iMagine – Imaging data and services for aquatic science

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MARIS (The Netherlands)

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Marine environmental management and implementing ocean restoration initiatives require more knowledge and understanding

In Europe, we spent circa 1.4 Billion Euro a year in marine data acquisition (1.0 BE in-situ; 0.4 BE remote sensing)

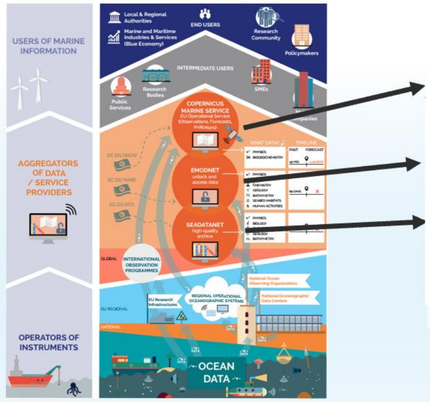
Europe already has developed an impressive capability for aquatic environmental observation, data-handling and sharing, modelling and forecasting.

Green Deal

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Blue-Cloud

European landscape marine data management



EuroGOOS European Global Ocean Observing System
EurOBIS European Ocean Biogeographic Information System
Copernicus Marine Service
ICOS Ocean Thematic Centre
ERIC
EMODnet European Marine Observation and Data Network
elixir
ICES CIEM
PANGAEA.
SeaDataNet
Euro-Argo
ENA European Nucleotide Archive
EGDI

Data aggregators and providers of data products and services

iMagine

Artificial intelligence
Machine learning

From DATA to KNOWLEDGE

Specific Objectives and indicators

O1

Objective 1. Deliver a scalable, shared IT platform for image analysis in marine and freshwater research

Operational iMagine platform with common AI development framework

O2

Objective 2. Advance existing image analytical services to increase research performance in aquatic sciences

Launch of 5 aquatic AI image analytics services, running operationally on the iMagine platform

O3

Objective 3. Develop & prototype new image analytical services and datasets that can accelerate progress towards healthy oceans, seas, coastal and inland waters

3 AI-based imaging processing application pilots, 8 scientific image repositories

O4

Objective 4. Capture and disseminate development and operational best practices to imaging data and image analysis service providers

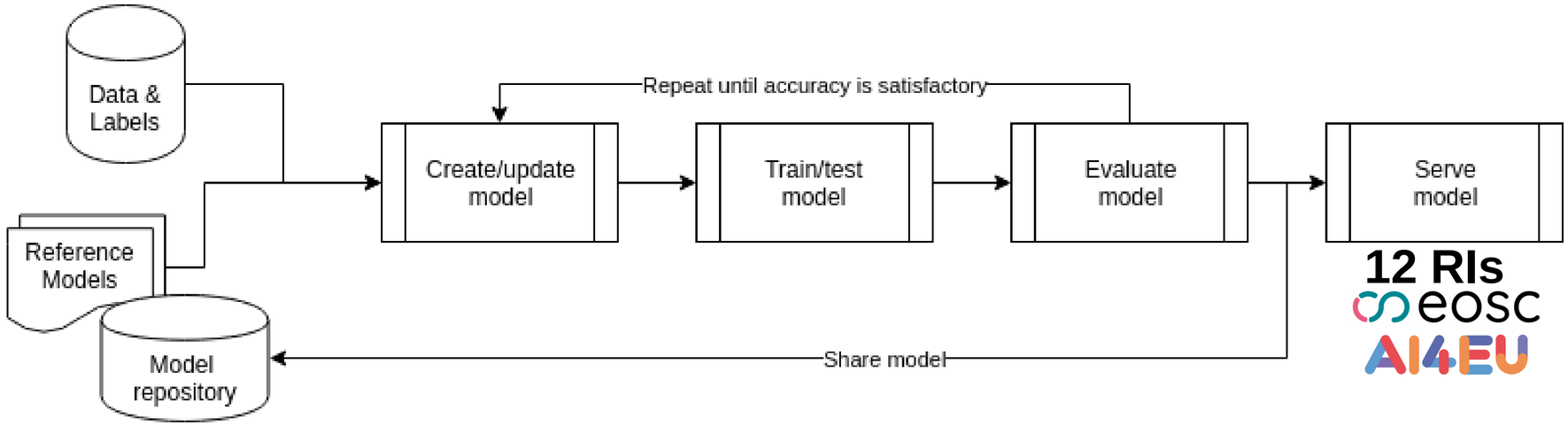
Best Practices documentation, interaction with EOSC and AI4EU platforms. Training programme

