Exploiting Physical Properties in Wireless Networks for Implicit Authentication

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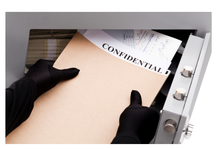
Device-free User Authentication

- Protect security and privacy in both corporate and home environments
- Provide customized services corresponding to a specific user

Private Devices



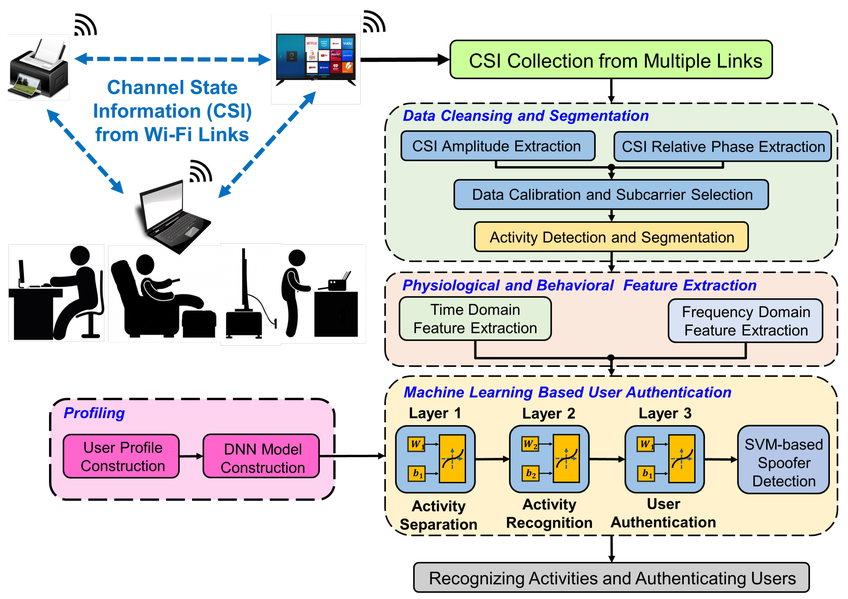
Secret Documents

Confidential Offices

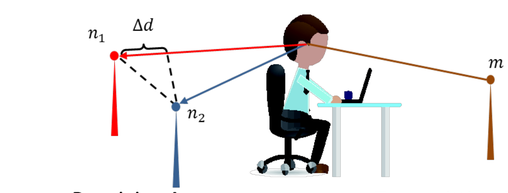
Risky Appliances

Smart Home Appliances

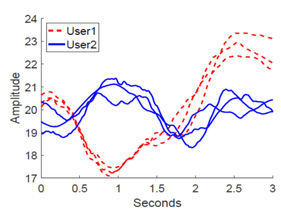
Customized Services



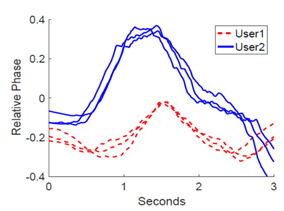
- Amplitude and relative phase in CSI could capture unique human physiological and behavioral characteristics



Receiving Antennas Transmitting Antenna



CSI Amplitude



CSI Relative Phrase

Challenges

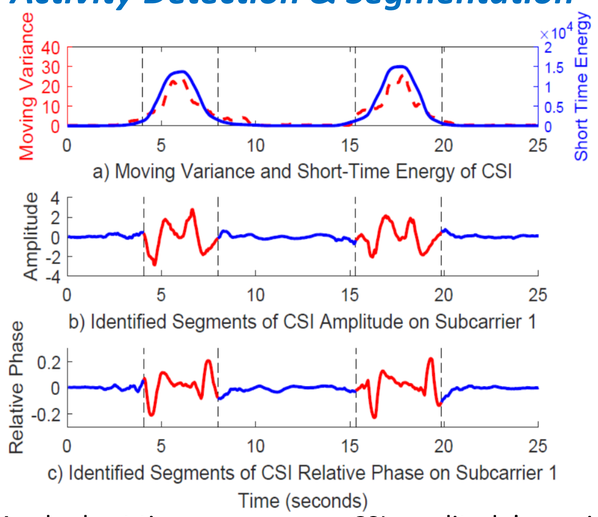
- Quantify the differences on physiological and behavioral characteristics captured by wireless signals
- Extract representative features from noisy CSI measurements
- Recognize activity and identity simultaneously
- Adapt the machine learning model to new enrollments and change of the environments

