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Compressed Sensing and Imaging Systems for Energy-Constrained AI-Edge Data Analytics

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Abstract: In the recent years, portable or edge computing devices are extensively explored for the real-time applications of automatic detection, recognition, localization and prediction of events in most smart automation systems with major domains of health and fitness (human, machine and structural), environmental health (air, water, noise, climate or weather), agriculture or farm, industry (machine and robotics), autonomous vehicles (land, aerial, surface and underwater), smart grid, smart city, and smart surveillance and defence security. Most modern devices or systems are embedded with various kinds of sensors, data acquisition, high speed processor, and different kinds of communication devices for enabling continuous or periodic sensing, processing, storing and transmission of sensed data or extracted parameters to the remote server or end user for further processing and analysis. In order to timely detect abnormality and provide diagnosis or notify, sensed data are processed continuously by using on-device processors and edge computing devices. Both continuous processing and transmission of processed data or parameters incurs significant energy consumption which highly demands frequent charging or replacement of batteries in long-term monitoring applications. Therefore, exploring energy consumption reduction (or improving energy efficiency) strategies is highly demanded to maximize lifetime of battery, which is the most essential requirement for energy-constrained devices or systems.

This talk presents the concept of analog and digital compressed sensing methods by highlighting the selection of sensing or measurement matrix, efficient implementation of measurement generation architecture, sparsifying matrix and sparse recovery algorithm with major objectives of reducing energy consumption and latency or processing time with minimum reconstruction error. With few preliminary evaluation results, this presentation also highlights key challenges and future directions.