1 Introduction

In a wireless sensor network (WSN), data aggregation where multiple data are fused into one or more data of smaller size at a node contributes to saving energy and bandwidth [1]. However, the aggregation efficiency and accuracy depend on selection of data to aggregate. In this paper, we compare four different selection methods through simulation experiments.

2 Data Selection Methods

Consider data $d_i(t)$ and $d_j(t)$ obtained by sensor nodes $i$ and $j$, respectively. Each of the sensor data defines the tolerance for aggregation, denoted as $a_i(t)$ and $a_j(t)$ respectively. We assume that the similarity can be defined between a pair of data. When similarity $s_{i,j}(t)$ between $d_i(t)$ and $d_j(t)$ satisfy both conditions of $s_{i,j}(t) \leq a_i(t)$ and $s_{i,j}(t) \leq a_j(t)$, they can be aggregated.

An aggregation rule can take a form of averaging, maximum, minimum, median, and any other mathematical or statistical operations but in some aggregation rules, the order of selection of data to aggregate at a node affects the aggregation efficiency and accuracy. For example, assume that there are three data $(d_i(t), a_i(t)) = (1,3), (4,4), and (5,5)$ and the similarity is defined as $s_{i,j}(t) = |d_i(t) - d_j(t)|$. As an aggregation rule, consider averaging. The tolerance of an aggregated data takes a smaller tolerance of the original two data. Because of the difference, (1,3) and (5,5) cannot be directly aggregated. However, aggregation of (1,3) and (4,4) results in a new data (2,5,3), which can further be aggregated with (5,5). Consequently, (1,3) is aggregated with (5,5).

In this paper, we consider four selection methods. With Similarity First, a node begins with a pair of data with the smallest similarity. Accuracy First first tries a pair of data with the lowest tolerance. Tolerance First first chooses a pair of data with the largest tolerance. Random randomly selects data. A node repeatedly tries aggregation until no pair of data can be aggregated.

3 Simulation Results

We randomly distribute 300 sensor nodes with communication range 50 m in a 500 × 500 m² field. They

4 Conclusion

In this paper, we compared four data selection methods for data aggregation in a WSN. Our future research includes aggregation-aware routing in a densely deployed WSN.

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References