SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

TOWARDS MATERIAL IDENTIFICATION: COMBINED X-RAY ATTENUATION AND SCATTER SYSTEM

DISSERTATION DEFENSE
By

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Abstract: We consider the problem of designing combined x-ray attenuation and scatter systems and the algorithms to reconstruct images from the systems. As is the case within a computational imaging framework, we tackle the problem by taking a joint system and algorithm design approach. Accurate modeling of the attenuation of incident and scattered photons within a scatter imaging setup will ultimately lead to more accurate estimates of the scatter densities of an illuminated object. Such scattering densities can then be used in material classification.

In x-ray scatter imaging, tomographic measurements of the forward scatter distribution are used to infer scatter densities within a volume. A mask placed between the object and the detector array provides information about scatter angles. An efficient computational implementation of the forward and backward model facilitates iterative algorithms based upon a Poisson log-likelihood. The design of the scatter imaging system influences the algorithmic choices we make. In turn, the need for efficient algorithms guides the system design.

We begin by analyzing an x-ray scatter system fitted with a fanbeam source distribution and flat-panel energy-integrating detectors. Efficient algorithms for reconstructing object scatter densities from scatter measurements made on this system are developed. Building on the fanbeam source, energy-integrating flat-panel detection model, we develop a pencil beam model and an energy-sensitive detection model. The scatter forward models and reconstruction algorithms are validated on simulated, Monte Carlo, and real data.

We describe a prototype x-ray attenuation scanner, co-registered with the scatter system, which was built to provide complementary attenuation information to the scatter reconstruction and present results of applying alternating minimization reconstruction algorithms on measurements from the scanner.

DATE: **Tuesday April 29, 2014**
TIME: **10:10 a.m.**
PLACE: **Green Hall, Room 0120**

Dissertation advisor:
Dr. Joseph O'Sullivan

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE