



# iMagine: AI-Powered Image Data Analysis in Aquatic Science

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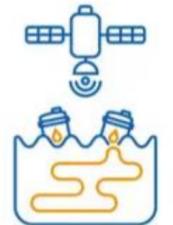
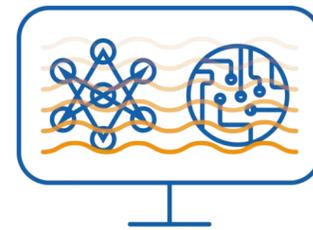


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# Outline

- Introduction
- Competence Center
- AI Platform
- Best Practices and Tools
- Case Study
- Summary

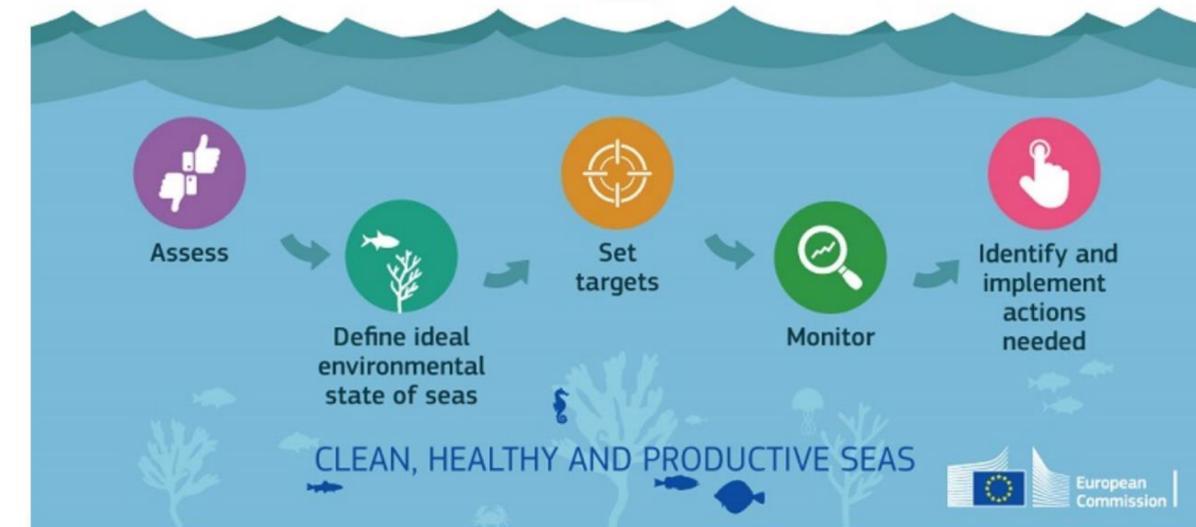


# Sustainable Development

## *EU Directives and Initiatives for Aquatic Domain*

- Marine Strategy Framework Directive (MSFD)
- Water Framework Directive (WFD)
- European Green Deal
- Mission Restore our Ocean and Waters by 2030
- United Nation's 2030 Agenda for Sustainable Development
- United Nation's Decade of Ocean Science (2021–2030)

