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EDITORIAL

Imaging Systems and Techniques 2011

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This special feature on Imaging Systems and Techniques comprises 11 papers, covering essential facets in imaging systems and techniques both in theory and applications, from research groups in three different continents. It mainly contains peer-reviewed articles from the IEEE International Conference on Imaging Systems and Techniques (IST 2011), held in Batu Ferringi, Penang, Malaysia, as well a number of articles relevant to the scope of this issue.

Breakthrough discoveries in imaging are promising for an array of disciplines and applications such as the design of highly efficient imaging sensors with enhanced figures of merit, for space-based surveillance and situational awareness missions, missile defense, homeland security, medicine, biology, bioengineering, advanced diagnostic and analytical devices and instrumentation, including nanoinstrumentation.

Imaging technologies are expected to play an important role in the protection of space assets and infrastructure such as space satellites, therefore enhancing the space situational awareness (SSA) and mission protection. Innovative and efficient detection and imaging trends for space-based surveillance and situational awareness missions will be emerge as a result of the discovery and development of quantum well structures, quantum dot lasers, nanomaterials, metamaterials and photonic nanocrystals. Imaging technologies relying on optoelectronic detectors and photonic components can be substantially improved by optoeletronic nanostructures, leading to controllable transmission and reflection optical filters and devices, with high agility, tunability, scalability and reconfigurability.

The tremendous evolution of nanotechnology promises to provide to molecular imaging an arsenal of novel targeted contrast agents. The desired properties of such targeted contrast agents are: long bioavailability, selective binding to targets of interest and low toxicity profile, while offering high contrast and high background rejection ratio. Advanced metabolic and functional imaging techniques, operating on multiple physical principles, using high resolution, high selectivity nanoimaging techniques, making use of quantum dots, nanoshells, biomarkers, contrast agents, gold nanostructures and PEBBLE (probes encapsulated by biologically localized embedding) nanosensors, will play an important role in the diagnosis and treatment of autoimmune diseases and cancer, as well as providing efficient drug delivery.

By integrating multifunctional nanovectors and nanoconjugates with imaging, nanophotonics could give rise to reconfigurable and scalable photonic devices and imaging systems for early diagnosis, accurate staging, better facilitation of localized surgical interventions, treatment of cancer, as well as minimally invasive monitoring of therapeutic response. As a result, this could dramatically improve the current poor survival rate of patients with a variety of tumors by providing imaging solutions for disease treatment with increased sensitivity and specificity. Multifunctional nanoassemblies would enhance the clinical imaging significantly by allowing the incorporation of imaging components, such as near-infrared (NIR) dyes, single photon emission computed tomography (SPECT) agents and positron emission tomography (PT) agents, onto surface mesoporous silicon particles (S1MPs).

Efficient digital imaging systems and techniques, and tomographic devices operating on electrical impedance tomography, electromagnetic scattering, computed tomography, SPECT and PT detection principles, are anticipated to

have a significant impact on a wide spectrum of technological areas, such as medical imaging, the pharmaceutical industry, analytical instrumentation, aerospace, exploration of resources, remote sensing, lidars and ladars, surveillance, national defense, corrosion imaging and monitoring, sub-terrestrial and marine imaging.

Pattern recognition and image processing algorithms can significantly contribute to enhanced detection and imaging, including object classification, clustering, feature selection, texture analysis, segmentation, image compression, and color representation under complex imaging scenarios, with applications in medical imaging, remote sensing, aerospace, radars, defense and homeland security.

As a result, the promotion of multidisciplinary research programs and new training programs in the multifaceted area of imaging would facilitate the development of new imaging technologies, nanomaterials, molecular probes and targeted contrast agents.

We feel confident that the exciting new contributions of this special feature on Imaging Systems and Techniques will appeal to the technical community. I would like to thank all the authors as well as all anonymous reviewers and the MST Editorial Board and Publisher for their tremendous efforts and invaluable support in enhancing the quality of this significant endeavor.