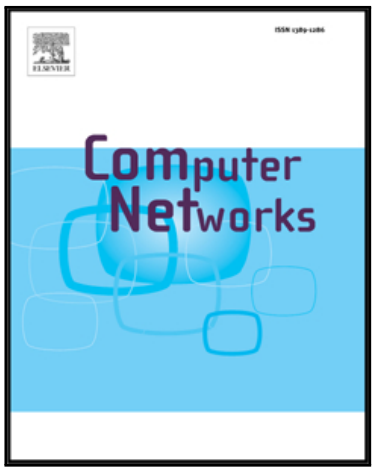

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CCS: Energy-Efficient Data Collection in Clustered Wireless Sensor Networks Utilizing Block-wise Compressive Sensing

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Abstract

In this paper, we propose an integration of compressive sensing (CS) and clustering in WSNs utilizing block diagonal matrices (BDMs) as the measurement matrices. Such an integration results in a significant reduction in the power consumption related to the data collection. The main idea is to partition a WSN into clusters, where each cluster head (CH) collects the sensor readings within its cluster only once and then generates CS measurements to be forwarded to the base station (BS). We considered two methods to forward CS measurements from CHs to the BS: (i) direct and (ii) multi-hop routing through intermediate CHs. For the latter case, a distributed tree-based algorithm is utilized to relay CS measurements to the BS. The BS then implements a CS recovery process in the collected M CS measurements to reconstruct all N sensory data, where $M \ll N$. Under this novel framework, we formulated the total power consumption and discussed the effect of different sparsifying bases on the CS performance as well as the optimal number of clusters for reaching the minimum power consumption.

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