How EU Member States develop marine strategies



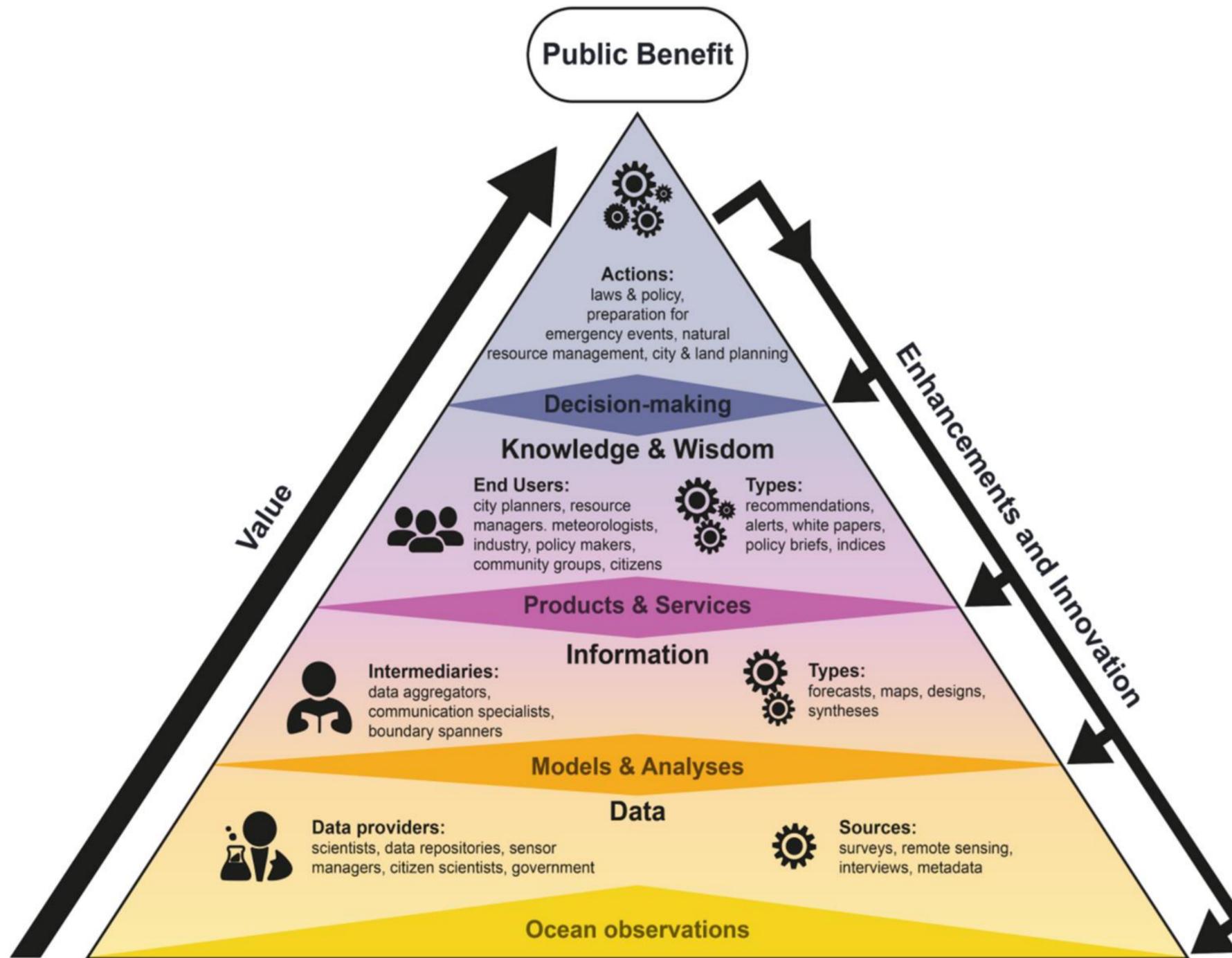
Source: EU MSFD website



2021-2030 United Nations Decade of Ocean Science for Sustainable Development



# Marine Value Chain



Source: European Marine Board

Statistics, Models, Policies, ...



