Data Science: a transformative force in the understanding, use, and management of the ocean

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The inverted world
Ocean Big Data

PAM & Acoustic Telemetry

Monitoring from space
- Radar imaging, RF detection, ...
- AIS vessel tracking
- Satellite imagery

Machine Learning & Big Data Analytics

Ketos: An open-source deep learning package that helps you develop your own underwater sound detection & classification models!

Example applications:
- Vessel whale collision avoidance
- Underwater noise monitoring
- Detection of illegal fishing activity

[1]
Revolution of sensors in and above the water

- **BIG** data:
  - JASCO collects 100TB of data/year
  - An observatory generates 1TB/\textit{day}
Ship movement monitoring

Towards real—time, globe-wide data on ship movements

• Illegal, Unreported and Unregulated fishing (IUU)
• West Africa Task Force
What’s next in ship tracking?

• Radar SAR data

• RF data!
Nanosatellites

- 10x10x10 cm, 1-10kg
- Commercial Off-The-Shelf components
- Close to Earth (500km), 15-16 polar orbits/day
- Sends
  - infrared
  - optical low-res images
- CubeSat standard
- Low cost earth stations
- Distributed system/data fusion philosophy

BlueWeek, 23.04.21
Sensors – biotelmetry [2]

- monitoring the position, activity, and **physiology** of animals and the **environment**
- environmental variables can be collected using animals as autonomous sampling platforms,
- auton
So:

• Sensors in the water
• Sensors in the air
• Non-sensor data
Data integration

• Complete ship movement data (AIS ground-stations) - Italian Guardia costiera

• Chioggia landing reports
• Surface Sea Temperature
• Chlorophyll
• Wave height

• Goal: prediction of catch next year [4]
Inspirational data management/data analytics challenges

• Deep learning –
  • data challenges
  • multimodal learning

• Squeezing models to go on deployed devices – edge computing

• Animal privacy?
CRISPR

- Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)
- Genetic technique of intentionally changing a genome.
- 2020 Nobel Prize to Emmanuelle Charpentier and Jennifer Doudna
- Allows fabricating modified or synthetic organisms:
  - Aquaculture?
  - A solution for food for 10B world?
- Consider potential pitfalls
...and growth

AI Meets Oceans
MAIPL
MERIDIAN 2.0
Ocean data is a good area for a Data Scientist to work in, now and in the future.


[4] Rovinelli, Matwin, Pranovi, Russo, Silvestri, Simeoni, Raffaetà: Multiple aspect trajectories: a case study on fishing vessels in the Northern Adriatic sea. EDBT/ICDT Workshops 2021

[5] Le Journal du Quebec
https://www.dropbox.com/s/oc7k0wado6lphse/J_du_Que_090421_E.pdf?dl=0