Fraunhofer CML

SOLUTIONS

FRAUNHOFER CENTER FOR MARITIME LOGISTICS AND SERVICES CML

CUSTOMIZED
MARITIME BIG DATA ANALYSIS

Maritime Big Data

Up to 20% efficiency gains can be realized by maritime big data applications on AIS and environmental data. With the introduction of the requirement of merchant ships being equipped with transmitters of the Automatic Identifcation System (AIS), efficiency and safety of the maritime transport could be increased by the automated exchange of position, speed, course and other data from ship to ship or ship to base station.

Besides the monitoring of ship movement data, timetables and weather conditions are also used for the overall monitoring of maritime traffic. Hence, in the past years a treasury of data of unexcpeted dimensions and possibilities has been accumulated. One focus for the exploitation of AIS data is currently on estimating ship movements in particular arrival times to the ports. In addition to forecasting ship movements, Fraunhofer CML develops intelligent algorithms for many other applications.

Key issue

As globalisation progresses, the maritime sector is subject to ever-increasing competetive pressure: emmision reductions, cost savings and increased safety restrictions are three consequences of this intensified competition between the players in the maritime supply chain.

Based on AIS and weather data, CML maintains algorithms for analysing traffic and movement patterns, which can be evaluated with regard to a variety of issues.

Various analysis or forecast areas of maritime logistics are of interest to ship owners, charterers, operators and navigators of both passenger and cargo ships.

Big Data Solutions at CML

Fraunhofer CML offers big data solutions that can help to make maritime big data analyses, individually adapted to the customer's needs from the following areas:

- Traffic Movement Analysis and Forecast
- Risk and Safety Assessment
- Correlation of Environmental Data
- Anomaly Detection & Collision Avoidance

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IMPRINT

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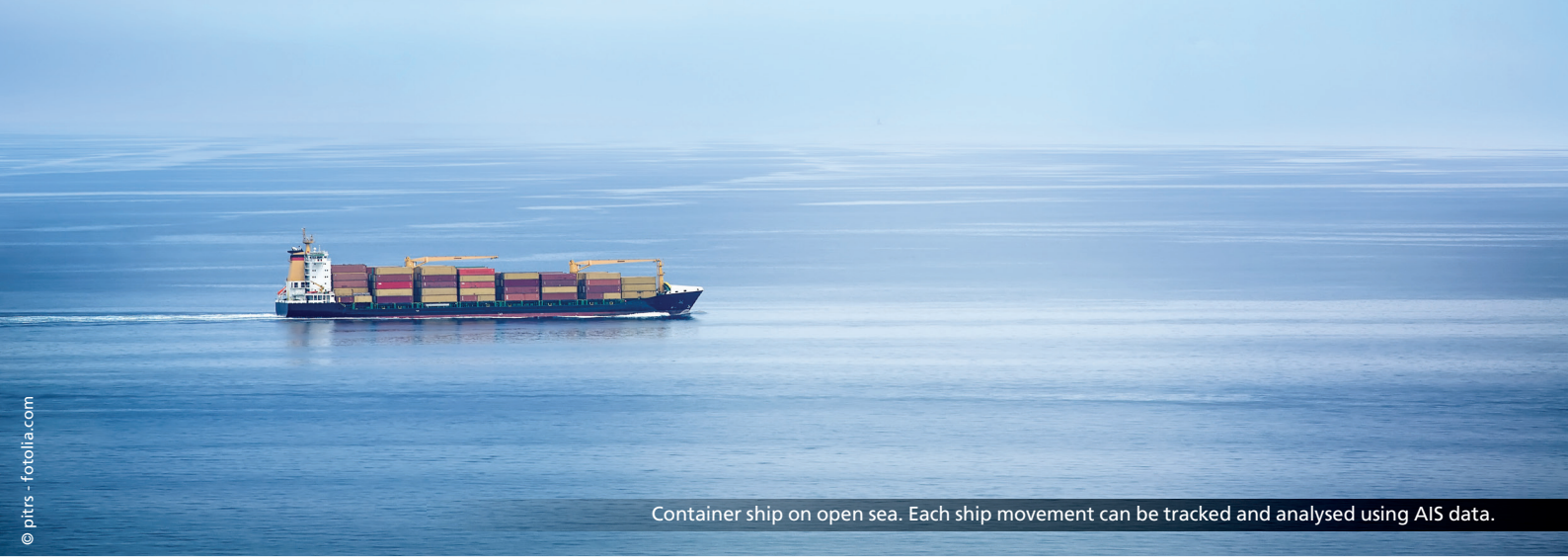

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Container ship on open sea. Each ship movement can be tracked and analysed using AIS data.

Traffic Movement Analysis and Forecast

Information on traffic movements and forecasts lead to immense expansions of the planning horizons of maritime stakeholders: Resources and hinterland transports can be planned in advance, waiting times can be managed more effectively and safety at sea can be increased. Different approaches and methods of machine learning are used for analysing historical ship movements to identify patterns of ships as well as route patterns and traffic densities of different ship classes or sea areas. In addition to the classical motion pattern analysis, automated frequency analyses of ships as well as distribution analyses of velocities and courses along predefined areas will be investigated and corresponding methods are developed. Fraunhofer CML develops methodologies to calculate the duration ships spend at berth and on roads as well as forecasting methods based on artificial intelligence for standard route prediction and estimating the arrival and departure times of ships in real-time.

Risk and Safety Assessment

Safe shipping and assessing navigational safety is essential for maritime stakeholders. Terminal operators and port administrations need to assess their harbor's accessibility as well as risks resulting from unsafe navigation that might affect their infra- and superstructure. Besides this, Fraunhofer CML develops methods to assess the safety of different encounter situations of ships using fuzzy logic to objectively evaluate safety in maritime traffic. The frequencies and probabilities of collisions and groundings in a given waterway can be estimated to assess maritime risks. The model Fraunhofer CML developed has been validated by expert judgements and internal simulation runs by means of CML's ship-handling simulator environment.

Correlation of Environmental Data

Up to 10% of the fuel consumption of ships is determined by weather and many facturs influence ships movements. Traffic separation schemes lead to strict route keeping within the fairway, harsh weather situations lead to the choice of another shipping route, actual wind or current conditions lead to speed regulations during the voyage of a ship. Fraunhofer CML develops a methodology based on machine learning to correlate environmental parameters with ships' position data to identify dependencies. By means of the parameters correlated in place and time, ship movements can be predicted. Using the correlation of historical position and movement data and fuel consumption of the ships, emissions of a voyage can be investigated.

Anomaly Detection and Collision Avoidance

Collisions, groundings, illegal fishing, smuggling, pollution and piracy threaten the safety of voyages by ship and coastal countries. Exemplarly using machine learning algorithms, groundings can be detected 20 minutes earlier than in the Vessel Traffic Service (VTS). Using AIS data, Fraunhofer CML develops a methodology to identify unusual behaviours of ships like random movements in the middle of water, unexpected stops, very short stracks, many interactions or deviations from standard routes. On the open sea, a ship experiences encounter situations with other ships. Fraunhofer CML develops a method to classify this encounter situations according to COLREG rules. Based on machine learning approaches, course, speed and route regulations are allocated to avoid collisions.