PAPER REVIEW

Synthetic Sensors: Towards General-Purpose Sensing

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Smart environments and the Internet of Things (IoT) rely on robust sensing of diverse environmental facets in order to enhance the human experience through sensing and computation. Traditional approaches rely on direct or distributed sensing, which most often involves measuring one particular aspect of an environment with special-purpose sensors. However, this sensing is generally limited to a particular use-case that thwarts a holistic experience. This approach also carries a significant upgrade cost, which so far has proven unpopular with consumers. Keeping these disadvantages in mind, the authors of this paper talk about a lightweight, general-purpose sensing approach that could overcome many of these issues.

The authors first provide a comprehensive review of sensors that are currently available academically and commercially, and claim some level of generality in their sensing. They then describe the environmental facets that users most commonly care to know, and at what level of fidelity they have acceptable privacy trade-offs.

Based on their research in these two aspects, the authors have proposed a novel, general-purpose, sensing architecture that denatures and virtualizes raw sensor data, and through a machine-learning pipeline, yields a sensor framework that they call Synthetic Sensors. In this framework, sensor data exposed to end-users is “virtualized” into higher-level constructs, thus providing a “top-down” approach. Such an output better matches human semantics and end-user applications can use this knowledge to power rich, context-sensitive applications.

They provide a detailed description of the overall architecture of the sensor framework. They then mention in depth about on-board featurization that they have adopted to transform the sensor data collected. They also mention server side feature computation that they have adopted. Following this they describe the learning modalities that have been used in their machine learning pipeline.

The authors end the paper with a detailed evaluation of the general purpose sensor framework that they have proposed. The evaluation covers various aspects including deployment, versatility, sensing accuracy, signal fidelity, stability over time and noise robustness.