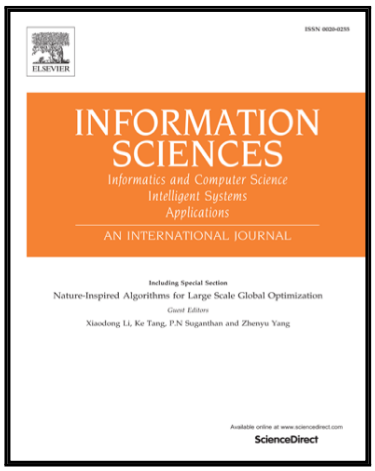

Data prediction, compression, and recovery in clustered wireless sensor networks for environmental monitoring applications

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Data prediction, compression, and recovery in clustered wireless sensor networks for environmental monitoring applications

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Abstract

Environmental monitoring is one of the most important applications of wireless sensor networks (WSNs), which usually requires a lifetime of several months, or even years. However, the inherent restriction of energy carried within the battery of sensor nodes brings an extreme difficulty to obtain a satisfactory network lifetime, which becomes a bottleneck in scale of such applications in WSNs. In this paper, we propose a novel framework with dedicated combination of data prediction, compression, and recovery to simultaneously achieve accuracy and efficiency of the data processing in clustered WSNs. The main aim of the framework is to reduce the communication cost while guaranteeing the data processing and data prediction accuracy. In this framework, data prediction is achieved by implementing the Least Mean Square (LMS) dual prediction algorithm with optimal step size by minimizing the mean-square derivation (MSD), in a way that the cluster heads (CHs) can obtain a good approximation of the real data from the sensor nodes. On this basis, a centralized Principal Component Analysis (PCA) technique is utilized to perform the compression and recovery for the predicted data on the CHs and the sink, separately in order to save the communication cost and to eliminate the spatial redundancy of the sensed data about environment. All errors generated in these processes are finally evaluated

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