

27-29 May 2024 



imdis

# International conference on Marine Data and Information Systems





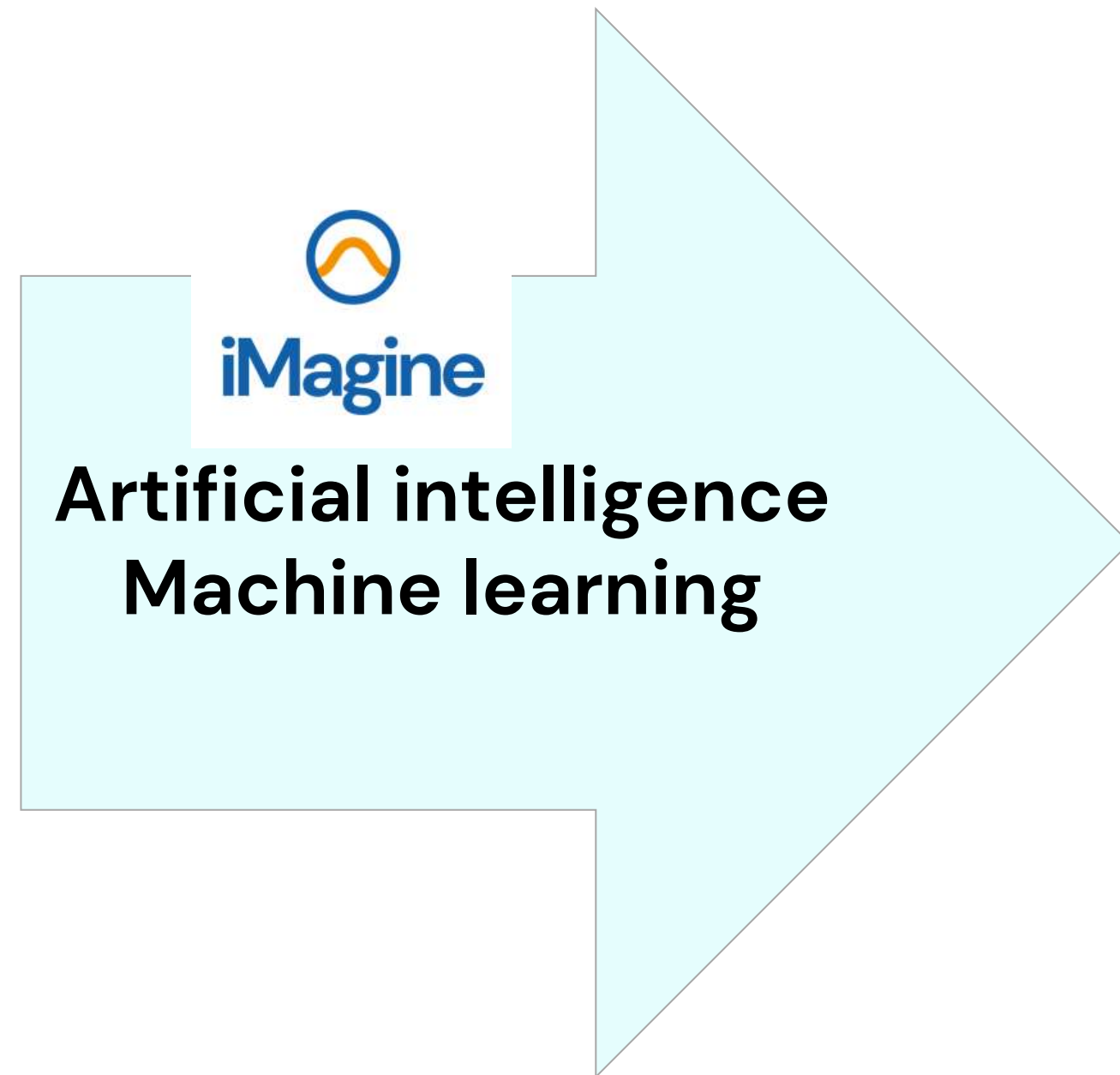
