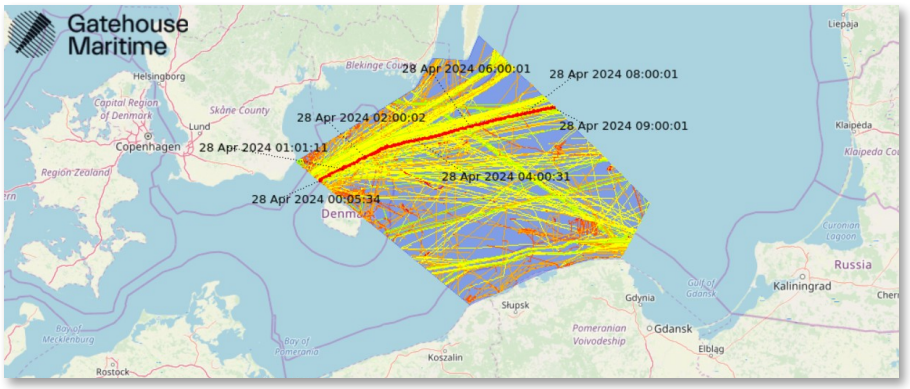
About Gatehouse Maritime

At Gatehouse Maritime, our mission is to empower Maritime Guardians worldwide with unparalleled tools for safety, order, and protection. With over 25 years of dedicated service to the maritime community, we continue to evolve, steadfast in our commitment to excellence.

At the heart of our offerings is a software platform trusted by hundreds of maritime authorities, defense organizations, and asset owners worldwide. This platform, with over 15 years in operation, supports our loyal customers in tracking vessels, monitoring suspicious activities, and safeguarding valuable offshore assets. Our developers are committed to enhancing its capabilities, ensuring it provides an unrivaled overview of maritime operations.

Gatehouse Maritime

Detecting abnormal vessel trajectories using AIS.



Introduction:

Maritime navigation relies heavily on Automatic Identification System (AIS) data, which provides real-time information on vessel positions, type, speed, course etc. Gatehouse Maritime has collected such data for decades, using it to monitor vessels traffic around the world. Monitoring vessel activities is crucial for ensuring maritime safety, environmental protection, and national security. AIS data offers a valuable resource for detecting unusual or potentially risky behavior.

This project aims to develop a machine learning-based system for identifying abnormal vessel trajectories in Danish waters. By analyzing AIS data, the project will focus on detecting deviations from typical routes, erratic movements, or unusual speed variations, which could indicate safety hazards, illegal activities, or operational anomalies.

Use cases:

Detect maritime sabotage/threads:

Current situation with the ship Yi Peng 3. Chinese ship suspected of maritime sabotage, sailing around near Danish waters.

Illegal activities:

- **Illegal fishing**
  Is a vessel fishing in restricted areas?
- **Rendezvous (smuggling)**
  Actual cases where container vessels seem to throw “something” aboard where a Dutch trawler afterwards crosses its trajectory to pick that something up.

Methodology proposals:

There exist many types of different vessels, which likely have different sailing patterns (trajectories). To reduce complexity, it is suggested to focus on a single vessel type, e.g. container vessel, fishing vessels or similar. Moreover, it is suggested to limit the data feed to e.g. Danish waters (Kattegat or similar, with good AIS coverage).

Use historical AIS data to develop a baseline model for normal behavior of vessels sailing Danish waters.

Create a machine learning model capable of identifying anomalies, such as unexpected route deviations, erratic speed changes, or unusual stopping behaviors.

Assess the feasibility of deploying the anomaly detection system for real-time monitoring in maritime applications.

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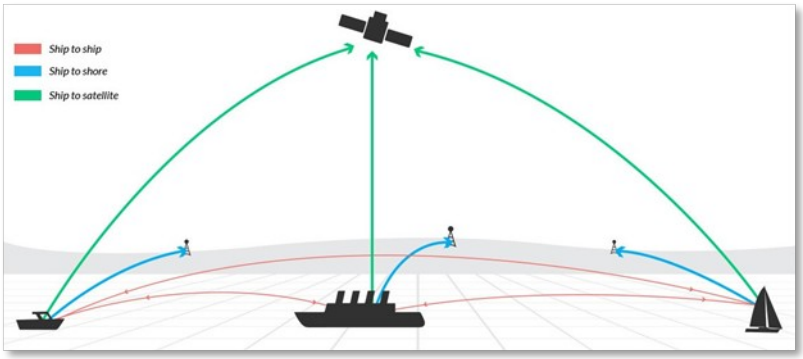
Predicting vessel positions in dynamic environments using AIS.



Introduction:

Maritime navigation relies heavily on Automatic Identification System (AIS) data, which provides real-time information on vessel positions, type, speed, course etc.

Gatehouse Maritime has collected such data for decades, using it to monitor vessels traffic around the world. While current systems enable efficient tracking, predicting future vessel positions and route changes remains a complex challenge, especially in dynamic environments influenced by external factors such as seasonal weather conditions, geopolitical events e.g., the Ukraine war and Suez incident, or global crises like the COVID-19 pandemic.

This project will involve creating a AI model based on AIS data able to predict near-future vessel positions. In addition, an analysis of whether these predictions patterns have changed over time is to be performed. If so, adapt the model, such predictions reflect the current situation.

Use cases:

Collision avoidance:

Use predictions to detect if two vessels are about to collide.

Next port:

Use predictions to predict which port the vessel is about to sail to.

Use predictions to estimate time of arrival to the next port.

Warning against maritime sabotage:

Use predictions to detect if a vessel is about to make maritime sabotage, for instance destroy underwater communication cable by sailing across it with the anchor down.

Methodology proposals:

There exist many types of different vessels, which likely have different sailing patterns (trajectories). To reduce the complexity, it is suggested to focus on a single vessel type, e.g. container vessel, fishing vessels or similar. Moreover, it is suggested to limit the data feed to e.g. Danish Exclusive Economic Zone (EEZ).

Use historical AIS data to create machine learning models (e.g. LSTM) to predict vessel positions 1-24 hours in the future for a given vessel type.

Investigate how the predictions can be used to prevent/detect some of the use cases described.

How do the predictions change over time or due to, for instance COVID-19.