Distributed Top-K Query Processing in Wireless Sensor Networks

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Abstract

Wireless Sensor Networks create an innovative technology that enables users to monitor and study the physical world at an extremely high resolution. Query processing in such ad-hoc environments is a challenging task due to the complexities imposed by the inherent energy and communication constraints. To this end, the research community has proposed to take into account user-defined parameters in order to derive the K most relevant (or Top-K) answers quickly and efficiently. A Top-K query returns the subset of most relevant answers, in place of all answers, for two reasons: i) to minimize the cost metric that is associated with the retrieval of all answers; and ii) to improve the recall and the precision of the answer set, such that the user is not overwhelmed with irrelevant results.

This tutorial presents the fundamental concepts behind distributed Top-K query processing and the adaptations of these algorithms to distributed and wireless sensor networks. It additionally provides a gentle overview of rudimentary and advanced techniques covering a significant body of research in this domain. The tutorial will start out with an overview of the most influential centralized and middleware Top-K query processing algorithms and then proceed with an elaborate description of distributed Top-K ranking algorithms for One-time Top-K Queries, Continuous Top-K Queries and Approximate Top-K Queries. Finally, it will provide an outlook to compelling future applications that can be constructed on the foundation of these algorithms. Although the tutorial is specifically geared towards Wireless Sensor Networks, many of the presented ideas find extensions in other mobile environments such as Adhoc Networks, Vehicular Networks and the Mobile Web.