AI machine learning to identify obstacles for autonomous shipping

Background and motivation

More than 60% of maritime accidents are attributed to human related operations. Furthermore, due to lack of capability for master mariners to continuously adjust a ship's operation profiles (speed/course), ships are not navigated in an energy efficient manner, leading to large waste of fuel cost and emissions. As the fast development of smart functions for maritime transport (in particular mature autopilot system is already available to navigate a ship to follow a predefined course during most of her sailing time in open calm sea), autonomous shipping is getting great attentions from different maritime stakeholders. It could provide more energy efficiency, safety and environmentally friendly shipping for low cost transport. At Chalmers Marine Technology, we have equipped two unmanned vessels as in Fig. 1 (1 meter and 3 meters long, respectively) to develop solutions for some key technical challenges within the autonomous shipping projects.

One of the most urgent challenge for autonomous shipping is to identify "obstacles (other ships)" surrounding the ships and design routes to avoid the collision. Considering the AIS (automatic identification system) and Radar are two common sensors used in the marine transportation. The AIS data contains the static and dynamic information of the ship, such as ship name, ship type, ship position, speed etc. Generally, AIS devices send the data every 6 to 20 second at different speed or situation. The radar images usually refresh in 1-2 seconds. It's easy to get the move ships according to the radar information. For the captains, they often need to get the moving information by the radar images, then check the AIS data on different screen to confirm a real ship. It's important to combine information from the two data sources to autonomous shipping. This project aims at developing AI/machine learning algorithms to use information from the AIS and radar to identify surround ships.

Objectives and goals

- Develop/improve algorithms (from our current system) to extract information from AIS and radar/camera images
- Develop machine learning algorithms to combine AIS and radar information to identify surround ships and inform a ship's voyage planning
- Test your algorithms in a simple lake environment to demonstrate the capability of obstacle identification and collision avoidance

Methods and tools

- Familiar with the equipment onboard our unmanned ship platforms, such as AIS receiver, controller, radar/camera images, ship models, etc., by actual tests at enclosed water environment.
- Python and sci-kit machine learning packages
- Regression toolbox to get parameters for ship model to check her capability to avoid obstacles

The tasks in the project include

- Literature review of state-of-the-art ship operational models and machine learning methods
- Be familiar with our unmanned ship platform
- Develop regression models to describe a ship's operation based on test data
- Understand signals from AIS and other sensors from the unmanned ship platforms
- Develop/revise algorithms to combine AIS and radar/camera images
- Develop machine learning algorithms to identify obstacles from the AIS and other sensor data

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Examiner and supervisor at Chalmers:

Wengang Mao (Wengang.Mao@chalmers.se)

Fig.1, the two unmanned ship platforms in our lab