Scientific Impacts

- Advance knowledge in exploiting physical layer information for securing corporate and home environments
- Contribute to the successful development and adoptions of customized applications involving wireless devices
- Implement and validate the proposed strategies by prototyping the framework with commodity hardware

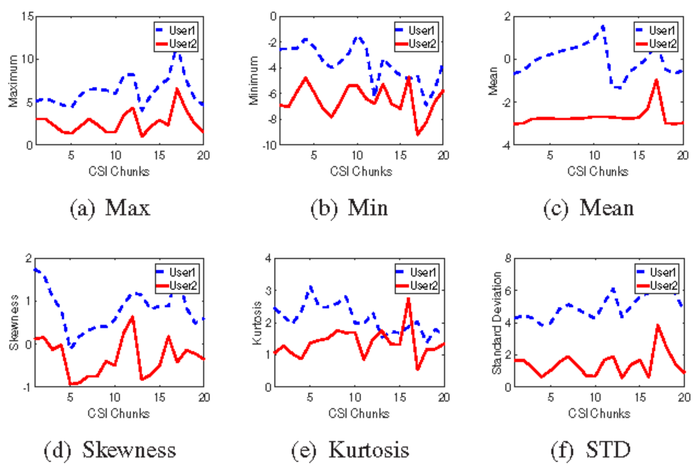
Approaches

Activity Detection & Segmentation



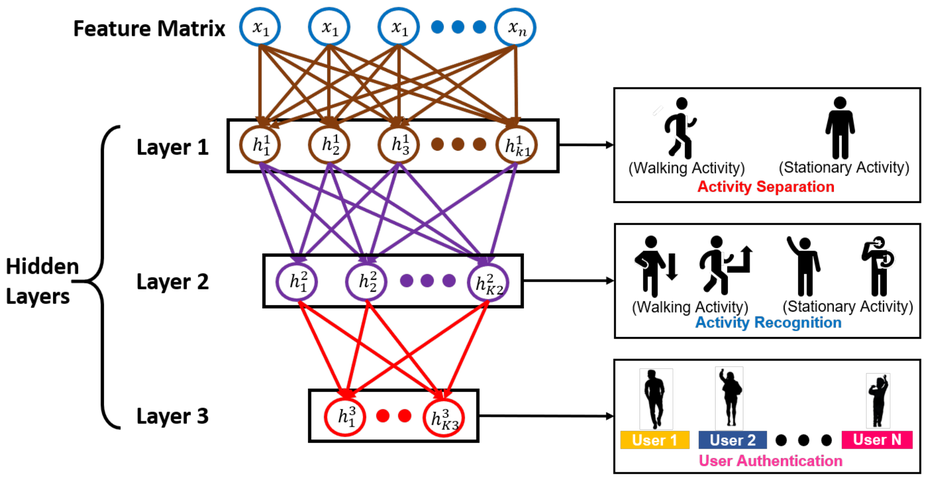
Apply short time energy upon CSI amplitude's moving variance to detect and segment human activities

Physiological/Behavioral Feature Extraction



Partition each CSI segment into chunks of equal length and extract time/frequency domain features

Deep Learning based User Authentication



Design three-layer Deep Neural Network based on stacked autoencoder and convolutional neural network structures

Broader Impacts

- Advance the foundation of exploiting Wi-Fi signals to assist security solutions
- Include curriculum development, outreaching to K-12 students
- Facilitate a variety of emerging wireless applications