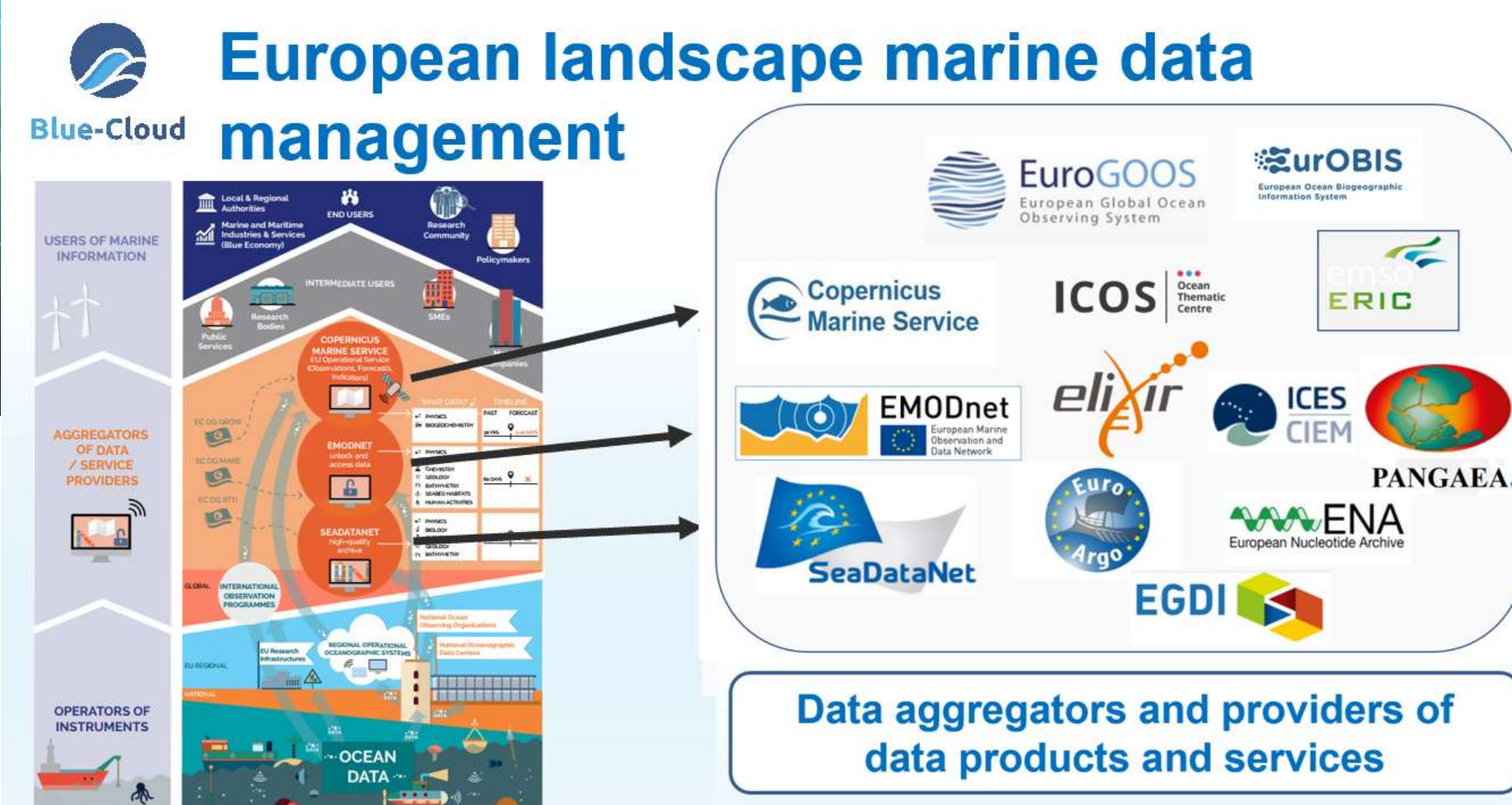
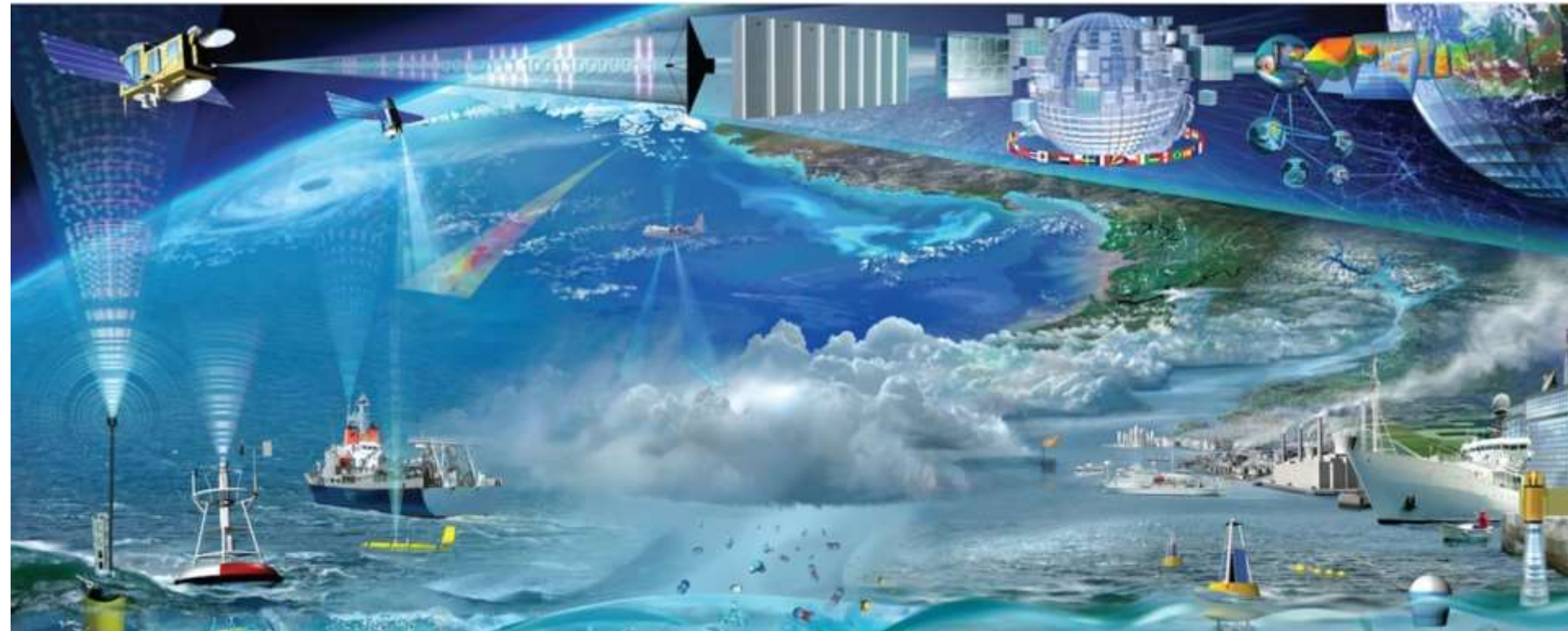
# iImagine – Imaging data and services for aquatic science

