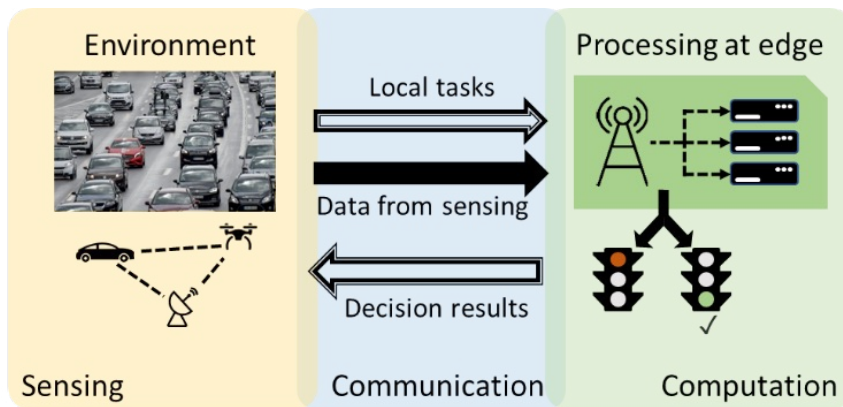


Achieving Cooperation Gain in Integrated Sensing, Communication and Computation (ISCC) Networks

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**What is the benefit to integrate multi-functionalities into our system?
How would the integrated multi-functionalities improve our system performance?**



In future 6G networks, the focus is shifted from data to information. A typical application scenario is to make real-time decisions in a dynamic environment based on certain observations. Such tasks can no longer be fulfilled with sole data communications. Instead, it requires integrating sensing, communication and computation functionalities into the same system and operates cooperatively.

KEY FINDINGS

Integrated Sensing, Communication, and Computation (ISCC) multi-functional networks represent a new paradigm in wireless communications, enabling comprehensive environmental perception, data processing, and communication. It is considered as one of the most significant features in 6G due to its potential integration gains, which can be achieved by sharing the resources, e.g., spectrum, architecture, and infrastructure. However, it receives less attention about its cooperation gains, i.e., how would these functionalities improve the performance for the tasks of interest? Therefore, we first investigate the concept of semantic communication as a potential pathway towards achieving this cooperation gain. We focus on the characterization and performance of semantic reliability within the ISCC framework. This approach transforms the traditionally competitive objectives into a cooperative framework from the perspective of semantic communications. We also leverage recent advances to utilize the same analog signals for radar sensing, data transmissions, as well as over-the-air computation. The model aggregations for federated learning is considered as the application, where we provide a joint user selection and resource allocation schemes.

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