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EDITORIAL

Editorial

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The current issue that you are holding in your hands is a special one honoring India's greatest ever engineer/architect/planner Dr. Mokshakundam Visvesvaraya, in whose name the Government of India has launched a Doctoral Programme to identify the Best Talent across the country.

The salient features of the scheme are reproduced here from the web site of Medial Lab Asia, the managers of the program on behalf of the Ministry of Electronics and Information technology, Government of India:

1. Give thrust to R&D, Create innovative ecosystem and Enhance India's competitiveness in the knowledge intensive sectors such as Electronics Systems Design and Manufacturing (ESDM), Information Technology (IT), and Information Technology Enabled Services (ITES).
2. To help in the fulfillment of the commitments made in National Policy on Electronics (NPE) 2012 and National Policy on Information Technology (NPIT) 2012.
3. Support to 1500 Ph.D. students in each of ESDM and IT/ITES sectors (Total: 3000 PhDs).
4. Out of the above, 500 PhDs in each of ESDM and IT/ITES sectors would be from full-time Ph.D. candidates. The other 1000 PhDs in each of ESDM and IT/ITES sectors would be from part-time Ph.D. candidates.
5. The scheme will also support 200 Young Faculty Research Fellowships in the area of ESDM and IT/ITES with the objective to attract and retain young faculty members. This is expected to help in the recognition and encouragement of young Faculty members involved in research and technology development in these areas.
6. Infrastructural grant to Academic Institutions for creation and/or up gradation of laboratories. Grant up to Rs. 5 lakh for every Full-Time PhD Candidate supported under the scheme may be provided to an Academic Institution.
7. One of the key goals of the Visvesvaraya Ph.D. Scheme is to encourage working professionals and non-PhD faculty members to pursue Ph.D. in the ESDM & IT/ITES sectors, as part-time candidates. It is envisioned that having part-time PhD students is likely to encourage the Industry-Academia interaction, help in the alignment of the R&D efforts between industry and academia, and bring value to the country.

An apex committee at national level, called National Academic Committee manages the program academically

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for quality assurance. I have the privilege of chairing the National Academic Committee. I have distinguished members from premier institutions, viz., Professor Navkant Bhat from Indian Institute of Science, Professor Sanjiva Prasad from Indian Institute of Technology Delhi, and Professor Abhay Karandikar from Indian Institute of Technology Bombay. I retired as Professor of Computer Science from Indian Institute of Technology Madras.

As the Visvesvaraya Ph.D. program is seen as a unique honor for a student to be selected, the academic committee concentrates on *quality of work carried out by the scholars*, on an ongoing basis. One of the efforts is to bring together the scholars on a quarterly basis for a *knowledge-sharing* workshop. The workshop is designed as a three level filter to get the *best from a batch* of students. A batch consists of students admitted in a certain academic year. For example, the *current issue carries the work reported by the first batch* of Visvesvaraya Ph.D. Fellowship awardees 2014–2015. The three levels of the quality filter are: Selection of about 10% from the abstracts presented by a specific batch, reviewing the presentation material, listening to the presentation by the scholars selected, and interacting with the scholars along with their research guides, and reviewing the full paper (based on the abstract and the presentation) for publication in an academic journal of India—*the* ***CSI Transactions on ICT*** *published by well known Springer and the journal is owned by the prestigious Computer Society of India*. Springer has the journal as a part of their Computer Science package, thereby ensuring worldwide circulation and exposure to the selected work of our prestigious Visvesvaraya Ph.D. Fellowship scholars.

Dedicating an issue for a specific program as a Special Issue is unique gesture by CSI Publications and a unique experiment by CSI Publications in supporting Indian academics for fast track publication of their work in a reviewed journal of repute with worldwide circulation. The idea is to ensure that our Visvesvaraya Ph.D. Fellowship holders who come up with high quality work, are recognized and rewarded on an ongoing basis. This was also part of the deliberations of the National Academic Committee to carry out *a bold experiment in synergy* across a Government Program, independent Journal of Computer Society of India, fast track recognition of Visvesvaraya scholars, and industry participation for value identification and enhancement from such pursuits. Above all, it is our way of saluting the young scholars using the paradigms, "Make in India" and "Made in India" for local relevance and global quality, in line with the Digital India pursuits of our Government.