Gergely Sipos, Dick Schaap, Alvaro Lopez Garcia and Valentin Kozlov  
On behalf of the iImagine consortium

# 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.



## 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 iImagine 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 iImagine 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, iImagine framework and platform*

# Enabling scalable AI/ML services



4 national cloud compute centres and  
5 AI/ML technology development institutes supports  
14 research institutes for 12 RIs



# Use cases overview (mature UCs)

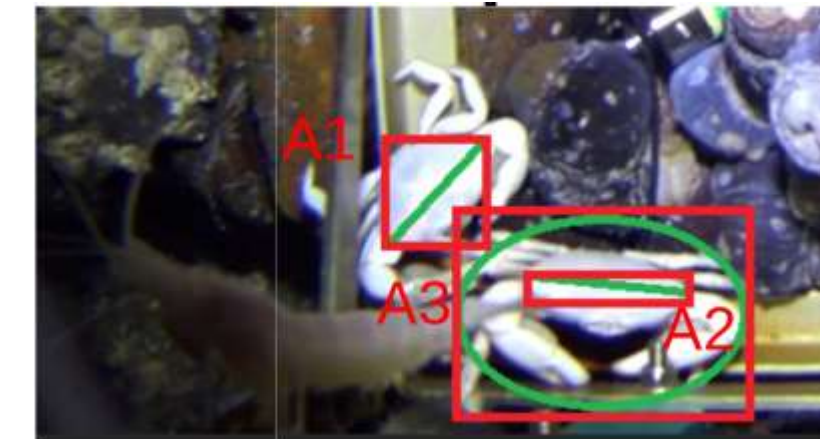
**Aquatic Litter Drones** (DFKI, MARIS, OGS):  
Monitoring system for Aquatic Litter  
Pollution



**Zooscan – EcoTaxa pipeline** (Sorbonne Université):  
Taxonomic identification of zooplankton using Zooscan



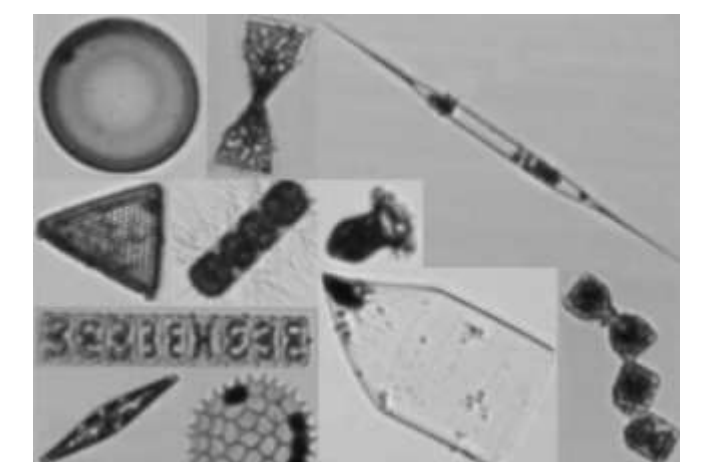
**Marine Ecosystem Monitoring**  
(EMSO ERIC, UPC, IFREMER, MI):  
Ecosystem Monitoring by means of video imagery from  
cameras at EMSO sites



