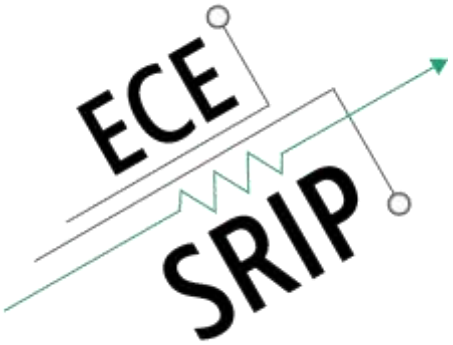


FACULTY MENTOR
Lin, Bill

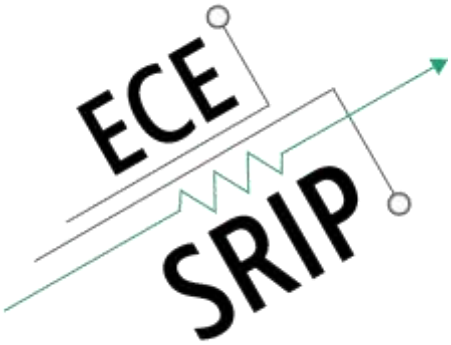
PROJECT TITLE
Machine Learning for Real-Time Wireless and Wireline Networking Problems

PROJECT DESCRIPTION
In wireless and wireline networking problems, complex scheduling and resource allocation problems must be solved in real-time. For example, many of them can be formulated as MaxWeight optimization problems with provable optimality guarantees, with optimization objectives ranging from throughput, to latency, to power efficiency. However, MaxWeight optimization cannot be solved fast enough in real-time due to a high polynomial complexity. In this project, students will explore machine learning based solutions in which a deep neural network can be trained to output near optimal solutions for the given input configurations. A training dataset can be generated by sampling the input configuration space and solving for these configurations optimally via MaxWeight optimization. Machine learning can then be used to encode this knowledge in a manner such the trained neural network can generalize well across the entire configuration space. This paradigm can be generalized for learning a variety of time-consuming optimization methods.

This project can accommodate both remote and in-person students

INTERNS NEEDED
2

PREREQUISITES
The ideal candidate should have a strong background in machine learning and optimization, as well as programming proficiency with PyTorch, which requires excellent programming skills with Python.



FACULTY MENTOR
Lin, Bill

PROJECT TITLE
SMT-Based Optimizations for Difficult-to-Solve Design Problems

PROJECT DESCRIPTION
Many design problems are difficult to solve using conventional heuristic algorithms because they are highly dimensional with exponential number of solutions. Further, valid solutions to these problems often must satisfy very complex constraints, which are difficult to find. Recently, Satisfiability Modulo Theories (SMT) solvers have proven very successful in tackling such problems. SMT solvers are extensions of Boolean satisfiability solvers, extended to consider mixed integer-linear constraints. In particular, SMT solvers can solve difficult integer-linear programming (ILP) problems much faster, is capable of expressing constraints far more succinctly than ILP formulations, and can solve much larger problems than ILP approaches. In our experience, we have been successful at applying the SMT paradigm to on-chip network design problems and sub-5nm cell synthesis problems. In this project, students will explore SMT formulations for several new network synthesis and quantum computing synthesis problems.

This project can accommodate both remote and in-person students

INTERNS NEEDED
2

PREREQUISITES
The ideal candidate should have a strong background in algorithms, as well as excellent programming skills in C/++.