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DISTRIBUTED INFORMATION FUSION WITH INTERMITTENT OBSERVATIONS FOR LARGE-SCALE SENSOR NETWORKS

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Abstract. *In this paper, we present a robust distributed fusion algorithm to handle intermittent observations via an interacting multiple model (IMM) and a sliding window strategy which is applied to large-scale sensor networks. Intermittent observations are frequently occurred in practice especially when the scale of network becomes larger and sensors are dynamically connected. To solve the problem, we model the communication channel as a jump Markov system and a posterior probability distribution of communication channel characteristics is calculated and incorporated into the filter. By doing so, the distributed Kalman filtering can automatically handle the intermittent observation situations. For the implementation of the distributed fusion, a Kalman-Consensus filter (KCF) is adopted to provide the average consensus based on the estimates of distributed sensors over a large-scale sensor network. In addition, the algorithm is extended to nonlinear systems so as to be implemented for more general dynamic systems. The advantages of proposed algorithm are subsequently verified from target tracking examples for a large-scale network with intermittent observations.*
Keywords: Kalman filtering, Distributed fusion, Intermittent observation, Nonlinear systems

1. **Introduction.** In the literature, distributed computing has been a natural breakthrough for many engineering problems due to its scalability, efficiency and reliability. Distributed computing has been employed in many disciplines, such as data fusion in sensor networks [1,3], distributed camera networks [2,13] and mobile robotics [9]. Historically, the development of distributed signal processing algorithms is not a new topic. It has been investigated over the past decades, and several types of distributed signal processing algorithms have been well-known [5,10]. However, further improvements are required to satisfy unconstrained real applications, e.g., channel link failure and intermittent observations.

Recently, real-world applications of distributed signal processing algorithms have faced practical issues such as time-varying network topologies and imperfect communication channels. As such, network scalability has been discussed in distributed Kalman filtering in an attempt to address issues related to ad-hoc network topologies [4]. To this end, the topology of a network is understood via algebraic graph theory, with individual network nodes by employing Kalman filter as a micro-filter regarding to the limited communication bandwidth between neighbouring nodes.