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Ph.D. DISSERTATION DEFENSE

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Date:	Tuesday, April 16th, 2024
Time/Location:	1:00 PM – 2:30 PM / Zoom --- https://stevens.zoom.us/my/ydyao
Title:	IoT Signal Identification Using Deep Learning
Chairperson:	Dr. Yu-Dong Yao, Department of Electrical and Computer Engineering, School of Engineering and Science
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ABSTRACT

The spectrum awareness techniques play an important role in IoT networks. It enables wireless devices or infrastructures to monitor and manage the heterogenous IoT traffics in order to improve the network throughput and efficiency. Signal identification methods are developed to exploit the characteristics of various wireless signals in the channel including modulation schemes, data rates, wireless technologies, etc. The information can be utilized by spectrum awareness methods to understand the status of massive network traffics and then to change the transmission scheme accordingly for performance optimization.

While conventional feature-based or likelihood-based signal identification methods suffer from significant feature selection efforts or high computation complexity, deep learning (DL) provides advantages in automatic feature extraction from signal data, and reduces the involvement of high-order computation in a deployment stage. Besides, the data-driven learning method offers the adaptivity to variation in wireless channels or environments. The DL-based identification model can be updated with real-time data to increase the robustness.

This dissertation investigates the signal identification problem in current and future IoT networks, including narrowband IoT (NB-IoT) and backscatter IoT networks. We propose customized convolutional neural networks (CNN) model to capture characteristics that distinguish NB-IoT signals from signals transmitted in other wireless technologies that commonly deployed in NB-IoT networks. We also examine the capability of the CNN model in identifying the occurrence of NB-IoT signals in a multi-band transmission scenario.

The signal identification problem in backscatter network is also studied in the dissertation. We consider the backscatter transmission in a Wi-Fi ambient backscatter setup. A CNN-based method is developed to identify the existence of backscatter transmission for potential signal monitoring and security proposes.