Master Thesis Defense Ethan Oswald Massey

Date: Monday, May 25th
Time: 10:00am
Room: Webex

Title: Estimating Confidence in Spatio-Temporal Models

Abstract:
Spatio-temporal models are often used in robotics to provide predictions about how and when dynamic changes occur in a given environment. They can be used in a variety of ways, but of specific interest are their uses in navigation, planning, and scheduling. While a diverse set of spatio-temporal modeling techniques exist, the majority of these models are unable to provide an indication of the confidence behind a given prediction once it has been made. These confidence values can be used to improve navigation by avoiding areas of high uncertainty during important tasks, provide travel time estimates for planners, and inform self-directed robotic exploration of an environment to improve environmental models.

This work presents a methodology for the creation of confidence estimates for pre-existing spatio-temporal models. The new methodology is then applied to Hypertime, a state-of-the-art spatio-temporal modeling technique, to create a total of eight confidence estimation models. These models have been designed for use with ROPOD, an autonomous multi-robot platform for the indoor transportation of goods. Multiple real-world datasets have been collected in association with ROPOD and are presented. Criteria for the evaluation of these new confidence estimating spatio-temporal models are outlined. These new models are then tested using the real-world datasets and their performance is analyzed with the new criteria. In the final experiment, a proof-of-concept is demonstrated, which combines the predictions of multiple world models in order to demonstrate a possible additional use for confidence estimates. Finally, recommendations for ROPOD are made using the results for the experimental section and a outline of possible future work is presented.