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Robust Max Consensus Algorithm for Wireless Sensor Networks

-Wireless sensor network (WSN) is a distributed network consisting of multi-functional sensors, which can communicate with neighboring sensors over wireless channels. Estimating statistics of sensor measurements in WSNs is necessary for detecting anomalous sensors, supporting nodes with insufficient resources, determining network area estimation, and spectrum sensing for cognitive radio applications, to name a few. Knowledge of extremes is often used in algorithms for outlier detection, clustering, classification, and localization. However, additive noise in wireless channels can significantly degrade the performance of distributed algorithms. Hence, a robust consensus algorithm is needed that accounts for and corrects for additive noise.

Researchers at Arizona State University (ASU) have developed a distributed algorithm for estimating the maximum of node initial state values in a network in the presence of additive communication noise. Typically, due to additive noise, the maximum at each node has a positive drift and this results in nodes diverging from the true max value. The algorithm developed at ASU estimates and compensates for the growth rate of the drift. The state values are updated accordingly to reach consensus on the true max value. Additionally, the algorithm converges faster with lower estimation error in comparison to existing algorithms.

Related Publication: Analysis and Design of Robust Max Consensus for Wireless Sensor Networks

Potential Applications:

- Wireless sensor systems, such as, the following:
  - Solar array monitoring systems
  - Cyber-physical systems
  - Industrial monitoring
  - Environmental sensing

Benefits and Advantages:

- Algorithm converges to correct value with low estimation error in the presence of additive noise
- Improved performance in:
  - IoT systems
  - Sensor localization
  - Distributed detection and estimation
  - Sensor fusion applications