**Oil Spill Detection** (CMCC, OrbitalEOS, UNITN):  
Oil spill detection from satellite images

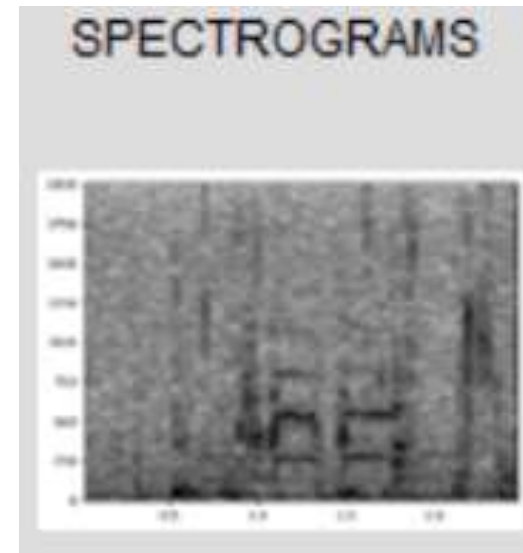


**Flowcam phytoplankton identification** (VLIZ):  
Taxonomic identification of phytoplankton



# Use cases overview (prototype, external)

**Underwater noise identification** (VLIZ):  
Identification of sound events from  
acoustic recordings using spectrograms



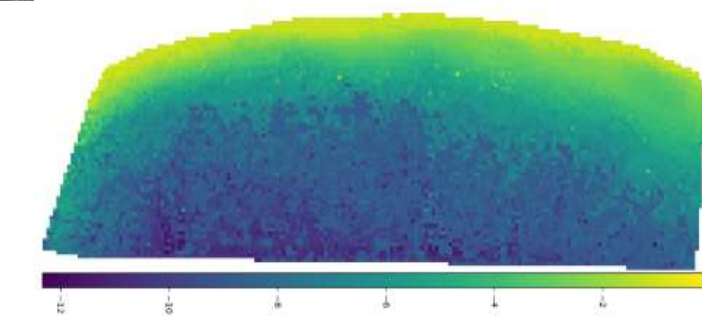
**Beach monitoring** (SOCIB):  
Posidonia oceanica berms and rip-currents  
detection from beach monitoring systems



**Freshwater diatoms identification** (UL-LIEC):  
Diatom-based bioidentification using automatic  
pattern recognition on microscope images

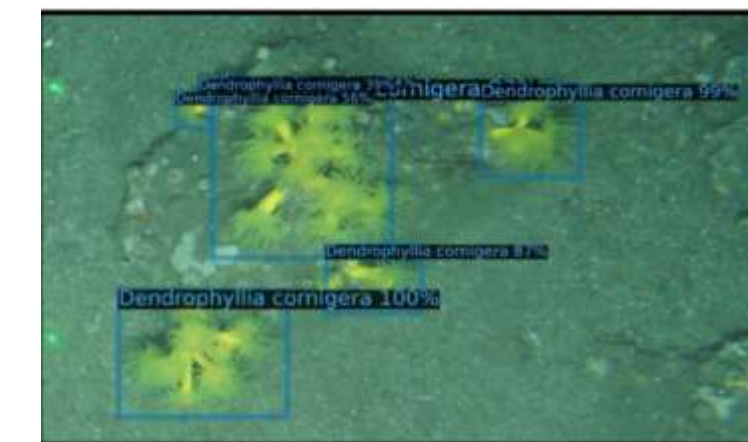


**Satellite-Derived Bathymetry** (ICMAN-CSIC)  
Nearshore bathymetry for coastal studies



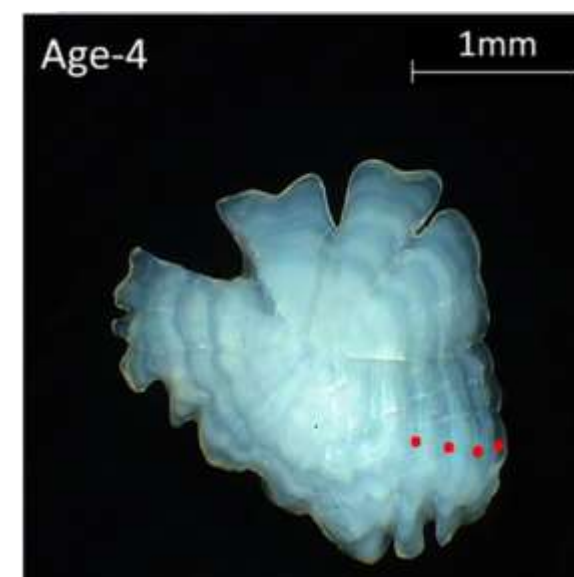
From Nov. 2023:

