# SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

## MULTIPLE-TARGET TRACKING IN COMPLEX SCENARIOS

PhD Preliminary Research Examination

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**Abstract:** The problem of multiple-target tracking in complex scenarios is of great interest in many commercial and military applications, including air traffic control and battlefield surveillance. The optimal solution (in mean-squares error) to this tracking problem cannot be found since the state-space model and the sensor-measurement model are both nonlinear. An important class of suboptimal filters that can be used for estimation in nonlinear models are the sequential Monte Carlo filters, also known as the particle filters.

In this research, we solve multiple-target tracking problems in two complex scenarios. In the first scenario, we consider a known number of targets moving in a time-varying multipath environment. Therefore, in addition to the target positions and velocities, we need to estimate the multipath channel state in each time interval. To solve this problem, we propose a multiple Rao-Blackwellized particle-filtering (MRBPF) method for joint estimation of the targets' positions and velocities, and of the multipath channel. We exploit the structure of the measurement and the state models and partition the state space into two lower-dimensional subspaces. We employ one Kalman filter and several particle filters for estimation of the overall state vector. In the second scenario, the number of targets and their types are not known. In addition to the target positions and velocities, we need to estimate the target number and their types. We propose a hierarchical particle-filtering (HPF) method for this joint estimation. We partition the state space and the measurement space into lower-dimensional subspaces and approximate the local posterior distribution corresponding to the first partition using a set of particles and associated weights. To approximate the subsequent partitions, we generate particles using the information obtained from the estimate of the previous partition and update the weights using the measurements from the current partition. We use numerical simulations to demonstrate that the performance of the tracking system improves when the proposed filtering methods are used.

DATE: Thursday, February 23, 2012
TIME: 2:00 p.m.
PLACE: Green Hall, Room 0120

Thesis advisor:
Dr. Arye Nehorai

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

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