SEMINAR NOTICE

Department of Electrical and Systems Engineering

STATISTICAL DESIGN OF POSITION-ENCODED 3D MICROARRAYS

DISSERTATION DEFENSE
by
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Abstract: We propose a three-dimensional microarray device with microspheres having controllable positions for error-free target identification. We conduct a statistical design analysis to select the optimal distance between the microspheres as well as the optimal temperature. Our design simplifies the imaging and ensures a desired statistical performance for a given sensor cost. Specifically, we compute the posterior Cramér-Rao bound on the errors in estimating the unknown target concentrations. We use this performance bound to compute the optimal distance and operating temperature of the image sensor. We discuss both uniform and sparse concentration levels of targets, and replace the unknown imaging parameters with their maximum likelihood estimates. We illustrate our design concept using numerical examples. The proposed microarray has high sensitivity, efficient packing, and guaranteed imaging performance. It simplifies the imaging analysis significantly by identifying targets based on the known positions of the microspheres. Potential applications include molecular recognition, specificity of targeting molecules, protein-protein dimerization, high throughput screening assays for enzyme inhibitors, drug discovery, and gene sequencing. We conclude by presenting preliminary results of implementing the proposed device using microfluidic fabrication by our collaborators. We discuss future work and our other research on segmenting cDNA microarray images, estimating sparse gene regulatory networks, and analyzing gene reachability.

DATE:	Monday, February 8, 2010
TIME:	4:00 p.m.
PLACE:	Bryan Hall, Room 305

Dissertation advisor:
Dr. Arye Nehorai

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SCHOOL OF ENGINEERING & APPLIED SCIENCE