**Improving knowledge about Cold Water Coral Reef**  
(IEO, CSIC) Use AI to precisely delineate areas of  
living coral and dead coral



From Feb. 2024:

**AI for image based age reading from fish otoliths**  
(DTU Aqua Denmark) To develop an AI algorithm to identify  
the age of a fish from an otolith image

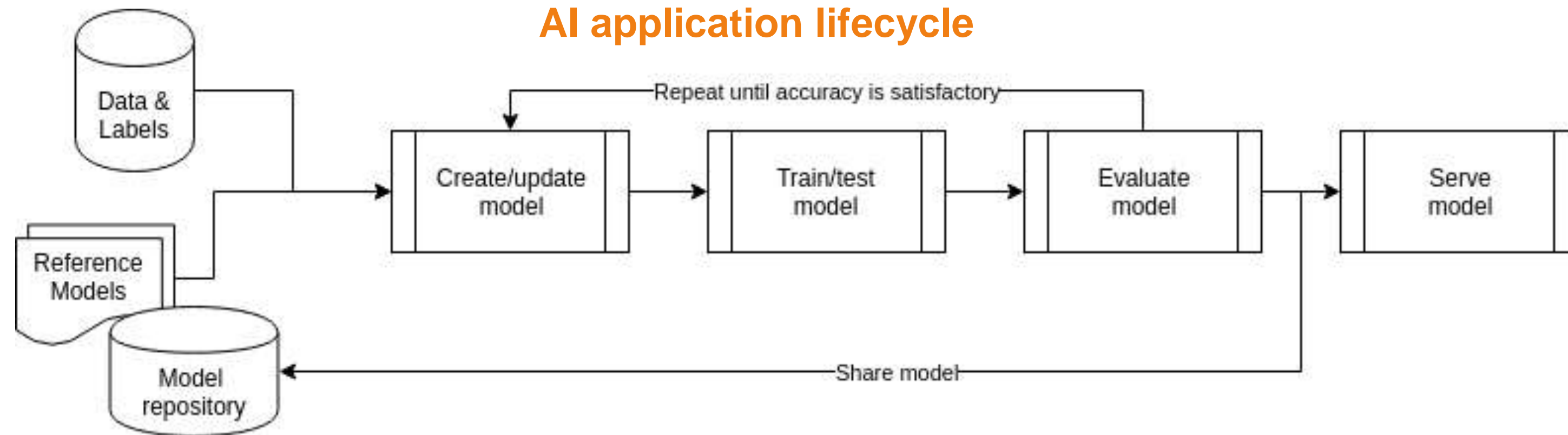
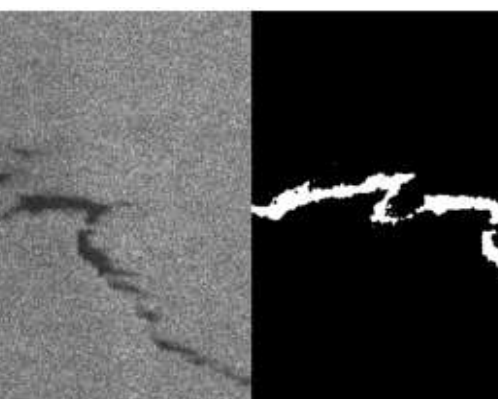
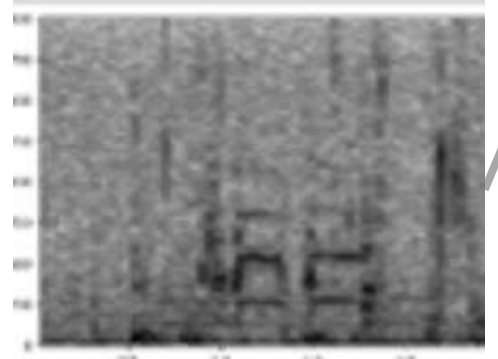