Object Detection & Identification



Images



Imaging instruments

# The iImagine Project

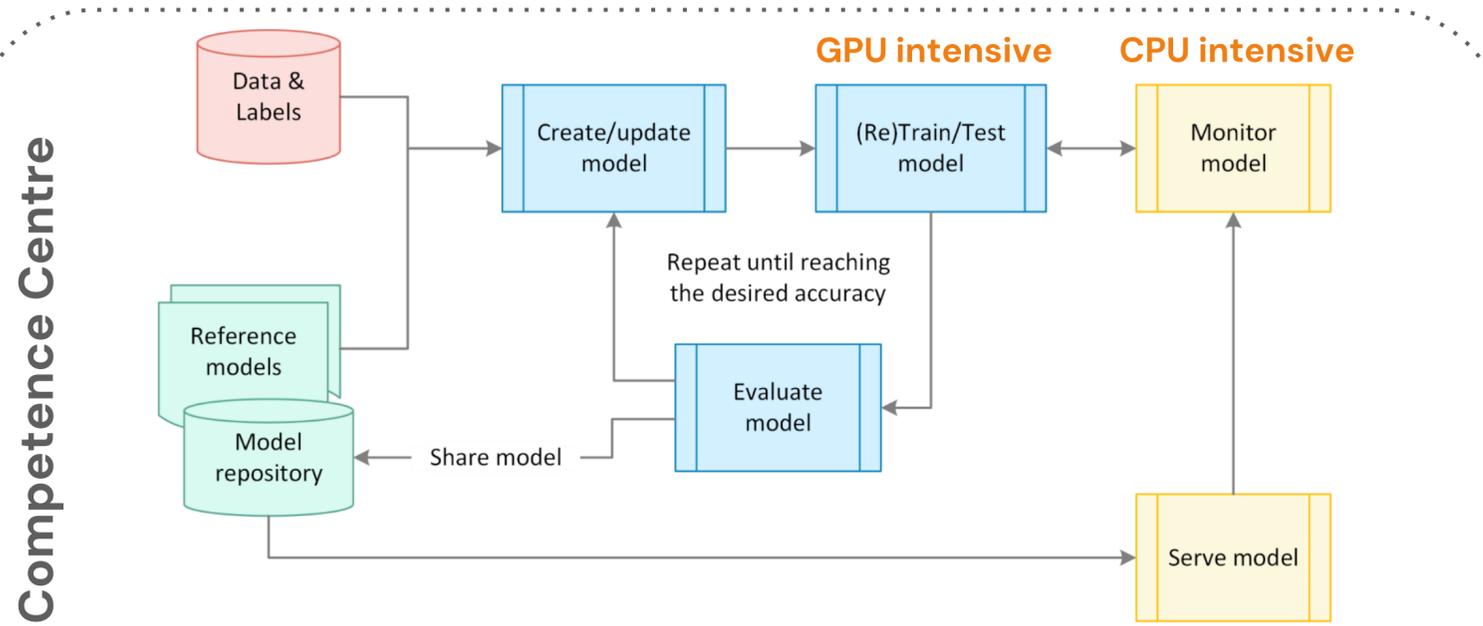


**4** national cloud compute centers and  
**5** AI/ML technology development institutes supports  
**14** research institutes for **12** research infrastructures



# The iImagine Approach

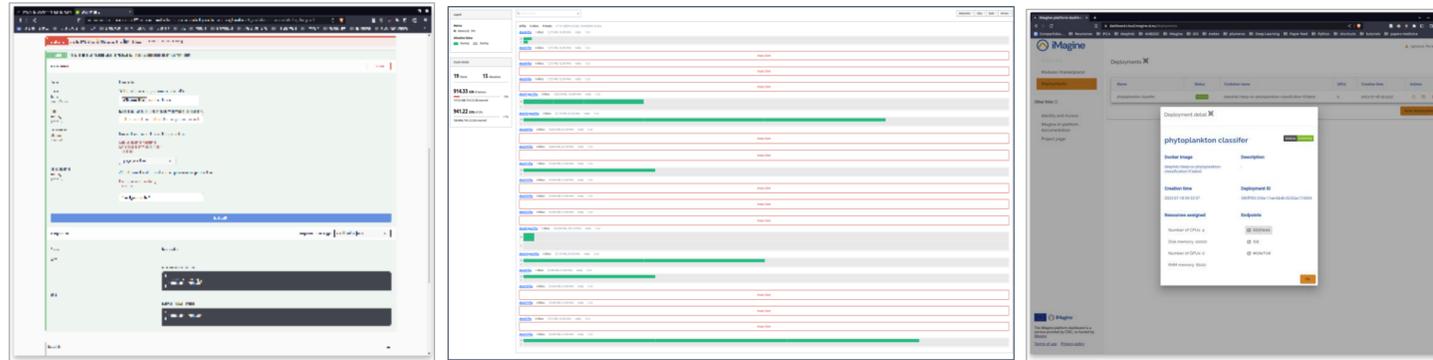
Thematic Services



## Use cases

- 8 internal
- 6 onboarded via open calls

Platform + Competence Centre



## iImagine AI Platform:

Generic and scalable platform for developing and sharing AI/ML applications

## iImagine Competence Centre:

Distributed support team for the full application lifecycle

Infrastructure



## Federated clouds from EGI

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

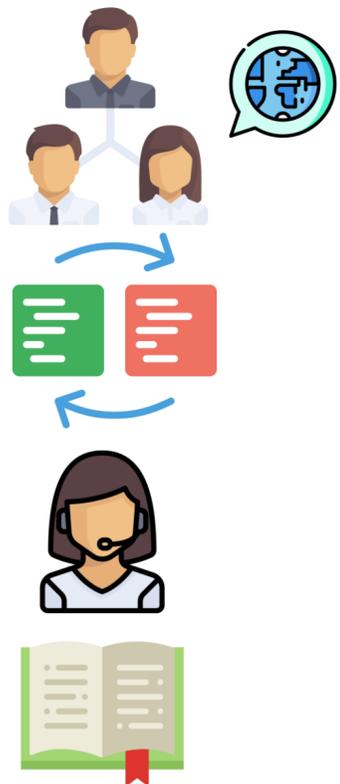
# Competence Center:

