Electrical Engineering Colloquium

Dallas Chapter of IEEE Signal Processing Society Presents

"Genomic Signal Processing:

The Key to Systems Medicine"

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Two terms now in use should awaken electrical engineers to the major role they have to play in the life sciences: *systems biology* and *systems medicine*. Systems biology involves understanding the manner in which the parts of an organism interact in complex networks, and systems medicine is the application of systems biology to medicine. Genomics, a key driver of systems biology, involves the study of large sets of genes and proteins, with the goal of understanding systems, not simply components. In this vein, Genomic Signal Processing (GSP) has been defined as *the analysis, processing, and use of genomic signals for gaining biological knowledge and the translation of that knowledge into systems-based applications*. A major goal of translational genomics is to discover families of genes whose products (messenger RNA and protein) can be used to classify disease, thereby leading to molecular-based diagnosis and prognosis. A second major goal is to characterize genetic regulation, and its effects on cellular behaviour and function, thereby leading to a functional understanding of disease and the development of systems-based medical solutions. GSP requires the development and use of novel models and methods specifically designed to capture the biological mechanisms of operation and distributed regulation at work within the cell. In particular, it is necessary to develop nonlinear dynamical models that adequately represent genomic regulation and to develop mathematically grounded diagnostic and therapeutic tools based on these models. This talk discusses the salient issues of GSP, their relevance to translational genomics, and some of the key obstacles that must be overcome.

Edward R. Dougherty is a Professor in the Department of Electrical and Computer Engineering at Texas A&M University in College Station, TX, Director of the Genomic Signal Processing Laboratory at Texas A&M University, Director of the Computational Biology Division of the Translational Genomics Research Institute in Phoenix, AZ, and Adjunct Professor in the Department of Pathology of the University of Texas M. D. Anderson Cancer Center. He holds a Ph.D. in mathematics from Rutgers University and an M.S. in Computer Science from Stevens Institute of Technology. He is author of twelve books, editor of five others, and author of two hundred journal papers. He is an SPIE fellow, is a recipient of the SPIE President's Award, and has served as editor of the Journal of Electronic Imaging. Prof. Dougherty has contributed extensively to the statistical design of nonlinear operators for image processing and the consequent application of pattern recognition theory to nonlinear image processing. His current research is focused in genomic signal processing, with the central goal being to model genomic regulatory mechanisms for the purposes of diagnosis and therapy.

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