# From data to knowledge

## Use cases



Training images



## Data publishing

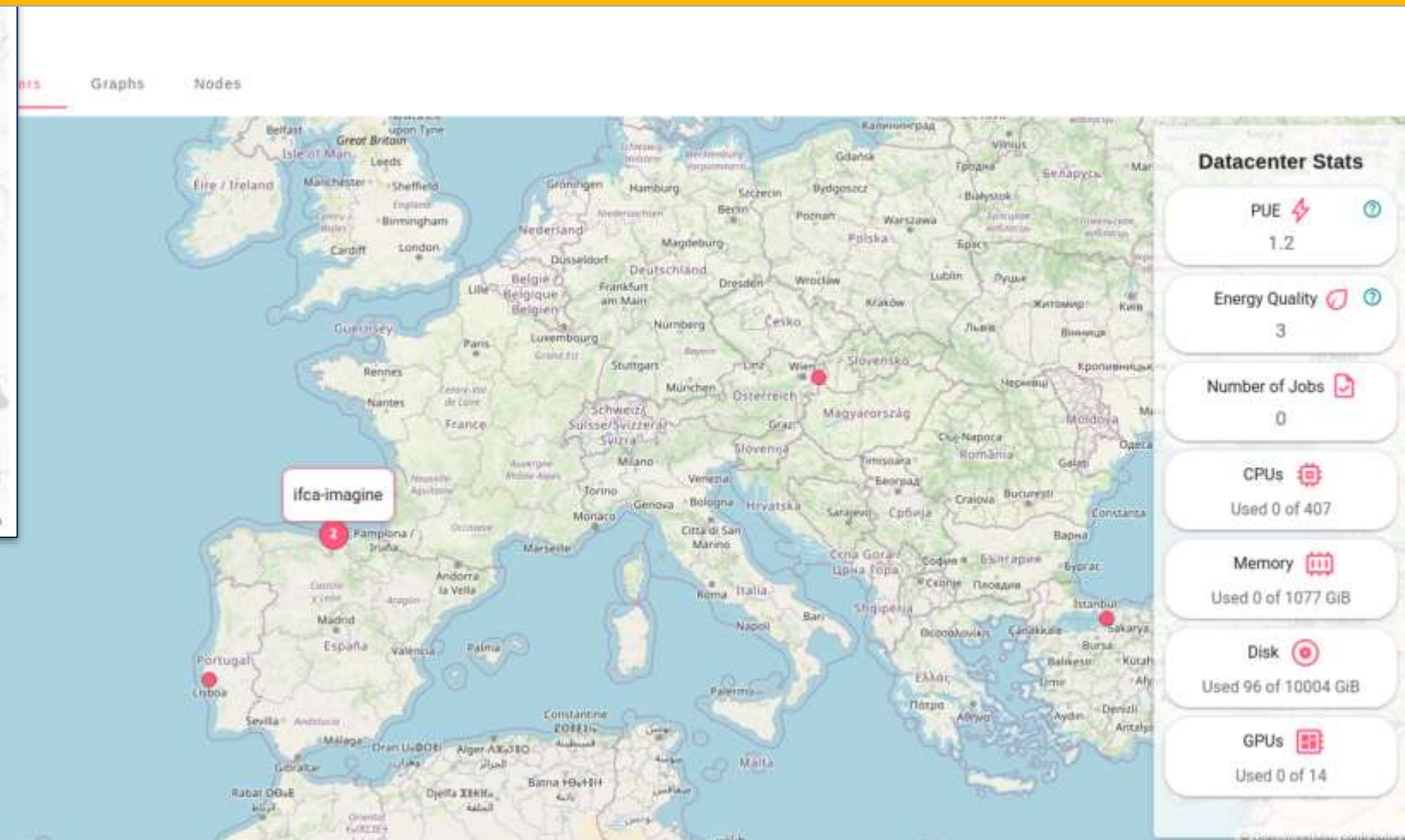


## Trained AI model publishing (for inference)



**iImagine AI Platform**


Powered by:  
**AI4**  
eosc

**Datacenter Stats**

- PUE: 1.2
- Energy Quality: 3
- Number of Jobs: 0
- CPUs: Used 0 of 407
- Memory: Used 0 of 1077 GiB
- Disk: Used 96 of 10004 GiB
- GPUs: Used 0 of 14







Marketplace

Useful links

- Identity and Access
- iImagine AI platform documentation
- Project page
- Storage
- Status
- Experiment tracking

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v1.7.2

Powered by [AI4OS](#) [AI4](#) [EOSC](#)

