CSIT (March 2018) 6(1):1–3
https://doi.org/10.1007/s40012-018-0189-9

EDITORIAL

Editorial

S. V. Raghavan[1]

While writing this editorial, the following thought crossed my mind: *CSI Transactions on ICT, or CSIT in short, is perhaps emerging as the "goto" journal in the 21st century.* Science, applied science, nano devices, electronic realisation, laying the foundation for future technologies, system building, experimental test benches, and applying all of those to solve societal problems and addressing national security, is happening in the current issue—March 2018. I am glad to inform the readers that the material is a select set from the regular quarterly workshops conducted among the national awardees of Sir Visveswaraya Research Fellowship of the the Ministry of Electronics and Information Technology, Government of India. The issue is also marked as SI: Visveswaraya.

Pathology, MRI scan, Prosthesis, sample three dimensions of future human need where Information and Communication Technology and fundamental science can play an integrated role. Applied science integrating material science and nano devices to produce and test a biomarker sensor for serum createnine defines pathology of tomorrow.

Serum creatinine is an established biochemical marker for monitoring of renal function, but require sophisticated instrumentation which limits its accessibility. In this regard, point of care biosensors provide a low-cost solution coupled with simple instrumentation. Authors *Pallavi Dasgupta, Vinay Kumar, P. R. Krishnaswamy, Navakanta Bhat*, in their work titled, *Development of biosensor for detection of serum creatinine*, aim to develop non-enzymatic electrochemical creatinine biosensor which simplifies the process of routine clinical analysis, making it accessible due to its low-cost.

Designing trajectories for scanning in MRI has attracted the attention of researchers recently. In this context, various cartesian and non-cartesian trajectories such as rectangular, spiral, radial, etc. have been proposed in the literature. Non-cartesian trajectories are observed to perform optimally in terms of scan time and reduced artifacts in the constructed image. *Subham Sharma and K V S Hari*, in their paper titled, *Four-shot non-cartesian trajectories for k-space sampling in MRI,* propose a Novel k-space sampling trajectories that use sinusoidal smooth functions and four RF excitations (four-shots). Their Simulations based on Shepp–Logan phantom image show that the proposed trajectory provides slightly better peak signal-to-noise ratio compared to the commonly used spiral trajectory.

Prosthesis control and fine movements require sensing and understanding the Electromyogram (EMG) signals from amputees residual limbs, to identify the human activities and intention. The study by *Rohit Gupta and*

✉ S. V. Raghavan
sv.raghavan@gov.in

[1] CSI Publications Ltd, Chennai, India

Ravinder Agarwal, titled, *Continuous Human Locomotion Identification for Lower Limb Prosthesis Control*, explores a pool of thirty-eight features in time as well as frequency domains, arising from the EMG signals. They propose an iterative greedy approach for the feature selection algorithm, compare the results with pre-existing feature vectors for single muscle and multi muscle based locomotion identification approach, and show that time domain features are best suited for locomotion identification, with SVM, LDA and NN as classifiers.

Bandwidth, Computing, Antenna, and Cognitive radio are defining the future of the technology in the entire ICT areana. Tremendous demand in bandwidth and computing coupled with intense sharing of the scarce resource in airwaves with high density demand and need for extremely low power consumption drives the imagination of scientists and innovators. While Laser physics and device construction is enabling one to meet the bandwidth demand, RNA computing bordering on protein synthesis is delivering a solution to future computation devices. Similarly, while embedded antennas and their structures are enabling reach, the cognitive enhancement of the radio regime is ensuring continuous availability for all.

Increasing demand for high bandwidth data communication requires development of innovative, reliable and scalable systems. Super-channels with Higher Order Modulation schemes will drive the next generation optical communication systems. Conventional implementations require hundreds of lasers and are not scalable; the alternative is to develop and use an Optical Frequency Comb (a series of evenly spaced spectral components). Generating such a comb with precise spacing and stability is a challenge. B. S. Vikram, Shankar Kumar Selvaraja, and V. R. Supradeepa, in their work titled, Optical Frequency Comb synthesis for super channel based high-bandwidth data communication, focus on optical sources for such systems. They achieve this by system design using Electro-Optic Modulators and three lasers where they demonstrate a 24-line comb which is de-multiplexed to realize optical source for super channels. This is a scale up of number of carriers by a factor of 8.

Ever increasing requirement of high performance from a computing device, implies increased transistor density and power dissipation rate. With the size of transistors approaching near-atomic scale, finding a satisfactory alternative platform that can fulfill the demand of high performance machine is the emerging imperative. As a consequence many alternative computing environments such as *Optical computing*, *Quantum computing*, *Membrane computing*, *DNA computing* have emerged. Among these, *DNA computing* has been proved to be most useful to solve computationally hard problems, but it suffers from lack of automation. DNA (Deoxyribonucleic Acid), along with another molecule RNA (Ribonucleic Acid) act as information carriers of a cell. RNA constructs a structure called ribosome which performs an automated process within itself. This automated process is referred to as protein synthesis or translation process. This process can also be regulated using (proper) mutations. *Pratima Chatterjee and Prashun Goshal,* in their work titled, *Computing in ribosome: logic gates implementation using mRNA-Ribosome system,* discuss the realization and implementation of all logic operation by controlling the protein synthesis procedure using mutations.

