

## Spatial-temporal Nonlinear Filtering in Command and Control (C2)

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### Abstract

Assimilating data in a highly changing dynamic environment, which allows battle commanders to make timely, informed decisions, is a difficult and challenging problem. In this paper, a spatial-temporal approach to examining the battlespace, based on multiple noisy data signals, is taken. We examine the danger-potential field generated by the positions of an enemy's weapons in the battlespace. The incoming noisy data on the position of weapons is filtered to update the weapons' positions and the danger field. The approach that is taken is that of sequential importance sampling (SIS), or particle filtering, which is used to generate realizations from the posterior distribution of the spatial-temporal danger field. Given realizations of the danger field, non-linear questions such as the locations of maximum and minimum danger, the extent of regions exceeding certain danger thresholds, and changes in the danger field over time, can be addressed. To examine the properties of this SIS approach, data generated from an object-oriented, combat-simulation program is analyzed and compared to a Kalman-filtering approach that depends on just the first two posterior moments.