Login - Register

Search modules

Marketplace

Modules Tools

<h3>Train an image classifier</h3> <p>Train your own image classifier with your custom dataset. It comes also pretrained on the 1K ImageNet classes.</p> <p>Trainable Inference Pre-trained</p>	<h3>Speech keywords classifier</h3> <p>Train a speech classifier to classify audio files between different keywords.</p> <p>Trainable Inference</p>	<h3>Train an audio classifier</h3> <p>Train your own audio classifier with your custom dataset. It comes also pretrained on the 527 AudioSet classes.</p> <p>Trainable Inference Pre-trained</p>	<h3>Object Detection and Classification with Pytorch</h3> <p>A trained Region Convolutional Neural Network (Faster RCNN) for object detection and classification.</p> <p>Trainable Inference Pre-trained</p>	<h3>Object detection with FasterRCNN</h3> <p>Object detection using FasterRCNN model(s) (fasterrcnn_pytorch_api)</p> <p>Trainable Inference Pre-trained</p>
<h3>YoloV8 model</h3> <p>Object detection using YoloV8 model</p> <p>Trainable Inference Pre-trained</p>	<h3>marine_species_seg</h3> <p>WIP Identification of marine species from EMSO Azores deep-sea observatory</p>	<h3>multi_plankton_separation</h3> <p>Automatic separation of objects in images containing multiple plankton organisms</p>	<h3>litter_assessment_service</h3> <p>Integration of DeepaaS API and litter assessment software</p>	<h3>OBSEA Fish Detection</h3> <p>AI-based fish detection and classification algorithm based on YOLOv8. The model has been finetuned to detect and classify fish at the OBSEA underwater observatory.</p>
<h3>Phytoplankton species classifier (VLIZ)</h3> <p>Identify the species level of Plankton for 95 classes. Working on OSCAR</p> <p>Pre-trained Trainable</p>	<h3>Train an underwater-noise-classification (VLIZ)</h3> <p>Train your own underwater-noise-classifier with your custom dataset to identify ships</p> <p>Trainable Inference Pre-trained</p>	<h3>AI4OS Development Environment</h3> <p>This is a Docker image for developing new modules</p>		

Dev iImagine Marta Obregón

Dashboard **Dashboard** Overview **Overview** Datacenters Graphs Nodes

Cluster Usage Overview **GPU Stats per model**



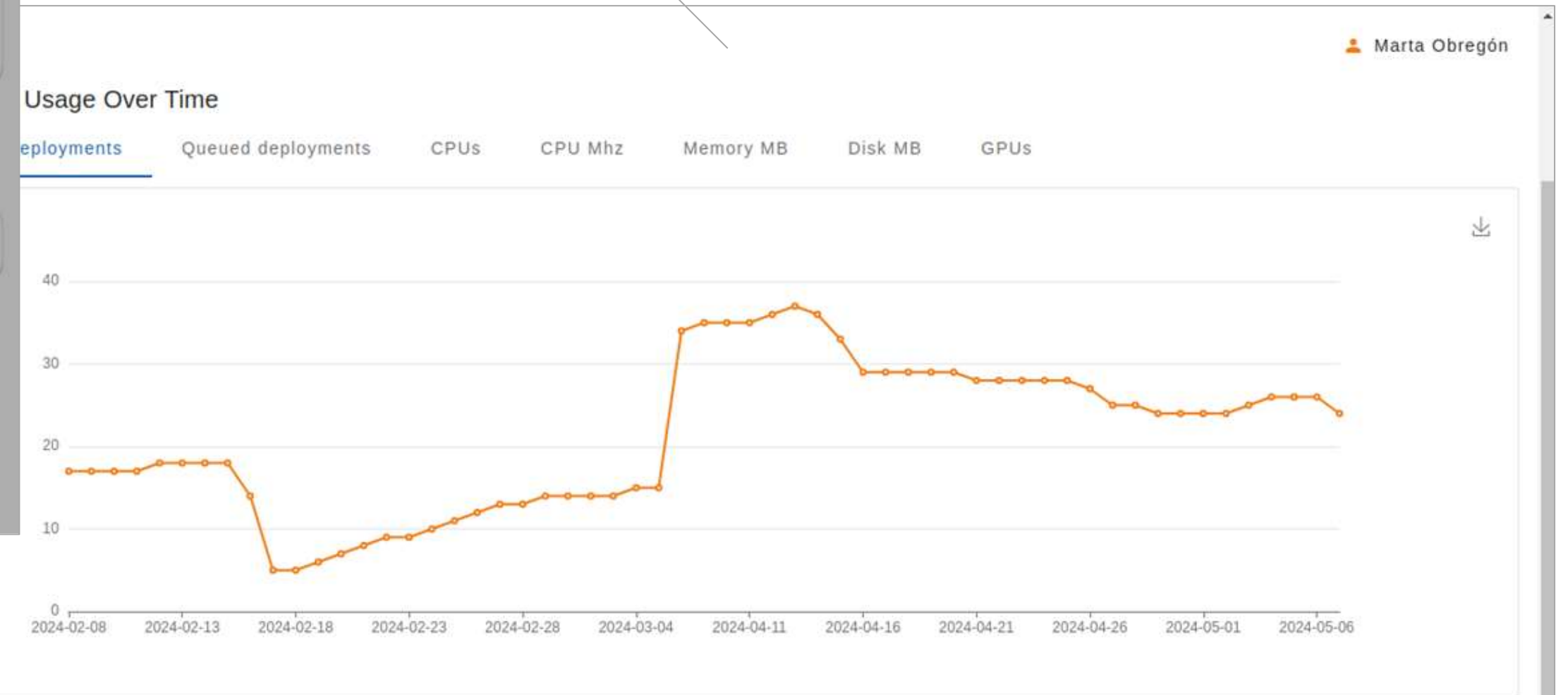
Model	Used	Free
NVIDIA A100-PCIE-40GB	1	0
Tesla K40m	0	1
Tesla V100-PCIE-32GB	0	10
Tesla T4	1	15

