Autonomous Self-learning Vehicle

Supervisors: Farhana Zulkernine and Dave Dove

The project will look into using machine learning algorithms to train vehicles to maneuver on the street. The research part of the project will involve exploring hardware and software technology for creating a working prototype and studying algorithms to improve the past approach to avoid collisions. It will build on a neural network/genetic algorithm project from last year. Last year's project used simulation software to train racing cars which focused on speed of completing the race track. I like to explore this further to have a toy car equipped with raspberry pi and sensors that can learn to maneuver in the real world not focusing on speed but avoiding collisions on a one-way street. The student will be given the code and the project report from last year and should be motivated to explore this further with own ideas. Your vehicle will be proud display at School of Computing open house events if it works well.

Pre-requisite: Should take or have taken the neural network course and Dave Dove's course

Scope: Design and build a self-driving vehicle and program it to learn how to maneuver. Perform and report a literature study for the area.

Deliverables: Toy car demonstrating how the algorithm works, program code and the prototype, report, and a poster for Creative Computing day.

Image Recognition using Deep Convolutional Network

Supervisor: Farhana Zulkernine

The project work will involve researching the state-of-the-art algorithms for image recognition and designing a deep convolutional network which have proven very successful in image recognition. The student will get access to high computing platform for final computation after the development phase. There is no strict requirement as to what image to analyze. There has been a lot of work on automatic image captioning, face recognition and emotion detection from facial expressions. This is going to be a fun experience to try to implement an image recognition algorithm and explore some of the video recognition algorithms.

Pre-requisite: Should take the neural network algorithm in winter and have interest and aptitude to explore and learn.

Scope: Implement the algorithm, demonstrate the functionality, and report the efficiency and performance in the written report with a literature study.

Deliverables: The program code, written report and a poster for the creating computing event.

Stock Market Prediction

Supervisor: Farhana Zulkernine

Financial market analysis and prediction has been an interesting research area and good models exist now for long term market prediction such as monthly or yearly stock market prediction. However, because we live in a much more connected world now, events around the world affect the market more now than before. This project will build on last year's project on daily stock price prediction using a hybrid predictive model made of ARIMA, ESM and a back propagation neural network models.

Pre-requisite: Should take the neural network algorithm in winter and have interest and aptitude to explore and learn.

Scope: Implement the algorithm, demonstrate the functionality, and report the efficiency and performance in the written report with a literature study.

Deliverables: The program code, written report and a poster for the creating computing event.

SLA (Service Level Agreements) for Provisioning Analytics-as-a-Service on the Cloud

Supervisor: Farhana Zulkernine

We developed a framework for Cloud-based Analytics-as-a-Service (CLAaaS) to provide a platform for analytics on the cloud. Currently the framework is hosted on Center for Advanced Computing (CAC) platforms of Compute Canada (CC) resources. We have servers at the School of Computing which has OpenStack cloud software installed. We like to use this platform for hosting the analytics service at the department for extending the research on cloud services. Thus the project work will involve doing a study on existing cloud software suite, make our computing cloud operational (wipe off the existing software and install new cloud software), host the existing CLAaaS on the cloud (software already exists – will need minor modification and installation of a database that it needs), and define and use an SLA (extend the existing CLAaaS SLA) to provide different service levels to the clients. The project will give the student a very good experience on cloud computing in general from installation to user level experience.

Pre-requisite: Should have taken a database and networking course and have interest and aptitude to explore and learn.

Scope: Install cloud software (may have multiple dependencies on other software packages that need to be explored), install the CLAaaS (trivial), extend the SLA and develop necessary code to provide the appropriate level of cloud service (IaaS, PaaS, or SaaS) based on the SLA. The report should contain a study of existing cloud software and SLA templates used for cloud service provisioning including the experience and validation results.

Deliverables: An operational cloud system with CLAaaS, program code necessary for the implementation of SLA, written report and a poster for the creating computing event.