGG., BADNERA  
KISHORE D. KULAT, V. N. I. T, NAGPUR



## **SESSION – ALD**

### **ALLIED TOPICS IN IMAGE PROCESSING**

**ALD.01 : LINE SEGMENTATION FOR NON-LINEAR ESTEMPAGE IMAGES – AN INDIGENOUS MODEL**

H. K. ANASUYA DEVI, NATIONAL INSTITUTE OF ADVANCED STUDIES, BANGALORE  
ABHISHEK KAPOOR, .R. SIDDHARTHA, V. SRIRAM, TARUN LAKHOTIA , VENGALIL RAGHU  
RAM, NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPALLI.

**ALD.02 : HIGH SPEED PATTERN MATCHING FOR AUTOMOTIVE INSPECTION**

P. CHITRA, AYAN CHAKI, H R MAHADEVASWAMY, B. GIRISH KUMAR AND  
ARUP RAY, RBIN/ECC, ROBERT BOSCH INDIA LTD., BANGALORE

**ALD.03 : FINGERPRINT VERIFICATION BASED ON ORIENTATION FIELD: AN IMAGE BASED APPROACH**

JAYANT V. KULKARNI, BHUSHAN D. PATIL AND RAGHUNATH S. HOLAMBE  
SGGS INSTITUTE OF ENGG. & TECHNOLOGY, NANDED, MAHARASHTRA

**ALD.04 : SEGMENTATION OF THE STEEL IMAGES USING SPECIAL CONNECTED OPERATORS FOR THE AUTOMATION OF STEEL GRAIN PROPERTIES**

MUNEER, P.A. COLLEGE OF ENGINEERING, MANGALORE  
S. P. PATIL, RAJARAMBAPU INSTITUTE OF TECHNOLOGY, SAKHARALE, MAHARASHTRA

**ALD.05 : CONCEPTUALIZING DESIGN AND DEVELOPMENT OF NON-INVASIVE GLUCOMETER FOR 2.0-2.4  $\mu$ M NEAR INFRARED RANGE**

RAJENDRA S. GAD, GOURISH M. NAIK , R K KAMAT, GOA UNIVERSITY, GOA

**ALD.06 : IMPROVED SVM PERFORMANCE THROUGH BOOTSTRAPPING**

VIJAYA V SARADHI AND HARISH KARNIK, IIT KANPUR

**ALD.07 : EXPLORING THE USE OF SELECTIVE WAVELET SUB-BANDS FOR PCA BASED FACE RECOGNITION**

VINOD PATHANGAY AND SUKHENDU DAS, IIT MADRAS, CHENNAI

## **SESSION – AIE**

### **AERIAL IMAGE EXPLOITATION**

**AIE.01 : A CLUSTER-BASED TARGET-DRIVEN ILLUMINATION CORRECTION SCHEME FOR AERIAL IMAGES**

AMEYA GALINDE , SUBHASIS CHAUDHURI, IIT, BOMBAY  
JHARNA MAJUMDAR, ADE, BANGALORE-560093

**AIE.02 : ADAPTIVE ENHANCEMENT OF AERIAL IMAGERY**

JHARNA MAJUMDAR, A G SEETHALAKSHMY, ADE, BANGALORE  
S.RAKSHIT, ANIMA MISHRA, CAIR, BANGALORE.