In the current issue of the CSI Transactions on ICT dated June 2017, we have 11 papers from the First Visvesvaraya Ph.D. Program Workshop held during October 2016 in Indian Institute of Technology Bombay. Shri Sanjeev Mittal, Joint Secretary in MCIT, Shri Anand, MD and CEO of Media Lab Asia and Advisor in MCIT, and Prof. Fernandes, Head of the Department of Computer Science in IIT Bombay shared their views and vision about the program. The four National Academic Committee members formed the review panel. I would like to take this opportunity once again to record my appreciation to the excellent work done by each one of them for our effort towards *quality assurance for the Visvesvaraya Ph.D. program*. For the benefit of the readers, I would like to present a quick preview of the work presented and their importance in today's digital world. Needless to add, that each paper has a significant contribution and is of global quality.

Research in 3D integration has attracted researchers from industry as well as academia due to its benefits over 2D architecture due to better performance, lower power consumption, small form factor and co-existence of heterogeneous technology. However, due to higher power density and reduced heat dissipation properties, thermal challenges cause significant concerns, in the otherwise promising 3D integration technology. *Lokesh Siddu and Preeti Ranjan Panda of Indian Institute of Technology Delhi,* investigate system-level thermal aware data/task mapping policies for 3D memory architectures.

On-chip Wavelength Division Multiplexing (WDM) application of ring resonators on Silicon-on-Insulator (SOI) platform, poses design challenges such as Large Free Spectral Range (FSR) and narrow line width requirements. In fact, the metrics demand opposing structural requirements from a ring resonator—larger FSR demands for a smaller resonator length whereas smaller line width requires a large resonator length device. *Awinash Pandey and Shankar Kumar Selvaraja of Indian Institute of Science Bangalore,* suggest the use of an embedded type ring resonator configuration—a structure made of a racetrack type ring resonator with another ring embedded inside it, because such structures are capable of showing coupled resonator induced transparency (CRIT) which can result in a very narrow line-width. The authors present an (initial) experimental demonstration of CRIT in an internally loaded micro ring resonator fabricated on SOI material platform. They optimized the structures using 3D-FDTD analysis and coupling-matrix method.

Remote sensing through atmosphere requires high power laser sources around 1.6 μm band in Laser Imaging Detection and Ranging (LIDAR) applications and free space optical communication applications. Improving the pumping efficiency and reliability of the laser without increasing nonlinearity that too in a cost effective manner is a significant challenge. *S. Arun and V. R. Supradeepa of Indian Institute of Science Bangalore,* argue that because of high atmospheric transparency in this band, one has to

build a high power laser that generates >25 W of output power at 1570 nm. They do so using sixth-order cascaded Raman amplification of a low power, Erbium–Ytterbium seed. The authors discuss the challenges in building a high power Ytterbium doped fiber laser operating at 1117 nm generating >100 W CW output power for use as the primary laser source for Raman laser experiments. In the process, the authors demonstrate a novel, drive scheme for standard laser diode modules (without wavelength locking) that they use for pumping rare-earth doped lasers and amplifiers.

Organic semiconductor based photo detectors would be very attractive, innovative and well suited for light detection applications. The reason for organic semiconductor in photonic devices is lower cost, light weight, mechanical flexibility, chemical modification, tunability of absorption range with co-evaporation and co-mixing of molecules and ease of integration. *Debarati Nath, Puja Dey, Debajit Deb, Jayantha Kumar Rakshit, and Jithendra Nath Roy of National Institute of Technology Agartala,* in their work discuss the fabrication and characterization of organic semiconductor based photo detector with a choice of organic semiconductor as donor and acceptor. Besides, they discuss optimization by employing diversified organic semiconductors for fast response time, high photosensitivity, high quantum efficiency, low dark current, large dynamic range and long lifetime. The authors discuss the design of an equivalent circuit model for organic photo detector (OPD) structure and present results obtained through simulation using MATLAB Simulink, in which Rubrene and BPPC are used as active layer of OPD. Using their OPD proposal, the authors argue that 500 MHz of Operating frequency that is much higher than the speed of the red light illumined Bi-layer OPDs reported till today, is feasible.

Non-contact measurements—non-ionizing and non-invasive – of human body have been attracting the attention of medical science researchers. Remote measurement of 'heartbeat' has several strategic applications besides medical diagnosis. *Harikesh Dala, Ananjan Basu, and Mahesh P Abegoankar of Center for Applied Research in Electronics, Indian Institute of Technology Delhi,* discuss a method for non-contact measurement of respiration and heartbeat using microwave Doppler radar phase modulation in X-band (8–12 GHz), as the reflected signal from the body depends on the radar cross section (RCS) of body.

