FACULTY MENTOR
Xinyu Zhang

PROJECT TITLE
AI-Driven 5G Networks for Connected Vehicles

PROJECT DESCRIPTION
Description: The objective of this project is to explore AI-driven algorithms and protocols for 5G millimeter-wave (mmWave) networks, more specifically the mmWave vehicle-to-everything (V2X) networks. mmWave is a core enabling technology for multi-Gbps 5G networks. mmWave networks use highly directional "laser-like" beams to deliver signals, thus boosting the signal quality and network capacity. Such directional signals are vulnerable to blockage and become unreliable when the radio devices are moving at high speed. It remains an open challenge how to realize seamless coverage and mobility support using such mmWave signals. In this project, we will design machine learning models that leverage intelligent physical-layer and sensor information as input, to guide the 5G network management (e.g., basestation selection, direction beam selection, etc.). The models will be tested over a real mmWave V2X that we build on the UCSD campus.
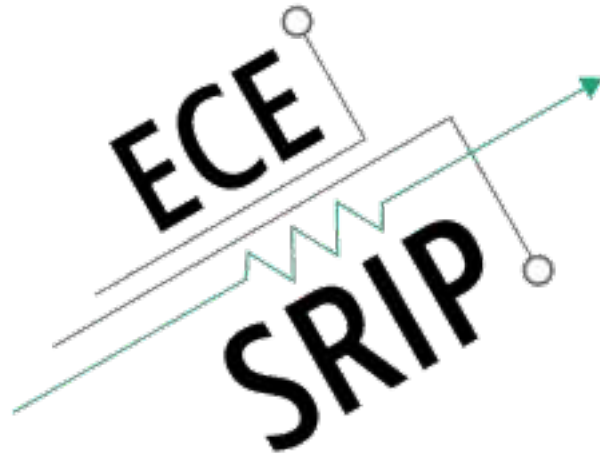
INTERNS NEEDED
2 MS

PREREQUISITES
Required Qualifications:
1. Have taken courses in Computer Networks
2. Have machine learning background
3. Experiences in high level language, such as Matlab and Python

FACULTY MENTOR
Xinyu Zhang

PROJECT TITLE
A Programmable Millimeter-Wave Massive MIMO Radio for 5G Communications and Sensingfor

PROJECT DESCRIPTION
Description: The first four generations of wireless networks mainly run on the low-frequency
microwave band. For 5G and beyond, millimeter-wave will become the dominant communication medium. The availability of mobile millimeter-wave devices will also enable novel wireless sensing applications, such as automobile radar, and the Google Project Soli gesture sensing hardware. In this project, we will design and implement a hardware platform to enable exploration of such new communication and sensing paradigms. The platform will assemble existing RF chips and FPGA baseband processors into a programmable radio.
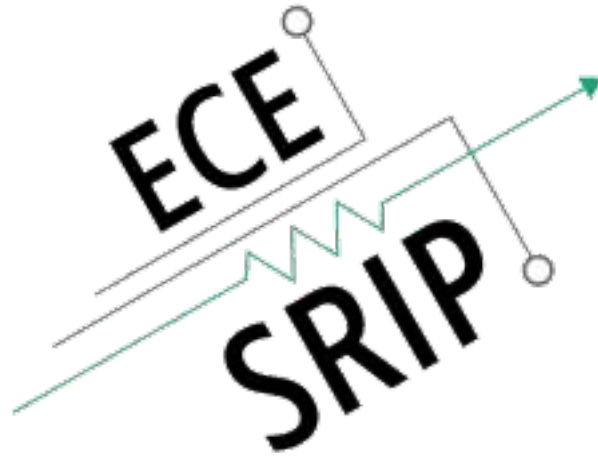
INTERNS NEEDED
2 MS and 2 BS

PREREQUISITES
Required Qualifications:
1. Experiences in FPGA programming
2. OR experiences in signal processing

FACULTY MENTOR
Xinyu Zhang

PROJECT TITLE
Sensing Everyday Activities Using WiFi: A Machine Learning Based Framework

PROJECT DESCRIPTION
Description: Knowledge about what a person does across the day is a critical input for many ubiquitous computing applications, such as life logging, elderly care, in-home patient care, etc. To obtain such information, existing approaches use either specialized on-body sensors which are intrusive and cumbersome to maintain, or cameras which do not work in low-light condition and often impinge on people's privacy. In this project, we propose to reuse WiFi radios as a wireless sensor to remotely track people's activities. The basic observation is that different activities will affect the WiFi signals in different ways. By collecting signal traces on WiFi devices, we can identify the activity based on a pattern recognition algorithm. This project will involve substantial amount of data collection, machine-learning model design and implementation.
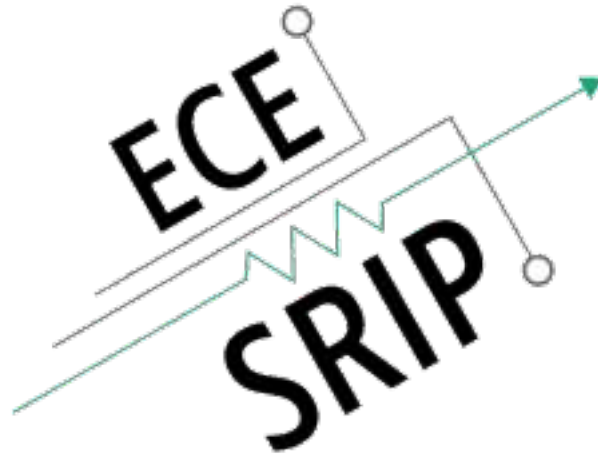
INTERNS NEEDED
2 MS and 1 BS

PREREQUISITES
Required Qualifications:
1. Experiences in machine learning
2. Experiences in high-level language, such as Python

FACULTY MENTOR
Xinyu Zhang

PROJECT TITLE
Mobile Indoor Navigation Using Existing Lighting Infrastructure

PROJECT DESCRIPTION
Description: Indoor localization technology holds potential to revolutionize human activities indoor, just
as GPS did for outdoor navigation. Despite numerous technologies proposed to sense indoor location, none of them have been widely deployed due to cost and reliability issues. In this project, we will develop an Android mobile app that can identify a smartphone's location using ceiling lights as location landmarks. We will repurpose the smartphone camera as location sensor, and develop efficient machine learning algorithms to extrapolate location information from the camera image. As a first step, this app will be used for buildings in UC San Diego, such as libraries and lecture halls.

INTERNS NEEDED
1 MS and 1 BS

PREREQUISITES
Required Qualifications:
1. Experience in Java programming
2. Experience in machine learning is a plus