DLR

esa

living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

EUMETSAT ECMWF EUSPA

Skytek's InCubed Port Project

Aurhor

date

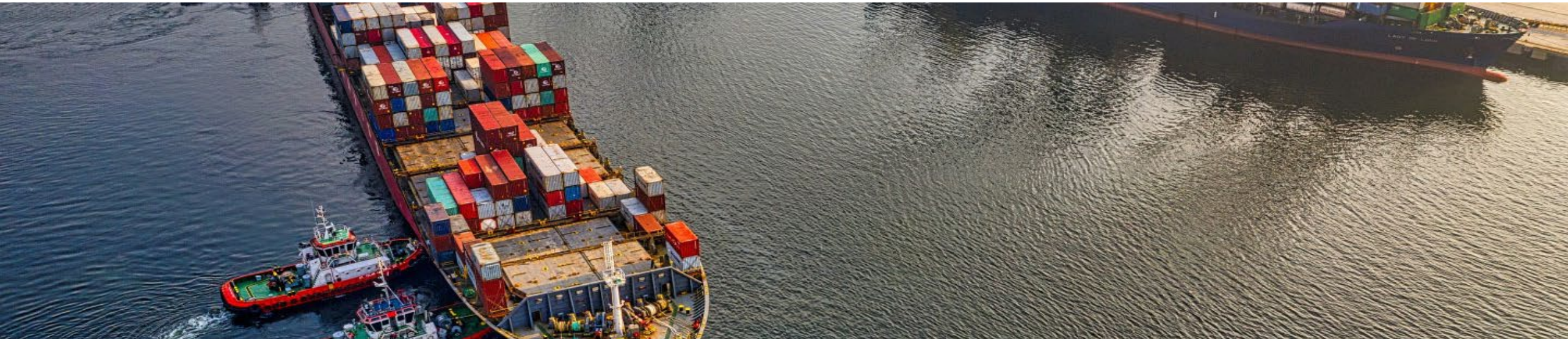
Skytek's InCubed Port Project - Challenges

Increased exposure – ocean shipping represents 90% of world trade and is growing

Mega ships – the largest ships of today carry 4 times the amount of the biggest containers ships in 1996

Mega ports – and these large ships needs to be handled in specialized terminals and thus concentrace in big ports

Climate change – increased risk of catastrophic events



Cargo Port Analysis. The Need

- Tanjin Port explosion
- Catastrophic events in ports **generate huge losses**
- Need for monitoring and assessing **risk accumulation in ports**
- Need for **value the cargo** stored port side
- Currently **generic models** of ports/asset movements/dwell times used for cargo estimates with poor results.
- Concept generated **strong interest** amongs insurance and reinsurance companies

Concept for Cargo Port Analysis using EO and GNSS

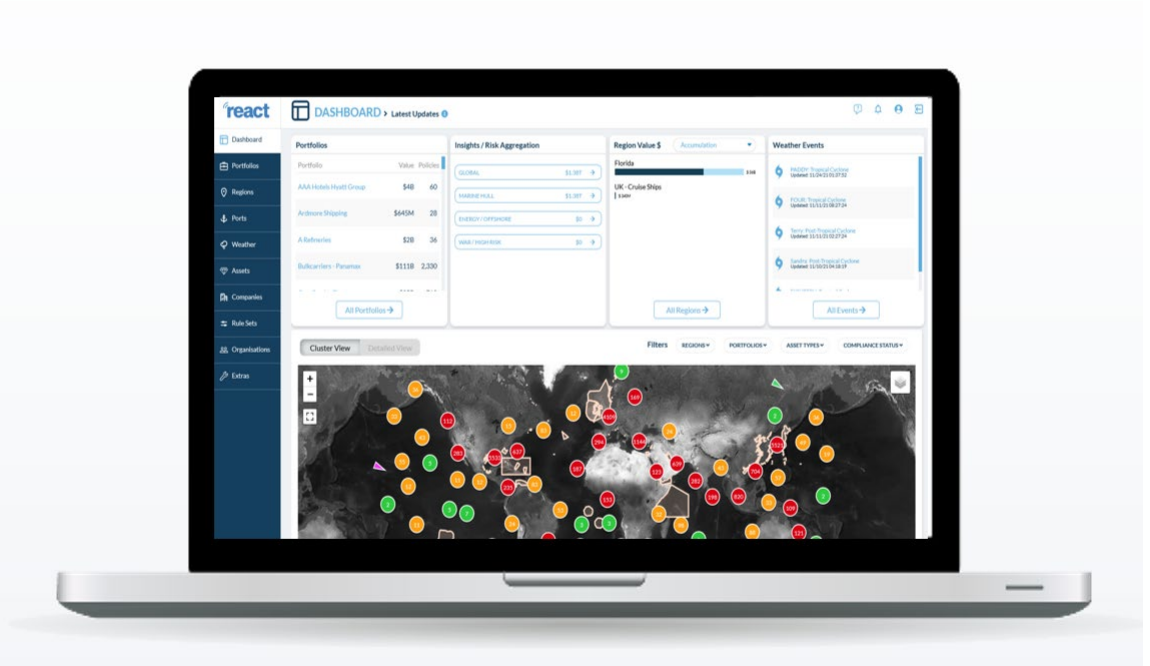
- Automated Identification System (AIS) gives incomplete picture of port accumulation
- Rapid evolution of high resolution earth observation platform
- Rapid development in Computer Vision/ML algorithms
- Can High Resolution EO imagery be used to monitor and quantify assets in port?
- Can medium and lower resolution EO imagery be useful in this type of analysis?