In automatic speech recognition systems, the information in the speech signal is traditionally retrieved in the form of feature vectors representing sub-word units and thereby converting the features into human readable text form. However, these systems perform poorly due to degradations of speech under varying environmental conditions. To improve the performance, the main issues to be considered are: (a) Determination of speech regions in the speech data collected in degraded environments, and (b) Recognition of speech sounds from the degraded speech in the detected speech regions. Although there exist wide variety of techniques, which address these issues, most of them are applicable for clean speech synthetically degraded by stationary noise conditions, due to the need for large amount of training data for statistical modeling. *Vishala Pannala of International Institute of Information Technology, Hyderabad,* focuses on methods of processing the signals so as to determine the desired speech regions in degraded conditions. For this, the author explores signal-processing methods to extract speech-specific characteristics independent of the characteristics of degradations.

The next generation networks (NGN) have higher network density to increase the capacity of the overall network and consequent energy consumption. *Yogitha Ramamoorthy and Abhinav Kumar of Indian Institute of Technology, Hyderabad,* argue that Base Station Switching (BSS) combined with appropriate coverage extension techniques, such as coordinated multi-point (CoMP) transmission is the way forward in achieving higher energy efficiency while maintaining the QoS. The authors discuss the performance evaluation of CoMP with BSS, utilizing *suitable* resource allocation techniques.

Ramesh K Gupta and Bijoy K Das of Indian Institute of Technology Madras, propose and demonstrate a method for the fabrication of a Silicon on Insulator (SOI) platform with custom-design device layer thickness (<1 μm) which can be accessed by any desired number of adiabatically tapered single-mode input/output waveguides (multi-input multi-output waveguides) of widths and heights >1 μm, operating at $\lambda \sim 1550$ nm. The input/output waveguides can be pigtailed with standard single-mode fiber with lensed tip ensuring modal overlap of >70% (coupling loss <1.5 dB). Such a multi-input multi-output SOI platform will facilitate for CMOS silicon photonics based on-chip applications with an additional usage freedom of device layer thickness. Moreover, it can be potentially used to design SOI based stand-alone devices, which can be useful at transmitters/repeaters for short-haul/long-haul optical communication.

In uncontrolled environment, recognition of faces from imagery, present multiple challenges. The primary challenges are occlusion, pose and illumination variation. Convolutional Neural Network (CNN) is a bio-inspired network that learns the way human brain learns. CNN offers deep observation of features present in input image. *Dattatray D. Sawat and Ravindra S. Hegadi of Solapur University, Solapur,* present a combined approach to detect faces using deep features extracted by deep CNN and the classification by Cubic Support Vector Machine. The authors use Area based approach for removal of distant

faces and background pixels, in order to reduce the processing time required per frame at detection stage.

Machine learning, where a machine will independently learn from users previous data and provide solution and better suggestions to the user, is considered to be the next generation human machine interaction technology. The emerging trend is to institutionalize learning as and when it happens, resulting in 'Reference based self-learning'. *Avinash Keskar of Visvesvaraya National Institute of Technology, Nagpur and N C Shivaprakash of Indian Institute of Science, Bangalore,* propose a reference based self-learning model, which can learn classification on new data from its previous trained models. The authors take recourse to simulation on three feature vectors as a process of events and achieve an accuracy of around 90% using reference-based learning. Obviously, this method of live training and classification reduces time required for database preparation and model training separately for each event based features.

Speech is the natural communication means, for interaction between humans and machines. Telephone-speech technology has been receiving more attention in recent times. The spectral-temporal features offer a significant performance improvement for telephone speech recognition when compared with the conventional 'feature based speech/speaker identification'. The commonly used method to measure the performance of a speech recognition system is the recognition accuracy. For obtaining proper accuracy it is necessary to design an efficient classifier for the recognition purpose which will lead to correct recognition results. *Mridusmita Sharma and Kandarpa Kumar Sarma of Guwahati University, Guwahati,* discuss soft computation based spectral and temporal models of linguistically motivated Assamese telephonic conversation recognition.

I am sure that readers find this issue extremely interesting. The contents of this issue not only present the state-of-the-art, but also show cases the research work being carried out in various institutions. While all the papers span the area of ESDM, IT and ITES, in line with Sir Visvesvaraya Ph.D. program objectives, it also presents the potential that exists across the length and breadth of India.

Enjoy reading!