An antenna with high efficiency and compact size has been a dream in the field of wireless communication. *Tarakeswar Shaw and Debasis Mitra*, in their paper titled, *Efficient design of electrically small antenna using metamaterials for wireless applications*, present a simple and efficient approach for the design of a compact coplanar waveguide (CPW) fed slot antenna loaded with complementary split ring resonators (CSRRs) and metamaterial (MTM) slab. The MTM slab consists of an array of 1×3 single-sided periodic structure of split ring resonator unit cells. The CSRRs are incorporated on both sides of the rectangular slot and the MTM slab is placed below the dielectric substrate of the antenna to achieve miniaturization. About 56.7% miniaturization is attained, while the effect on the co-polarization and cross-polarization is minimal. The overall antenna size is $0.23\ \lambda_0 \times 0.23\ \lambda_0 \times 0.009\ \lambda_0$, where λ_0 is the free space wavelength and the radiation efficiency is 84.2%.

Cognitive radio is a prominent technology for improving radio spectrum efficiency. The basis is to study the underlying cognitive radio network (CRN), consisting of a cognitive base station (CBS) and multiple multicast group of secondary users (SUs), where normally a common primary user (PU) channel is used to support multicast services to a group of Sus with the objective to minimize the outage probability of the SU multicast groups. Sangeeta Bhattacharjee, Tamaghna Acharya, and Uma Bhattacharya formulate the problem using constrained optimization framework with the constraints; PUs' outage probability and CBS's average transmit power. Their study based on simulation validates their power allocation scheme, that improves the spectrum efficiency of the CRN.

Underwater Optical Communication and Electronic nose are both technologies of tomorrow so far as national security is concerned. While the former poses ever increasing complexity, the latter remains the elusive holy grail.

Gaining insight into the nature of errors that can occur in under water optical communication and the means that can be adopted to improve the reliability of information transfer across such channels has been a research pursuit

for years. Turbulence in the medium can cause beam wander creating random errors, while blockage blocks the data for certain duration leading to burst errors. Prasad Naik Ramavath, Amardeep Kumar, Shrutkirthi Shashikant Godkhindi, and U. Shripathi Acharya, in their paper titled, Experimental studies on the performance of underwater optical communication link with channel coding and interleaving, describe the establishment of an experimental setup to study the performance of underwater optical communication links under conditions of turbulence and blockage by creating a water column filled with sea water containing sediments and organic matter, water jets placed appropriately in the medium to create turbulence and use of a motor driven paddle running with a constant rpm to simulate conditions of blockage and added turbulence. They demonstrate the use of the experimental test-bench for developing counter measures.

Optical, mechanical, and electrical approach to sensing gas molecules has been the evolutionary growth path, since the days of gas chromatographs. As science research delves deep into nano particles and deals with nano tubes, the holy grail of embedded "electronic nose" appears to be within reach. *Sanghamitra Ghosal and Partha Bhattacharyya*, in their paper titled, *Influence of distributed reduced graphene oxide clusters on methanol sensing performance of TiO_2 nanotube based device*, aim to improve the methanol sensing performance of TiO_2NT based devices by incorporating to RGO clusters on top of the TiO_2NT matrix in a distributed format. They argue that a systematic comparison of the *bare TiO_2 nanotube based sensor* and *reduced graphene oxide-TiO_2 based sensor,* carried out with methanol vapor as the test species, show remarkably superior performance of the latter in sensor parameters such as response magnitude, response time, and recovery time.

Water and Electricity are fundamental to human existence. While the former appears to be a depleting resource, the latter seems to be a challenging carbon issue from climate change perspective. Balanced usage and ensuring adequacy has been the concern of the country's planners.

Water demands are increasing as the population increases, it's the challengeable task for municipality to equalise supply against demand. Drinking water system is high budget asset, hence planning of such utilities needs simulation. Whole supply system is complex with multi-characteristic elements working together for the supply of water to the consumer. *Ganesh S. Ragade, Rajesh Dhumal, and Bharti W. Gawali* in their paper titled, *Analysis and modelling of drinking water utilities by using GIS: in Aurangabad city, Maharashtra, India,* implement a computerized hydraulic model using EPANET and Integrates it with GIS for analysis.

Now a days solar photovoltaic (PV) is the promising technology to address global issues such as carbon-free electricity, shortage of fossil-fuel, global warming and low cost electricity. This would be successful while the conversion efficiency is improved and new technology is developed. One such technology to achieve over 40% efficiency is to stack III–V compound semiconductors to form multi-junctions. Indium Gallium Nitride ($In_xGa_{1-x}N$) is a highly emerging material with band gap ranging from 0.64 to 3.4 eV which has the ability to absorb nearly whole solar spectrum to increase the conversion efficiency copiously. Since past few years, $In_xGa_{1-x}N$ material has been showing its potential for different optoelectronic and power electronic applications. This motivation is driving immense scientific interest to develop high-performance solar cells using $In_xGa_{1-x}N$ material. *S. R. Routray and T. R. Lenka*, in their paper titled, *InGaN-based solar cells: a wide solar spectrum harvesting technology for twenty-first century,* highlight the basic advantageous properties of $In_xGa_{1-x}N$ materials, its growth technology and state-of-the-art application towards PV devices.