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***Independent Component
Analyses, Wavelets, Neural
Networks, Biosystems, and
Nanoengineering IX***

**Harold Szu
Liyi Dai**
Editor

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Introduction

The tenth annual SPIE conference on Independent Component Analyses, Wavelets, Neural Networks, Biosystems and Nanoengineering, continues our yearly tradition of contributing and communicating knowledge to one another. The SPIE Defense Security and Sensing (DSS) Symposium has provided our community with the proper venue to exchange information, provide education through short courses, and network through various hospitality events. Boasting over 500 exhibiting vendors and talks given by over 7000 scientists and engineers worldwide, the symposium is an immense gathering. Our conference, however, is relatively small, but has a rapid dissemination of timely work in the disciplines covered. New to the conference this year is post-conference publication. We appreciate the timely submissions of our authors and the patience of our readers.

Being co-chairs, we often face questions about our goals and focus for the future of the conference series. To state the question plainly, how has the conference endured, and how can it continue to endure and evolve in a changing scientific environment? The answer lies partly in the following secret: We have adapted a workable system tested by the Nobel Foundation for over half a century—passing the baton of honor.... “The past award recipients shall determine the new awardees.” The role SPIE and the co-chairs serve is to act as facilitators for the decision process. A major difference between the systems is a lack of recourse in supporting the awardees. Thus we have improvised a temporary win-win-win solution: in order to prepare the interdisciplinary audience, state of the art knowledge is disseminated by both past and present award recipients, who are encouraged to teach short courses at the meetings.

Driven by our desire to learn from nature, the SPIE conference on wavelets has evolved, and is now in its 18th year with SPIE. When the conference started 18 years ago progress began slowly. Then, year after year, knowledge began growing, building, and changing. The evolution of knowledge has led to a strong foundation for the work this year. The use of wavelets has seen much progress from a biomedical standpoint. From the 2011 Wavelet Pioneer Award Recipient Prof. John J. Benedetto (University of Maryland, College Park), we have learned how to apply the mathematical model of wavelets to explain natural phenomenon and applications to compressive sensing technology. Compressed sensing is a mathematical technique in which data is sparsely sampled by a series of zeros and ones, which acts like a “mask”. Then the original data is reconstructed mathematically, a technique founded and developed by Candès, Romberg, Donoho, and Tao. Unsupervised learning uses artificial neural networks to imitate the human brain's ability to learn from previous data. The 2011 recipient of the Unsupervised Learning Neural Network Independent Component Analyses (ICA), Prof. Hyung-Min Park (Korea, Republic of), explains how ICA can be used to collect relevant acoustic data from acoustic mixtures. Decades of theoretical explanations have provided us with the means for experimental exploration and implementation. These experimental endeavors led to great progress by such efforts as applying computational intelligence to image diagnosis done by the Biomedical Wellness award recipient Dr. Hiroshi Nakajima (OMRON Corp.). Experimental works from nanoengineers explore innovative methods for fabrication of exciting materials. We introduce our 2011 Nano-Engineering Pioneer Award recipient Prof. Metin Sitti (Carnegie Mellon University), who will provide insight from the field of nanorobotics. Nano-engineers can take advantage of the nanometer regime, in which unique physical and chemical properties not observed on a macroscale can be manipulated. Finally, we are ready to emulate the most robust, and

perhaps most efficient field in its own right, System Biology, as elucidated by our 2011 Pioneer Award recipient Prof. Douglass A. Lauffenburger (MIT) during the last day of our program.

Lastly, compressive sampling is a relatively new technique and its application can be applied to a broad spectrum of disciplines. The committee has decided to acknowledge the pioneering efforts of compressive sensing in 2012 by Dai in the Army Research Office.

We wish to thank all of 2010 recipients, who headed the selection process for this year's awardees: Prof. Jan-Olov Stömberg, Prof. Yutaka Hata, Prof. Diana Huffaker, Soo-Young Li and Dr. Hamid Bolouri. The conference would not be a success without you and your unselfish contributions. We would also like to thank the SPIE technical support staff and last but certainly not least, I would like to thank the members of the program committee.

Harold Szu
Liyi Dai