Skytek's InCubed Port Project - Platform

- Risk analysis for underwriting, reinsurance and claims
- Real-time assessment of aggregate exposure for any region
- Asset cluster detection and monitoring
- Historical and trend analysis of asset movement
- Pre and post event analysis for severe weather events
- Sanctions compliance of marine assets

Incubed Cargo Port Analysis - Product Overview

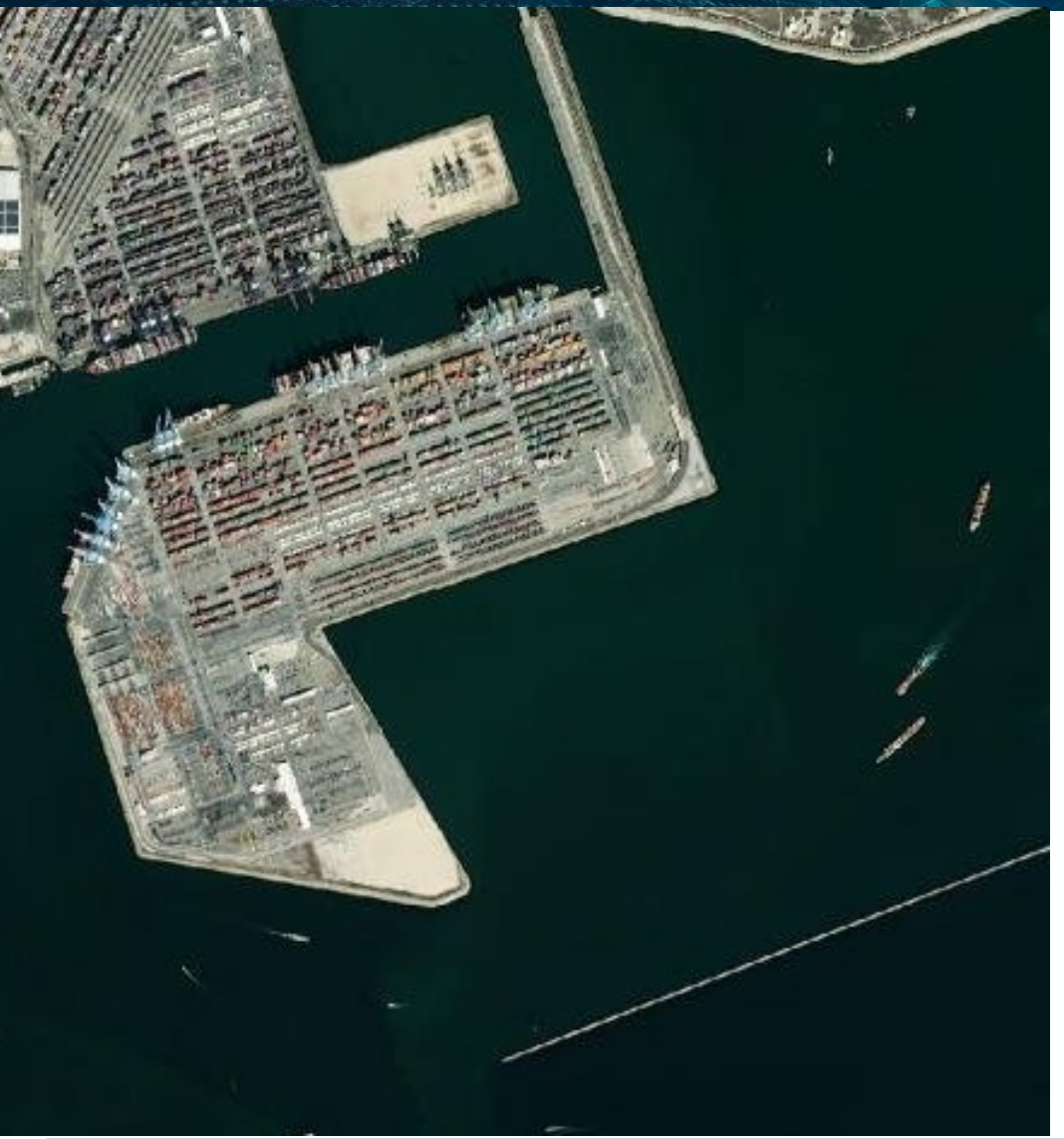
- Build on top of existing REACT platform
- Moving from AIS based to ‘AIS – EO data fusion’
- ML models for valuing port side cargo
- Completing the risk accumulation picture in ports
- Monitoring extreme weather events