O5

Objective 5. Deliver a portfolio of scientific image and image analytics services targeting researchers in marine and aquatic sciences

Portfolio: operational services, image repositories, Best Practices, iMagine framework and platform

The technical architecture

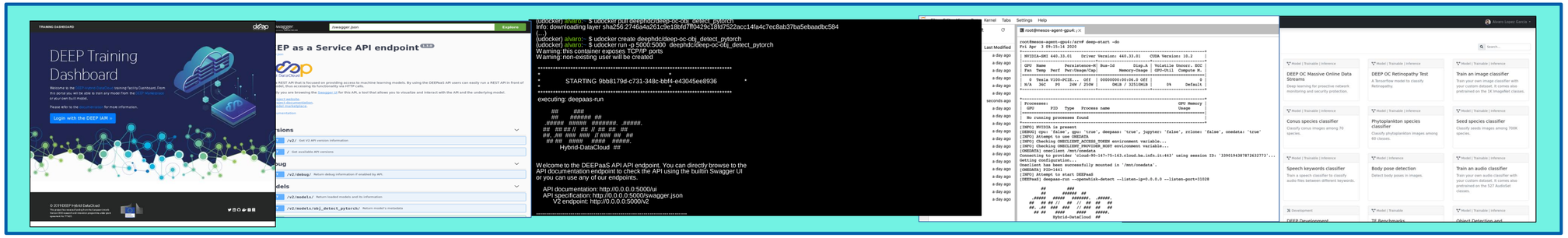


12 RIs

eosc AI4EU

- 5 production AI services
- 3 AI application prototypes

...for aquatic sciences



Hybrid DataCloud

Generic, scalable platform for AI/ML applications

EGI federated cloud infrastructure OpenStack GPUs, CPUs, Storage in Spain, Portugal, Turkey, Ireland

EGI · grnet · TÜBİTAK · CSIC Consejo Superior de Investigaciones Científicas · INCD · WALTON Institute for Information and Communication Systems Science

1500 TB-months
132,000 GPU-hours
6,000,000 CPU-hours

iMagine

Enabling scalable AI/ML services

ANTARES

emso ERIC
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

EMODnet
European Marine Observation and Data Network

OBSEA
EXPANDABLE SEAFLOOR OBSERVATORY

SeaDataNet

JERICO RI
SCIENCE - SERVICES - SUSTAINABILITY

EMBRC
EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

Copernicus Marine Service

LifeWatch ERIC

Euro Argo

PAP

OBSERVATOIRE OCEANOLOGIQUE VILLEFRANCHE/MER

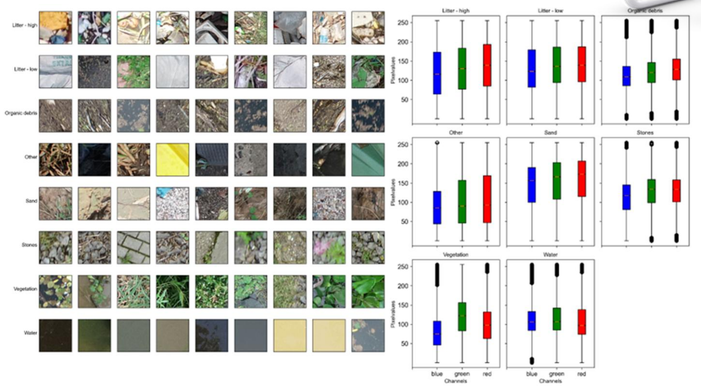
5 AI/ML technology development institutes (*LIP, CSIC, IISAS, KIT, UPV*)

12 research infrastructures supporting use cases

4 national cloud compute centres (*TUBITAK, CSIC, INCD, Walton*)

