AIMS² Research Project for Fall 2019 – Spring 2020

Title of Project:	Automated Testing and Validation for Software Systems Based on Machine Learning
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Project Background

Machine learning (ML) has rapidly grown in popularity over the past several years, and has contributed to major improvements in voice and facial recognition, search algorithms (including those of Google and YouTube), self-driving cars, drone flight control software, among many others. However, just like traditional software systems, ML-based systems are prone to flaws. Biometrics can fail or be tricked. Search algorithms can deliver imprecise results and amplify misinformation. Self-driving cars can crash. Drones can collide.

Despite the critical nature of these systems, there are no formal ways to ensure they work correctly, and methodology for finding problems in ML-based systems is lacking.

Goals and Objectives of the Project, Expectations and Outcomes

This project seeks to improve this state of affairs, and develop ways to test and validate ML-based systems. To this end, students on this project are expected to:

1. Read primary literature sources to learn about ML and existing work related to the testing and validation of ML-based systems.
2. Replicate experiments described in the literature. This is to better understand existing work and to inspire new ideas and improvements.
3. Design and conduct their own experiments based on their own observations.
4. Develop potential solutions, and to experimentally evaluate their effectiveness.
5. Write a technical report summarizing relevant findings and lessons learned.

Some prior programming experience is necessary. Prior experience in software testing and ML is preferred, but not required. Experience setting up complex software, particularly poorly-documented software, is ideal. Students may choose to work individually or in groups.