## *Mission & Methodology*



**Mission:** Facilitate the path from image data to imaging applications and services for scientists in aquatic sciences

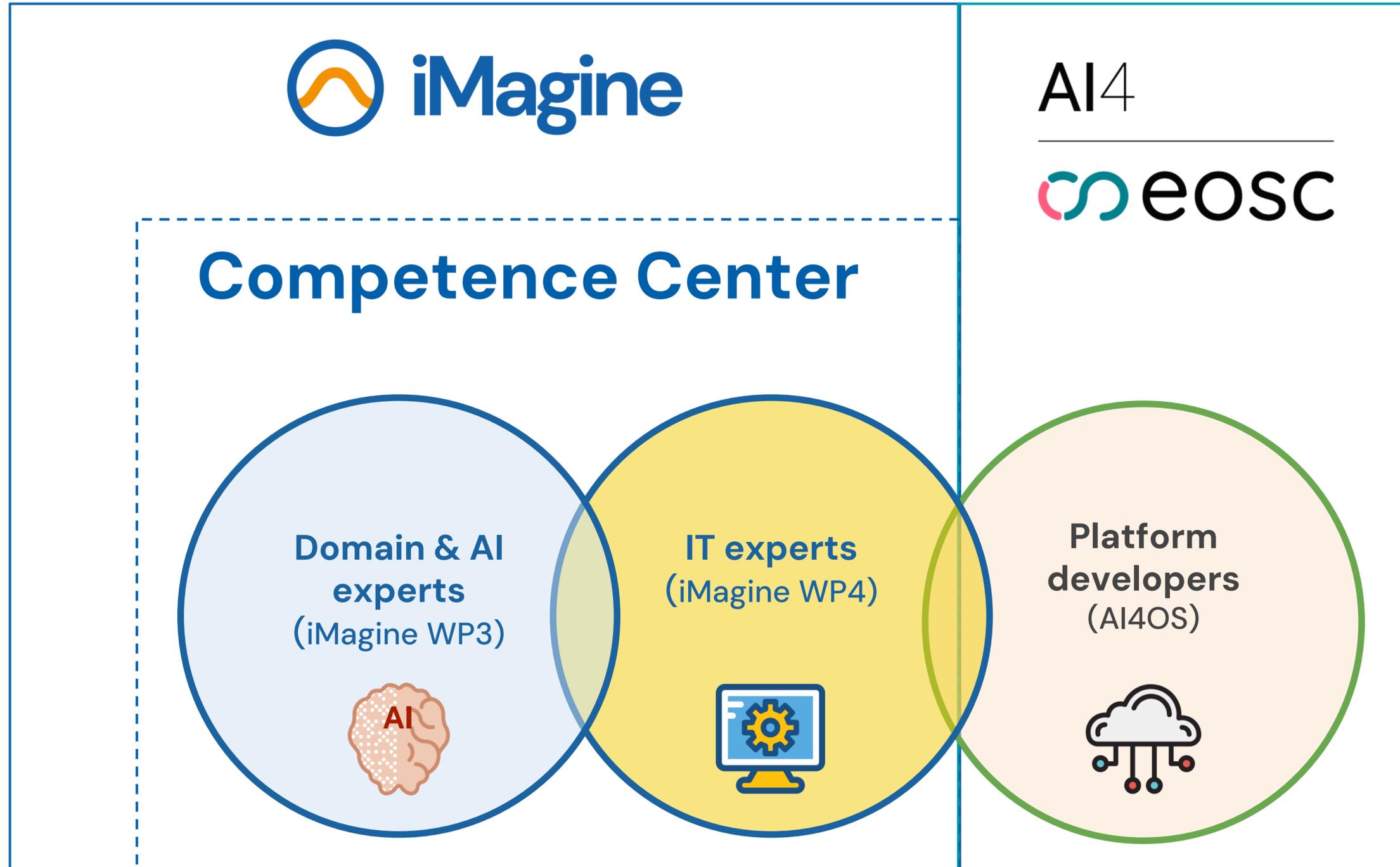
## Methodology:



- Connect **experts** from different domains (science, AI, IT, ...)
- Stimulate **knowledge exchange** between the parties
- Speak **common language**
- Provide **training and support**  
(data, AI, FAIR, platform, service management)
- Create **best practices**