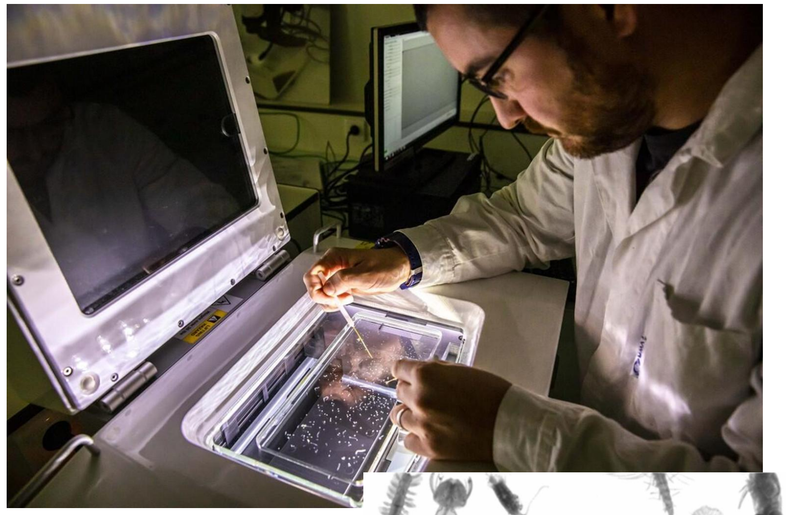
Aquatic litter monitoring using drones

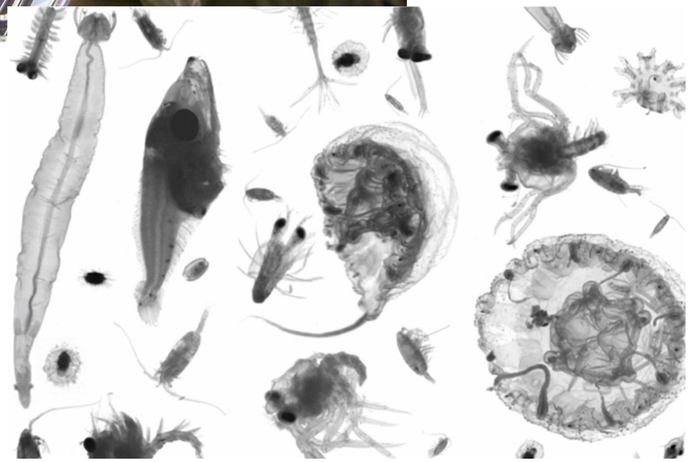
- Partners
  - DFKI (DE), MARIS (NL), OGS (IT)
- Objective
  - Establish an operational service for ingestion, storage, analysis and processing of drone images, observing litter floating at surface waters in seas, rivers and lakes, and lying at beaches and shores, delivering standardised classified litter data sets, which are fit for purpose of environmental management and indicators
- Expected impact
  - Litter data sets of importance for environmental management, cleaning operations, and contributing to indicators such as for the EU Marine Strategy Framework Directive (MSFD) and EU Green Deal.



Zooscan – EcoTaxa pipeline: Taxonomic identification of zooplankton using Zooscan

- Partners
  - SU (FR)
- Objective
  - Establish an operational image handling service that ingests, stores, processes images of marine water samples taken by the Zooscan instrument and uploads the resulting regions of interest to the EcoTaxa platform for later taxonomic identification
- Expected impact
  - The provision of the ZooScan – EcoTaxa pipeline will accelerate and standardise the processing of plankton samples and result in more numerous and more interoperable zooplankton data to better describe and understand these systems.

