Sponsor Northrop Grumman

2019 CU Senior Project Proposal
Northrop Grumman Mission Systems

We would like the students to apply machine learning algorithms capable of incorporating long-term information to the output of a vehicle classification technique developed by our previous student group. Last year, the students took those classification results and used them to track vehicles through scenes over time. This year, we would like to focus on boosting vehicle classification accuracy by incorporating long-term information and treating inputs as dependent through time rather than independent. The goal is to reduce temporal instabilities in classification associated with training on still images.

We would like to see a survey of techniques with a comparison of accuracies among other metrics. At a minimum, the following techniques would be implemented and applied to the classification results.

1. Attention
2. Long Short-Term Memory (LSTM)
3. Recurrent Neural Network (RNN)
4. Temporal Convolutional Neural Network (TCNN)

More specifically, we would like to see the current classification accuracies across scenes, and the effects on those accuracies from the application of each of the listed techniques. Metrics should also include training times and data rate restrictions for real-time applications, such as data throughput and the implications of noisy/missing data. If time allows, we encourage the students to seek out and experiment with other memory-aware learning algorithms with time series modelling and share their findings with us.

NGMS would expect the project to use an Agile-like development process. They would have sprint definitions and reviews before starting each sprint. Northrop Grumman engineers would attend at least monthly status meetings with the students and otherwise be supportive of technical tasks as needed.

We have a machine we can offer the students with GPUs to speed up the training process. The team would have ideally two presentations at the Northrop Grumman Boulder site in front of several members of the engineering staff to demonstrate their product and their success at the end of each semester. We especially encourage US citizens to work on this project because our facility can only admit citizens, and we would like everyone in the group to present at our site. We have found that experience to be valuable to both the students and Northrop Grumman in the past.