Exploiting Oceans of Data for Maritime Applications

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http://www.bigdataocean.eu/
BigDataOcean Factsheet

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<th>BigDataOcean</th>
<th>Exploiting Oceans of Data for Maritime Applications</th>
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<tr>
<td>Project Number</td>
<td>732310</td>
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<tr>
<td>Starting Date</td>
<td>01/01/2017</td>
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<tr>
<td>Project Duration</td>
<td>30 months</td>
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<td>Call (part) Identifier</td>
<td>H2020-ICT-2016-1</td>
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<td>Topic</td>
<td>ICT-14-2016-2017 Big Data PPP: cross-sectorial and cross-lingual data integration and experimentation</td>
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BigDataOcean Challenges

➢ Undeveloped Blue Data sharing and linking between enterprises and entities of the maritime domain and other domains

➢ Lack of agreed standards and formats

➢ Huge potential from cross-sectorial and cross-domain blue data applications – still unexploited

➢ Out-of-the-box Big Data services, advanced queries and analytics

There is a need to build an open ecosystem of innovation and Maritime data sharing principles
BigDataOcean Objective

Develop a Maritime Big Data Solution

class="answer"
that delivers out-of-the-box, value-added analytic services for maritime applications

by exploiting cross-sector data streams
BigDataOcean Architecture
BigDataOcean Services

- Find Maritime Data & Services
- Query / Interlink Datasets
- Visualise Datasets
- Analyse Datasets
- Create (real-time) dashboards / Reports
- Service Composition
- Templated Service Parameterisation
- On-demand Services
Case 1 - Fault Prediction & Proactive Maintenance
Description of Pilot Case

Need for:

- Damage and mechanical failures prediction and proactive maintenance of vessel equipment
BigDataOcean Solution

- Plant Maintenance System for Main Engine & spare parts
- Vessel routes
- In-situ Observations
- Cross-domain Forecast Data
- Port information

- Analytics
- Complex prediction model for maintenance & repair prediction
- Alerting service
- Ethical use of sensible data
Expected Benefits

● Shipping companies
  ▪ Data use and exploitation
  ▪ Minimum repairs and maintenance
  ▪ Maximum vessels’ use and financial benefit
  ▪ Reliability and innovation

● Indirect positive environmental impact
  ▪ Less resources/ machinery stock needed for unplanned maintenance
  ▪ Reduction of pollution risk in marine environment

● Potential commercialisation of enriched data and prediction model in more ship types and other industries
Case 2 - Mare protection - Oil Spill dispersion forecast
Description of Pilot Case

- **Objective**: Improve the efficiency of the POSEIDON Oil Spill service for emergency response against hazardous oil spill accidents at sea

http://poseidon.hcmr.gr/
http://osm.hcmr.gr/
Current Solution

- **Oil spill scenario submission**
  - Location, Rate, Nature & characteristics

- Weather Forecast

- Ocean Circulation Forecast

- Poseidon OSM

- Wave Forecast

Graphical output
**BigDataOcean Solution**

- **Oil spill scenario submission**
  - Location, Rate, Nature & characteristics

- **Weather Forecast**

- **Ocean Circulation Forecast**

- **Cross-domain Forecast Data**

- **In-situ Observations**

- **Satellite Data**

- **Wave Forecast**

- **AIS Data**

- **Pollution reports**

**Services/Analytics**

**POSEIDON OSM**

**Graphical output**

**BigDataOcean**

**Data 10/09/15 Hour: 3:30 UTC**

- Vectors indicate surface current velocity and direction
  - Initial volume: 10000
  - Evap. volume: 15.4%
  - Emuls. volume: 2.8%
  - 0.0% of points on beach

- "Initial point of accident"
- "Sea points, depth < 10 m"
- "Sea points, depth > 10 m"
- "Sedimentation points"
- "Land points"
Expected Benefits

- Extended knowledge, models and enriched datasets
- New products addressed to environment protection organisations and maritime authorities for rapid intervention against oil spills in the sea
- Control and limit impact and damage on the coast and on essential resources and structures.
- Efficiency in the protection of the marine environment and of the marine life.
Case 3 – Wave Power as Clean Energy Source
Description of Pilot Case

- Utilise ocean as a resource for energy
- Predict best wave energy plant location
- Many different models
- Many different data
- Minimise equipment costs
- Minimise environmental impact
BigDataOcean Solution

- Waves In-situ Observations
- Satellite Data
- Wave models output
- Instruments Data
- Vessel routes
- Ports
- Protected areas

BigDataOcean Solution

- Resource assessment services
- Data Visualisation
Expected Benefits

- Wave Energy is predictable and reliable (compared to wind and solar).
- Data integration from multiple sources
- Increase data capacity accessed
- Calculate more efficiently the potential for wave power production
- Assess environmental impact of wave power plants
- Assess equipment impact reports on the effects of the ocean on the wave power equipment, which can define the success of any wave power plant project
Case 4 – Security and anomaly path detection
BigDataOcean solution

- AIS data
- Weather Data
- Location of Sea Ports
- List of “High Risk” Vessels
- List of security incidents & vessels implicated
- Nautical Information Maps
- Feedback from vessel’s crew & domain experts

BigDataOcean Solution

- AIS Anomaly Detection

Analytics
Anomaly detection services
Visualisation
Objective: Identify vessel routes based on their motion patterns to act proactively and minimize threats at sea

- **Dynamic**
  - Proximity with other vessels or structures
  - Travelling into dangerous area
  - Type Mismatch
  - Route Mismatch
  - Destination/Voyage Mismatch

- **Static**
  - Speed/Course Changes
  - Zone/Activity Mismatch

- **AIS Anomaly Detection**
  - Based on Current Behaviour
  - Based on Patterns
  - Previously recorded dangerous behaviour

- **Destination Reported**
  - Reporting
  - Destination Reported
  - Owner/Company
  - Name/IMO/MMSI

- **Flag/Country**
Expected Benefits

- Effectively handle the information volume from tracking technologies
- Perform automated analysis
- Identify patterns
- Proactively minimise the impact of possible threats
- Impact on global safety, economic activity or the environment

Step 1: **We filter out all positions that**:
- Do not belong to cargo and tanker vessel types
- Have reported speed less than 0.5 knots

Step 2: We assign **metadata to each position**
- Departure and arrival port
- Departure and arrival timestamp
- Elapsed time from departure

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Trajectory Curve Fitting

The Least Squares (LSQ) Fit
Trajectory Curve Fitting
THANK YOU FOR YOUR TIME!
ANY QUESTIONS?

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ICT-14-2016: Big Data PPP: cross-sectorial and cross-lingual data integration and experimentation

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