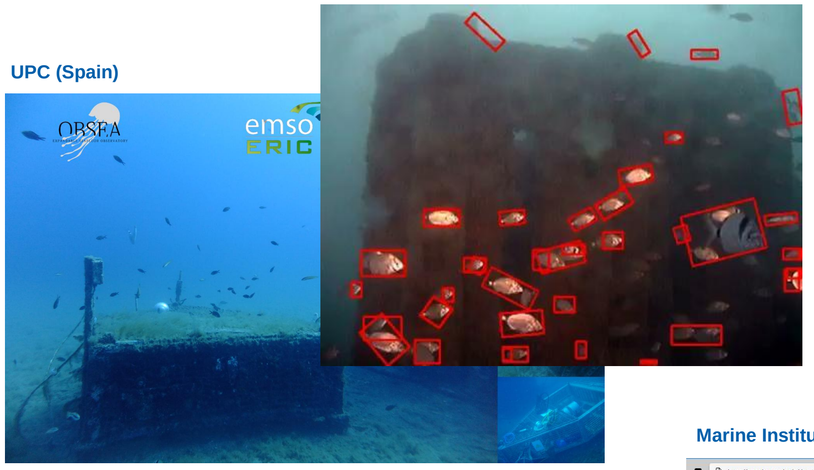




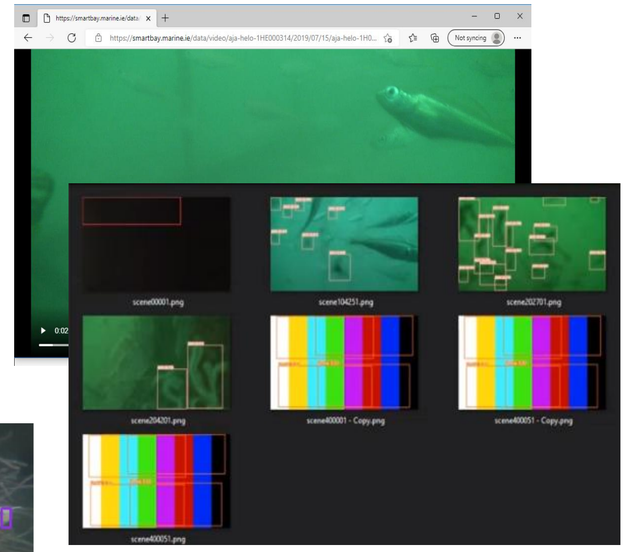
Ecosystem monitoring at EMSO sites by video imagery

- Partners
  - EMSO ERIC (IT), UPC (ES), Ifremer (FR), MI (IE)
- Objective
  - Establish an operational service automatic processing of video imagery, collected by cameras at EMSO underwater sites
  - Identify and further analyse images for ecosystem monitoring
- Expected impact
  - Having a common capacity which can be adopted by all EMSO-sites, contributing to generating and making available relevant input for biodiversity and ecosystem studies

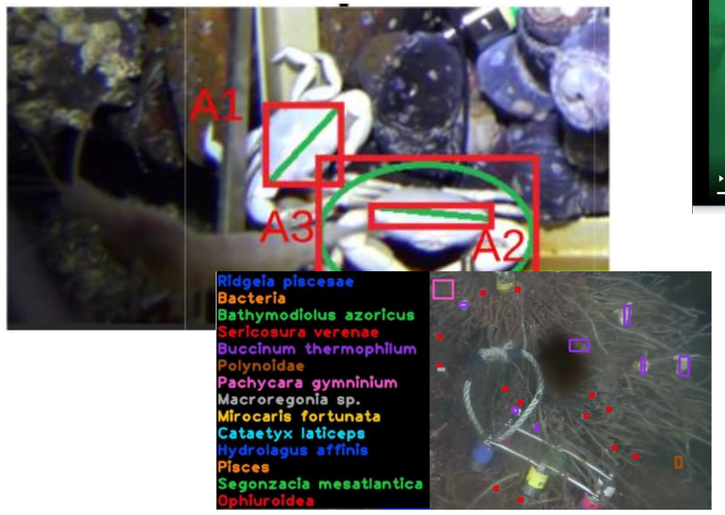
UPC (Spain)



Marine Institute (Ireland)