Cargo Port Analysis - Components

- EO – satellite data product processing pipelines, ingestion, storage and visualisation
- Weather – extreme weather events forecast product ingestion and visualisation
- ML – deployed inference model and training infrastructure
- Stats – reporting and data analysis

Cargo Port Analysis – EO Module



- Connectors to Data Provider's APIs
- Processing pipelines
- Tasking schedulers
- Tasking results polling
- S3 Storage for imagery
- Map server
- Tile cache, map proxy

Cargo Port Analysis – ML Module

- ML module split into two sub-components
  - Car counting in port terminals
  - Cargo Container quantity estimation
- Model training infrastructure
- Custom convolutional neural network (CNN)
- Data preprocessing tooling
- Deployed models
- Processing pipelines

Cargo Port Analysis – Car Counting Approach

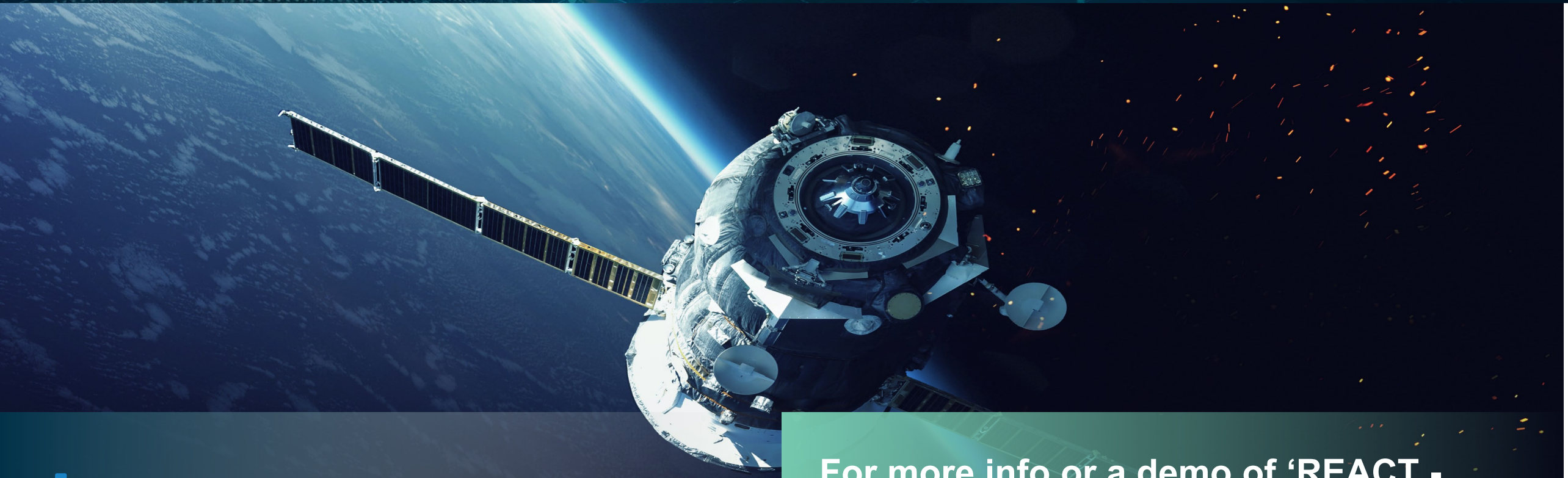
- Capture high-resolution images from Google Earth.
- Human annotation of a small sample of the dataset.
- The Human annotated set was used to train deep learning model, which we later use to annotate the rest of our dataset.
- The combined annotated dataset was down sampled to create a synthetic low-resolution dataset.
- A model is trained on the down sampled dataset.
- For inference, on an actual low-resolution satellite images, very low-resolution satellite images were upscaled using a super-resolution algorithm.
- Then inference was conducted on an upscaled images dataset.

Cargo Port Analysis – ML Implementation Overview

ML Module

- Multi-Column Convolutional Neural Network (CNN) for learning of target density maps
- Image size 256x256, Batch size 32, 1400 epochs
- Adam Optimiser with a learning rate of 0.0001
- Relu activation for layers, final layer uses Linear activation
- Loss function was Mean Square Error (MSE)
- Low resolution images result R2=0.95 and R=0.91
- Inference is 99% accurate compared to the human count.

Skytek's InCubed Port Project



skytek
SPACE TO INNOVATE

For more info or a demo of 'REACT - Cargo Port Analysis' please contact me.

Email: Paul.Kiernan@skytek.com