Number of Jobs: 1

Storage: 9 GiB | GPUs: 0

Useful links: Identity and Access, iImagine AI platform documentation, Project page, Storage, Status, Experiment tracking

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Storage Status Experiment tracking

Aggregate Resource Usage

**CPUs**


Your total: 38  
iImagine total: 16527



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**Memory**


Your total: 74GiB  
iImagine total: 33790GiB



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**Disk**


Your total: 37GiB  
iImagine total: 2689GiB



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**GPUs**

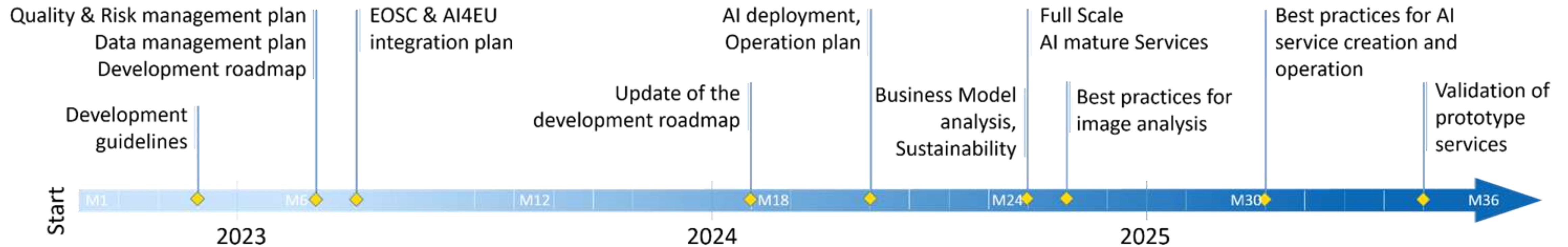
Your total: 0  
iImagine total: 1547



Marta Obregón iImagine

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# Common implementation approach across RIs and e-infrastructures



Continuous interaction with users, feedback & knowledge sharing

- Agile development in epics
- Building up operation plans
- Data delivery
- Application service delivery
- Good practices on AI for RIs

Results published in iImagine community in Zenodo: <https://zenodo.org/communities/imagine-project/>

# Key Exploitable Results

- 1. A common iImagine 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 iImagine 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 iImagine portfolio, and to research engineers who wish to develop and deliver similar services, making use of the facilities of the iImagine AI platform

# Preliminary Results



SCAN ME



# Lessons learnt... so far

- Data preparation, manual labelling is effort-intensive
  - The more metadata produced at the source the better
  - The more automated metadata production the better
- High quality, open source AI models exist for image analysis → ready to use for scientists in the platform
  - e.g. Yolov8, DOVER, CNN, U-Net
- Regular knowledge exchange is important
  - iImagine Competence Centre approach works well
  - Domain knowledge to leverage AI tools is a must
- Federation of national clouds in EGI for AI application support
  - Virtual Access is crucial to enable cross-national access to 'fit-for-purpose' services



# iMagine



## The iMagine Open Call for AI-powered image analysis in aquatic sciences is NOW OPEN!

We offer:

- 10-month collaborative projects

Support for

- AI model training
- Large-scale image analysis
- Use of the iMagine AI platform to develop and train AI models
- Access to cloud resources (GPUs, CPUs, storage) to store images and to scale up analysis workflows





**iImagine**

**Thank you!**

<https://www.imagine-ai.eu>



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