**AIE.03 : SEGMENTATION OF AIRBORNE AND SPACEBORNE IMAGES**

JHARNA MAJUMDAR, B. VANATHY, ADE, BANGALORE  
SANGEETA KHARE, SHAMSHER SINGH, S C JAIN, DEAL, DEHRADUN

**AIE.04 : CLASSIFICATION OF TEXTURES IN SAR IMAGES USING MULTI-CHANNEL MULTI-RESOLUTION FILTERS**

LALIT GUPTA, SHIVANI G. RAO AND SUKHENDU DAS, IIT MADRAS, CHENNAI

## **SESSION – IPC**

### **IMAGE PROCESSING - COMPRESSION**

**IPC.01 : EFFICIENT MOTION VECTOR CODING FOR IBMCTF FRAMEWORK**

H. ANITHA, M. M. MANOHARA PAI, A. K. KARUNAKA  
MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL

**IPC.02 : THE CURVELET TRANSFORM FOR DIGITAL IMAGE COMPRESSION**

AWAIS MANSOOR, COMSATS INSTITUTE OF INFORMATION TECHNOLOGY (CIIT) ISLAMABAD-PAKISTAN  
ATIF BIN MANSOOR, CENTER FOR ADVANCED STUDIES IN ENGINEERING (CASE) ISLAMABAD-PAKISTAN

**IPC.03 : A NOVEL DIRECTION-BASED BLOCK MATCHING ALGORITHM FOR FAST MOTION ESTIMATION IN CARDIAC VIDEO**

M. EZHILARASAN , P. THAMBIDURAI, JYOTSNA PRADHAN, B. RAMYA, B. SUSHAMA BHAT  
PONDICHERRY ENGINEERING COLLEGE, PONDICHERRY

**IPC.04 : EMBEDDED IMAGE CODING USING MULTI WAVELETS**

D. JEYAKUMARI , R. SATYABAMA, GOVT.COLLEGE OF TECH, COIMBATORE-13.  
S. ANNADURAI , GOVT.COLLEGE OF ENGG, TIRUNELVELI

**IPC.05 : OPTIMAL WAVELET DECOMPOSITION FOR WAVELET BASED IMAGE COMPRESSION CODERS: AN EMPIRICAL STUDY ON MEDICAL IMAGES**

B. RAMAKRISHNAN, MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL, INDIA  
N. SRIRAAM, MULTIMEDIA UNIVERSITY, MALAYSIA

**IPC.06 : MOTION VECTORLESS COMPRESSION FOR TELEMEDICINE**

ROHINI NAGAPADM, NATIONAL INST OF ENGG, MYSORE  
NARASIMHA KAULGUD, WIPRO, BANGALORE

**IPC.07 : WAVELET BASED COLOR IMAGE COMPRESSION USING CONTRAST SENSITIVITY FUNCTION**

D. SANGEETHA , R. SATYABAMA, GOVT COLLEGE OF TECH, COIMBATORE.  
S. ANNADURAI, GOVT COLLEGE OF TECH, TIRUNELVELI.

**IPC.08 : PERFORMANCE ANALYSIS OF VARIOUS PROGRESSIVE IMAGE TRANSMISSION CODING TECHNIQUES ON MEDICAL IMAGES**

B. SATHYABAMA, A. BANUMATHI , S.RAJU AND V. ABHAIKUMAR  
THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI

**IPC.09 : PERFORMANCE ANALYSIS OF H.26X ON MEDICAL VIDEO SEQUENCES**

R. SIVARANJANI, B. YOGAMEENA AND S. MD. MANSOOR ROOMI, THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI

**IPC.10 : MEDICAL IMAGE COMPRESSION USING WAVELET PACKETS**

G. THIRUGNANAM AND P. MANGAIYARKARASI, ANNAMALAI UNIVERSITY

**IPC.11 : WAVELET BASED IMAGE COMPRESSION USING MORPHOLOGICAL OPERATORS AND NEURAL NETWORK**

T. VIDHYA, R. SATYABAMA, GOVT.COLLEGE OF TECH, COIMBATORE  
S. ANNADURAI , GOVT.COLLEGE OF ENGG, TIRUNELVELI

**IPC.12 : LOSSLESS VOLUMETRIC MEDICAL IMAGE COMPRESSION WITH PROGRESSIVE MULTI-PLANAR REFORMATTING USING 3-D DPCM**

VISHRAM NANDEDKAR, S. V. BHARATH KUMAR AND SUDIPTA MUKHOPADHYAY,  
IMAGING TECHNOLOGIES LAB, GENERAL ELECTRIC - GLOBAL RESEARCH, JFWTC,  
BANGALORE.