DETECTING ANOMALOUS VESSEL MOVEMENTS WITH AI AT PORT OF ANTWERP

Bart Adams
CTO xyzt.ai

xyzt.ai
location analytics at scale
We help our customers to gain insight into mobility and traffic patterns to improve and adapt strategies.

By providing a self-service big data location analytics platform.

That connects to multi-source data, such as connected car, mobile device, people flow, vessel tracking data,…
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Self-service Location Analytics Platform
Software-as-a-Service (SaaS)
Scales to Billions of Location Records
Take Your Data Live in Less than One Day
Easy and Effortlessly
Vessel tracking using radar and AIS
WHY TRACKING VESSELS?

REALTIME

Vessel Traffic Control

HISTORIC

?
Do vessel operators follow the regulations related to registrations, times of operations,...
Analysis of near misses can reveal opportunities for increasing safety in port fairways and terminals.

**Unmoored container ship collides with crane in Antwerp port causing extensive damage**

Tuesday, 10 December 2019

A large container ship, which began drifting after it came loose from its moorings, rammed into a crane in the port of Antwerp on Monday, causing it to collapse and wreaking havoc in Belgium’s largest port.

Source: The Brussels Times

**Two container ships collide at Busan Port**

The container ship Safmarine Nokwanda collided with the container ship Tianjin, while berthing at Busan Container Terminal, on March 2. Both ships sustained damages, while several containers fell from Tianjin.

The collision took place while the ‘Safmarine Nokwanda’ was berthing at the port. At that time, it hit the stern of Tianjin.

Source: safety4sea.com
Analyze the operational efficiency of your port and the neighboring and competing ports.

Analyze changes over time.
Driven by the objectives of sustainable development and international regulations, the shipping industry has embarked upon the energy transition.

Port of Antwerp is aiming to be a climate-neutral port by 2050.

Netherlands moves to implement nationwide ban on degassing of tankers
AI DRIVEN ANOMALY DETECTION

Exploiting historic data to separate the normal from the abnormal
GOALS

DATA DRIVEN
From historic data, find movements out of the ordinary by assuming the majority of traffic is normal

AUTOMATIC
Assist the analyst in finding the “needle in the haystack” by providing a “degree-of-interest” ranking

EXPLAINABLE
Provide information on why a vessel movement is ranked as anomalous
Bevrijdingsdok → Deurganckdok

Common route 1

Bevrijdingsdok

Deurganckdok

Common route 2
Tanker with long in-between journey
DATA FUSION

ANNOTATED
TRAJECTORIES

START = TERMINAL A

STOP AT B

TANKER

STOP AT C

END = TERMINAL D
start = Vrasenedok (correct)

stop inside lock

stop inside lock

end = Leopolddok (wrong)
RANKING ALGORITHM

ANNOTATED TRAJECTORIES

RANKED TRAJECTORIES

MOST ANOMALOUS

LEAST ANOMALOUS
How to identify anomalies from trajectory data?

APPROACH 1: AUTO-ENCODERS
Encode to low-dimensional space and decode back to high-dimensional space
Difference with original is measure for oddness
How to identify anomalies from trajectory data?

**APPROACH 1: AUTO-ENCODERS**
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**APPROACH 2: k-Nearest Neighbors**
Search for the k nearest neighboring trajectories
Average weighted distance between journey and nearest journeys is measure for oddness
Takeaways

1. Vessel tracking has business cases beyond real-time situational awareness.

2. Technologies exist to visualize and analyze historic location data at scale.

3. Your competitor is implementing their digitalization strategy, don’t get left behind.
THANK YOU!

www.xyzt.ai   |   info@xyzt.ai