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Dr. Sam Efromovich is the Cecil and Eda Green Endowed Professor in Systems Biology and a Professor of Mathematical Sciences at the University of Texas at Dallas. He is a Fellow of the Institute of Mathematical Statistics and was recently elected to the title of Fellow of the American Statistical Association (ASA) for his "fundamental and influential contributions to statistics, notably in the theory, methodology and applications of adaptive nonparametric curve estimation; and for service to the profession." He has over 150 refereed publications, most of which have appeared in top research journals, and he is the author of the Springer's book **Nonparametric Curve Estimation: Methods, Theory and Applications.** His most recent publication was the Editor's Special Invited Paper (with discussion) in the first 2007 issue of *Sequential Analysis, titled* "Sequential Design and Estimation in Heteroscedastic Nonparametric Regression." He is the Coordinating Editor of *Journal of Statistical Planning and Inference* and an Associate Editor of *The Annals of Statistics* and *Methodology and Computing in Applied Probability*.

Applications in Finance, Engineering and Health Science

Abstract: Sequential analysis is one of the branches of the statistical science which is famous by its application-driven nature and by its revolutionary methodology which allows statisticians to answer question raised by constantly changing technology. This talk will illustrate this flexibility with main emphasis on modern nonparametric curve estimation procedures.

First, we shall consider a new statistical methodology for the analysis of ChIP-on-chip microarrays. Special protocols, based on using these microarrays, have been recently developed for understanding of the mechanism of gene regulation in bacterial systems. Microarrays are known by producing extremely large and noisy datasets where typically each prob performs independently of others. This does not favor the use of a nonparametric curve estimation procedure (a "smoother"). The situation is different for ChIP-on-chip technology where a protein binding site (the point of interest) produces a curve-like signal over probs neighboring in a chromosome. Known statistical methods use this neighboring effect solely to define so-called peaks, which are locations of probs producing relatively large signals. Known methods also do not search after underlying binding sites. It is suggested to use probabilistic models for describing an underlying binding process, and then use it in a sequential statistical procedure for finding binding sites. Further, based on the model, several sequential changes in protocols of microarray experiments are suggested.

Second, we shall consider new statistical frontiers in super-frequent functional Magnet Resonance Imaging (fMRI). To understand neuronal events and brain diseases, it is necessary to have non-invasive tools for observing neuronal activity with high spatial (within several millimeters) and high temporal (within tens of milliseconds) resolution. The classical fMRI allows a high spatial resolution, but has limited temporal resolution (typically several seconds). Given the millisecond scale of neuronal events, it is recognized that the current fMRI methodology may have missed significant amount of critical information in brain activation (e.g. the time it takes to process the sensory inputs at different cortical levels). A super-frequent fMRI technology, recently developed by the UTSW Medical School, allows one to make up to 50 images per second. Sure enough, the super-frequency aggravates all the known statistical issues of low signal-to-noise ratios in fMRI. To overcome these issues, new statistical procedures, including wavelet denoising and sequential estimation, have been developed. The suggested procedures allows us not only to remove noise, but also to visualize and analyze two of its more important components: cardiac and respiratory signals. In particular, the latter allows us to understand how these signals "move" inside brains.

Finally, several interesting applications in analysis of financial instruments will be presented. Further, depending on the progress of current research, some actuarial applications may be presented as well.