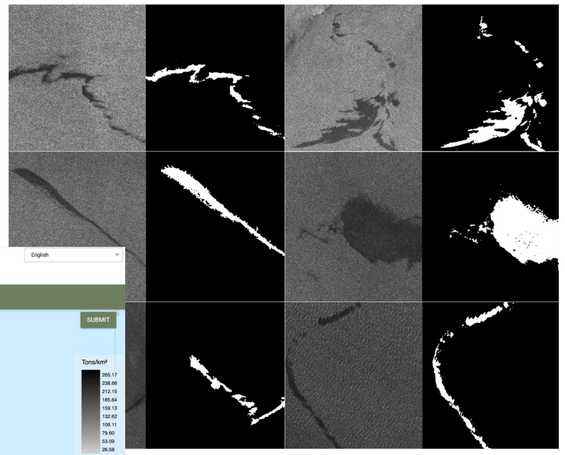


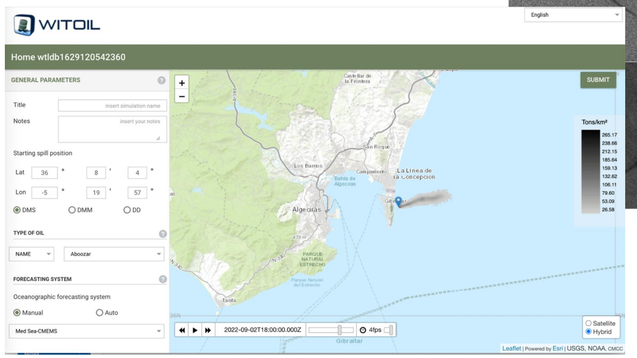
Ifremer (France)



Oil Spill Detection: Oil spill detection from satellite images

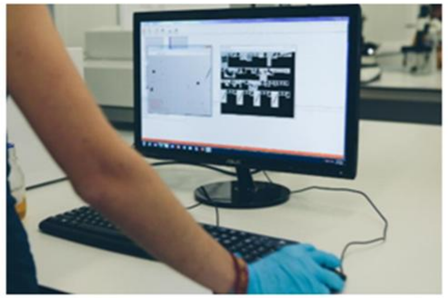
- Partners
  - CMCC (IT), ORBITAL EOSC (ES), UNITN (IT)
- Objective
  - Establish an operational service for automatic processing of satellite images for detecting oil spills as extra component of an existing marine pollution oil spill monitoring and modelling service
- Expected impact
  - Having a common capacity which can be adopted by all EMSO-sites, contributing to generating and making available relevant input for biodiversity and ecosystem studies





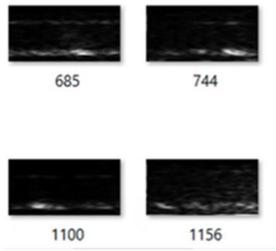
Flowcam phytoplankton identification: Taxonomic identification of phytoplankton using Flowcam images

- Partners
  - VLIZ (BE)
- Objective
  - Establish an operational service for ingestion, storage, analysis and processing of Flowcam images for determining taxonomic composition of phytoplankton samples.
- Expected impact
  - Global description of the abundance and diversity of phytoplankton communities. More users and more image providers, contributing to more phytoplankton information and more efficient biomonitoring.



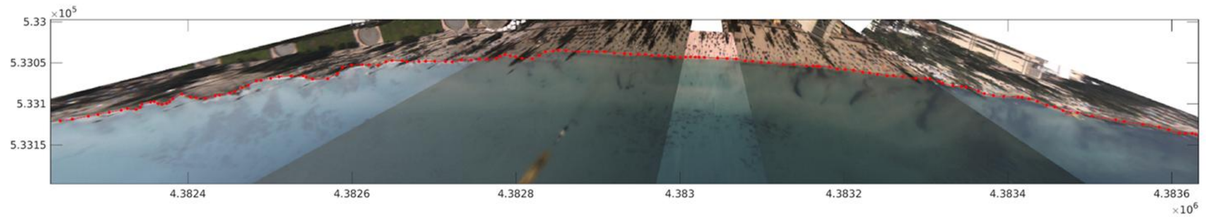
Underwater Noise Identification: Underwater noise identification from acoustic recordings using spectrograms

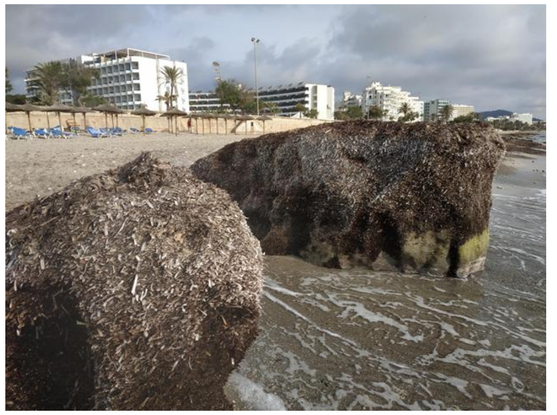
- Partners
  - VLIZ (BE)
- Objective
  - Develop a prototype service for processing acoustic underwater recordings for identification and recognition of marine species and other noise types (e.g., offshore piling).
- Expected impact
  - Contribution to species abundance assessment, insight in effects of human activities on marine life.