# Competence Center:

*Synergetic Approach*



# Use Cases

5 mature + 3 prototypes

## Marine Litter Assessment

(DFKI, MARIS, OGS)

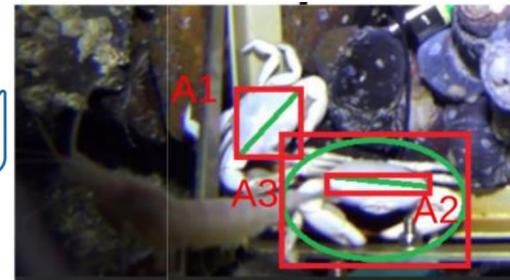
Monitoring system for aquatic litter pollution



## Marine Ecosystem Monitoring

(EMSO ERIC, UPC, IFREMER, MI)

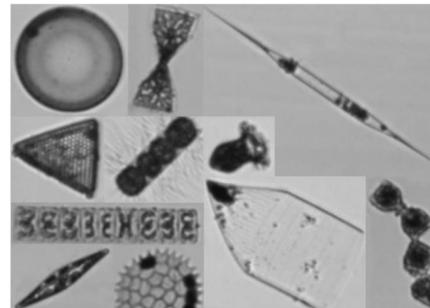
Ecosystem monitoring by means of video imagery from cameras at EMSO sites



## FlowCam Phytoplankton Identification

(VLIZ)

Taxonomic identification of phytoplankton using FlowCam images



## Beach Monitoring

(SOCIB)

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



## ZooScan – EcoTaxa Pipeline

(Sorbonne Uni.)

Taxonomic identification of zooplankton using ZooScan



## Oil Spill Detection

(CMCC, OrbitalEOS, UNITN)

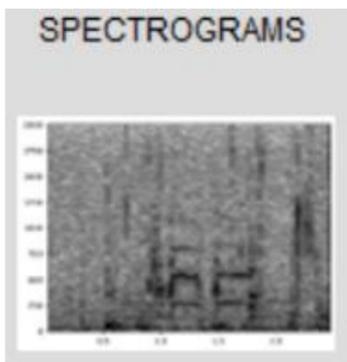
Oil spill detection from satellite images



## Underwater Noise Identification

(VLIZ)

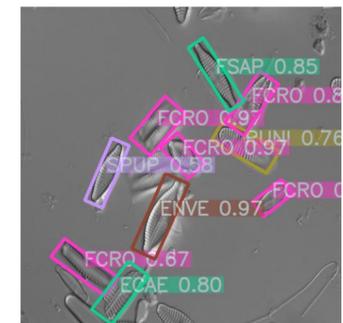
Identification of sound events from acoustic recordings using spectrograms



## Freshwater Diatoms Identification

(UL-LIEC)

Diatom-based bioidentification using automatic pattern recognition on microscope images



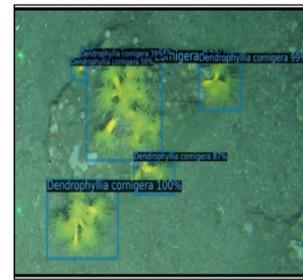
# Use Cases

*Onboarded via Open Calls*

## Improving Knowledge about Cold Water Coral Reef

(Spanish Oceanographic Institute)

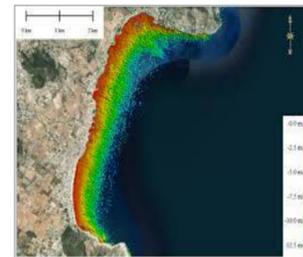
Use AI to precisely delineate areas of living coral and dead coral



## Satellite-Derived Bathymetry

(Institute of Marine Sciences of Andalusia)

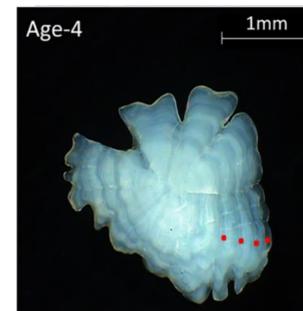
Nearshore bathymetry for coastal studies



## AI for Image-Based Age Reading from Fish Otoliths

(Danish National Institute of Aquatic Resources)

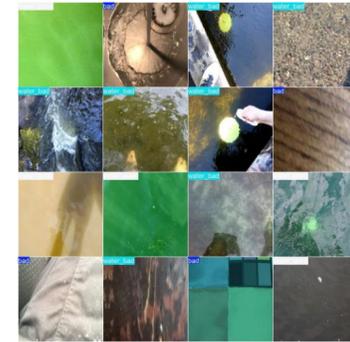
Develop an AI algorithm to identify the age of a fish from otolith images



