Internet Technology Letters

Recent Advances on Semantic IoT Data Integration

The rapid increase in the number of network-enabled devices and sensors deployed in the physical environments is changing the information communication networks. It is predicted that within the next decade billions of devices will generate myriad real-world data for many applications and services in a variety of areas such as smart grids, smart homes, e-health, automotive, transport, logistics, and environmental monitoring. The related technologies and solutions that enable the integration of real-world data and services into the current information networking technologies are often described under the umbrella term of the Internet of Things (IoT). As most of the IoT devices operate in real-world environments, the exposed services are not as reliable and stable as those well-engineered and maintained business services and the quality of information and services in the IoT domain can vary over time. The heterogeneity of underlying devices and networks also makes it difficult to provide one-fit-all solutions to represent data and services that emerge from the IoT networks. This brings significant challenges to data integration, data fusion, and discovery mechanisms that require interoperable and machine-interpretable data and quality descriptions.

A potential solution to face this challenge is to model IoT data using machine-interpretable and interoperable formats. The existing work often uses solutions that are adapted from the Semantic Web (SW) and semantic data modeling to overcome the interoperability issues and to provide semantically rich descriptions for the IoT data. The recent advancements in this area are discussed in several existing works such as the Semantic Sensor Web (SSW) and Linked Sensor Data (LSD) on the Linked Open Data (LOD) cloud. Research on the IoT data so far has largely focused on knowledge representation, i.e. how to semantically describe capabilities of IoT devices and services, data annotation, and publications, i.e. how to create and publish semantically annotated IoT data and linked data models. However, modeling and integrating the observation and measurement data, streaming sensor data, and providing discovery mechanisms to enable distributed query mechanisms are other key issues to enable end-to-end solutions for publications and consumption of the sensory data emerging from IoT resources.

The potential topics include but are not limited to the following:

(1) Sensor Knowledge Modeling and Representation
(2) Sensor Data Analysis and Knowledge Discovery
(3) Sensor Ontology Engineering and Sensor Data Annotation
(4) Sensor Ontology Alignment and Linked Sensor Data Integration
(5) Machine Learning, Deep Learning and Optimization Techniques for Semantic Sensor Data Annotation and Integration

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