Beach Monitoring: Posidonia oceanica berms and rip-currents detection from beach monitoring systems

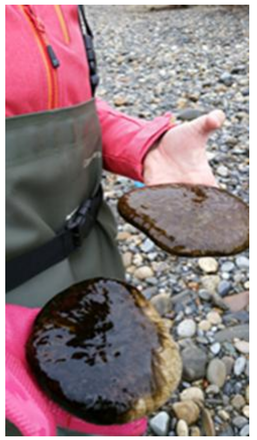
- Partners
  - SOCIB (ES)
- Objective
  - Develop a prototype service for processing video images from beach cameras for monitoring formation and dismantling events of seagrass beach berms (Posidonia oceanica) and detecting rip-currents.
- Expected impact
  - Detection of Rip-currents will contribute to developing a real-time warning system for beach recreation. Their characterization will help to gain knowledge on sediment transport processes and beach erosion/accretion patterns related to rip-currents.





Freshwater diatoms identification: Identification of freshwater diatoms using microscopic images

- Partners
  - UL-LIEC (FR), CNRS-IRL2958 (FR), SU-LOCEAN (FR)
- Objective
  - Develop a prototype diatom-based bioindication service using automatic pattern recognition algorithms from individual microscope images from freshwater environments.
- Expected impact
  - improve the diagnostic tools currently available, notably by improving the sampling effort, extending the current monitoring network to a larger number of stations and generating AI-based new metrics.



Summary:
iMagine will achieve impact by providing…

1. A common iMagine AI framework and computing platform, based upon earlier DEEP developments and to be built on EGI resources, connected to EOSC, facilitating researchers in development, testing, training, hosting, and operating of AI based image analysis services, following FAIR practices.

2. Five operational and three prototype AI based image analysis services with image repositories, highly relevant for aquatic sector, to be deployed at the iMagine AI platform for open access and exploitation by researchers. These will demonstrate value and foster further uptake.

3. Best Practices consisting of documentation and training materials, giving practical guidance and examples to end-users on how to exploit image datasets and analysis applications offered by the iMagine portfolio, and to research engineers who wish to develop and deliver similar services, making use of the facilities of the iMagine AI platform

8 Use Cases & Their Links to RIs and Initiatives

Services with Virtual Access	Aquatic Litter Drones: Aquatic Litter monitoring system using drones	SeaDataNet, EMODnet
	Zooscan – EcoTaxa pipeline: Taxonomic identification of zooplankton using Zooscan	LifeWatch ERIC, EMBRC
	Ecosystem monitoring at EMSO sites by video imagery	emso ERIC, PAP, Euro-Argo, LifeWatch ERIC, JERICO RI, EMBRC
	Oil Spill Detection: Oil spill detection from satellite images	JERICO RI, emso ERIC, Copernicus Marine Service, LifeWatch ERIC
	Flowcam phytoplankton identification: Taxonomic identification of phytoplankton using Flowcam images	LifeWatch ERIC, JERICO RI
Validated application prototypes	Underwater Noise Identification: Underwater noise identification from acoustic recordings using spectrograms	LifeWatch ERIC
	Beach Monitoring: Posidonia oceanica berms and rip-currents detection from beach monitoring systems	JERICO RI, EMODnet, Copernicus Marine Service
	Freshwater diatoms identification: Identification of freshwater diatoms using microscopic images	LifeWatch ERIC

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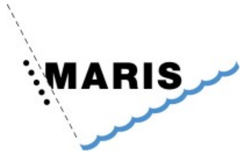
Consortium Overview



iMagine

Interested in partnership?

Contact us:

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- *Dick Schaap (dick@maris.nl) - Scientific director*

https://www.imagine-ai.eu

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