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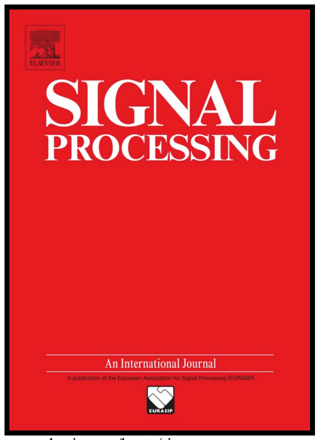

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A robust scheme for distributed particle filtering in wireless sensors networks

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Abstract

Wireless sensor networks (WSNs) have become a popular technology for a broad range of applications where the goal is to track and forecast the evolution of time-varying physical magnitudes. Several authors have investigated the use of particle filters (PFs) in this scenario. PFs are very flexible, Monte Carlo based algorithms for tracking and prediction in state-space dynamical models. However, to implement a PF in a WSN, the algorithm should run over different nodes in the network to produce estimators based on locally collected data. These local estimators then need to be combined so as to produce a global estimator. Existing approaches to the problem are either heuristic or well-principled but impractical (as they impose stringent conditions on the WSN communication capacity). Here, we introduce a novel distributed PF that relies on the computation of median posterior probability distributions in order to combine local Bayesian estimators (obtained at different nodes) in a way that is efficient, both computation and communication-wise. An extensive simulation study for a target tracking problem shows that the proposed scheme is competitive with existing consensus-based distributed PFs in terms of estimation accuracy, while it clearly outperforms these methods in terms of robustness and communication requirements.

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