A Scalable Algorithm for Tracking an Unknown Number of Targets Using Multiple Sensors

Abstract:

We propose an algorithm for tracking an unknown number of targets based on measurements provided by multiple sensors. Our algorithm achieves low computational complexity and excellent scalability by running belief propagation on a suitably devised factor graph. A redundant formulation of data association uncertainty and the use of "augmented target states" including binary target indicators make it possible to exploit statistical independencies for a drastic reduction of complexity. An increase in the number of targets, sensors, or measurements leads to additional variable nodes in the factor graph but not to higher dimensions of the messages. As a consequence, the complexity of our method scales only quadratically in the number of targets, linearly in the number of sensors, and linearly in the number of measurements per sensor. The performance of the method compares well with that of previously proposed methods, including methods with a less favorable scaling behavior. In particular, our method can outperform multisensor versions of the probability hypothesis density (PHD) filter, the cardinalized PHD filter, and the multi-Bernoulli filter.