7a.035.UVA - Improved Decision Making for Autonomous Systems

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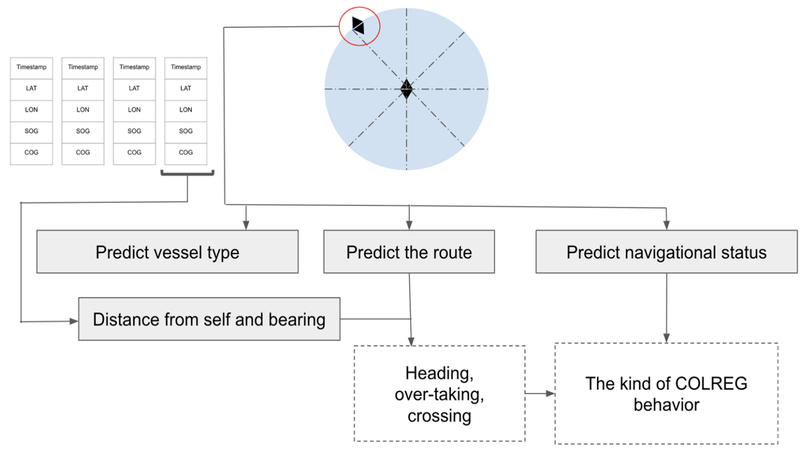
Project Start: 8/1/2018	End Date: 7/31/2019	Project Budget: $40K	Spent: $10K

Project Summary:

In this project, we intend to develop a decision support system for an autonomous maritime vehicle interacting with other maritime entities. Ships/vessels usually have to sail in and out of cluttered environments while avoiding collision with other vessels. Intent prediction and collision avoiding behavior in manned surface vessels is cognitive and also depends hugely on various visual/audio signals, along with an ability to communicate with neighboring vessels. Predicting intent of other vessels is an even more difficult problem in autonomous vessels. We plan to create a logical model for classifying and identification of maritime entities with the goal to infer the intent of those entities without direct communication or coordination. We propose a hierarchical data-driven approach to predicting intent of maritime entities in collision risk scenarios and otherwise. In this approach, we break down the problem of intent prediction into a series of classification problems. This project is expected to lead to improved decision making models for autonomous systems with limited protocols and without coordination.

Details of Progress/Achievements:

The expected behavior of a vessel at sea in collision-risk scenarios and otherwise is laid out in the International Regulations for Preventing Collisions at Sea (COLREGS). We reviewed the COLREGS and determined dependencies between expected behavior and various vessel features. The available AIS data at https://marinecadastre.gov/ais/ is incomplete and incorrect in some places. We performed the necessary preprocessing on the data and filtered out data suitable for use. Further, we built a preliminary design of the approach, shown in the right hand side figure.



PROJECT DELIVERABLES

Deliverable	Achievements		Remaining To Do
Literature Review	• Identification of various collision scenarios and expected vessel behavior	100% complete	
	• Determining dependencies between the expected behavior and various vessel features	100% complete	
Preliminary design of total solution	100% complete		
Software and associated artifacts	• Classification models for sub-tasks	30% complete	• More data preprocessing • Completion of classification models for sub-tasks
	• Complete end-to-end intent prediction model	Planned before February, 2019	
Final Report	Planned before June, 2019		