## Validating Images Collected with the EyeonWater App

(MARIS)

Detect and automatically reject false images, measuring life in water



## Sea Wave and Coastal Inundation Detection Methodology (SWiM)

(National Laboratory for Civil Engineering)

A methodology for an automated wave runup and wave detection from images for the surveillance of coastline



## DEcentrAlised Learning (DEAL)

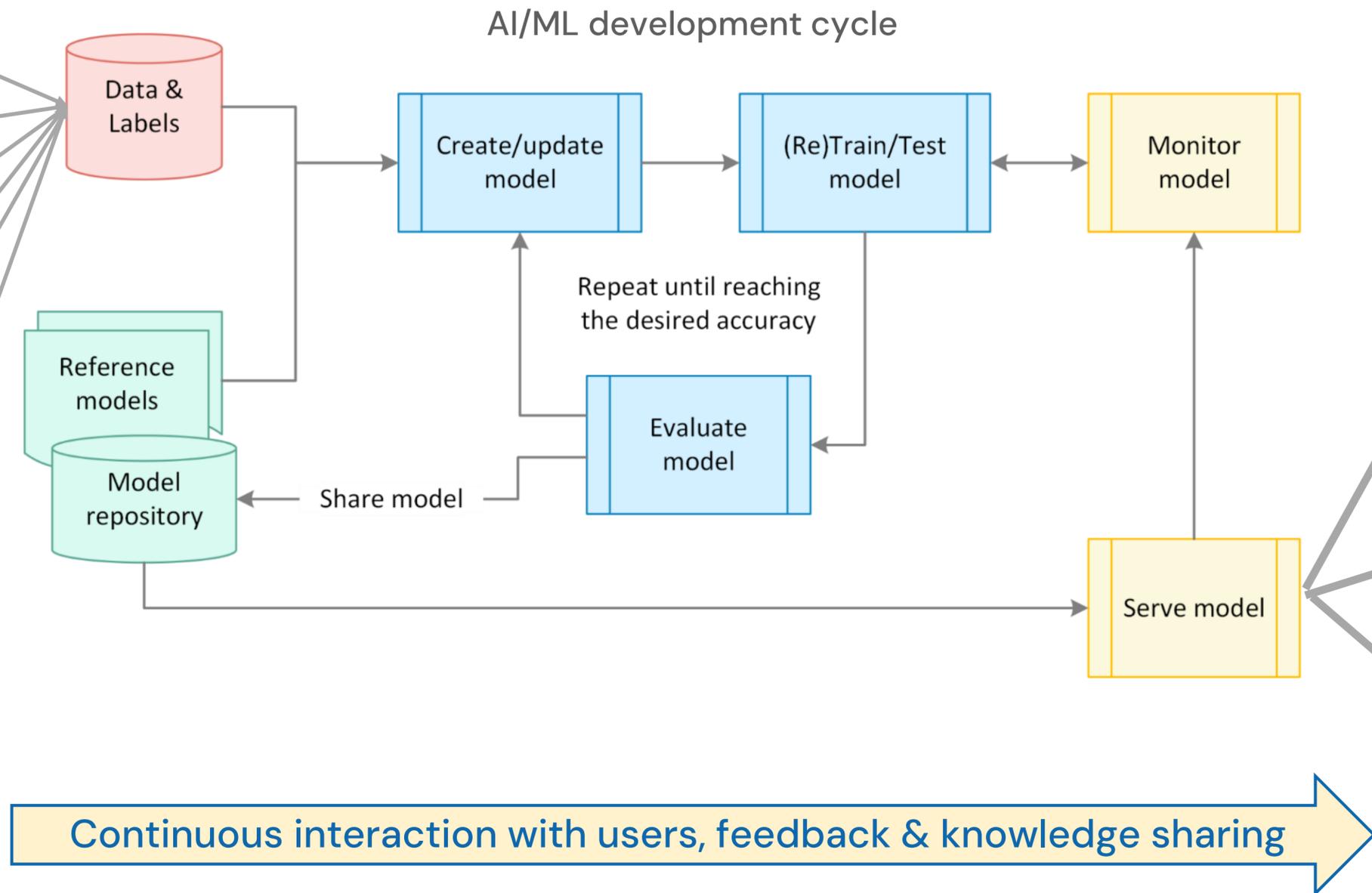
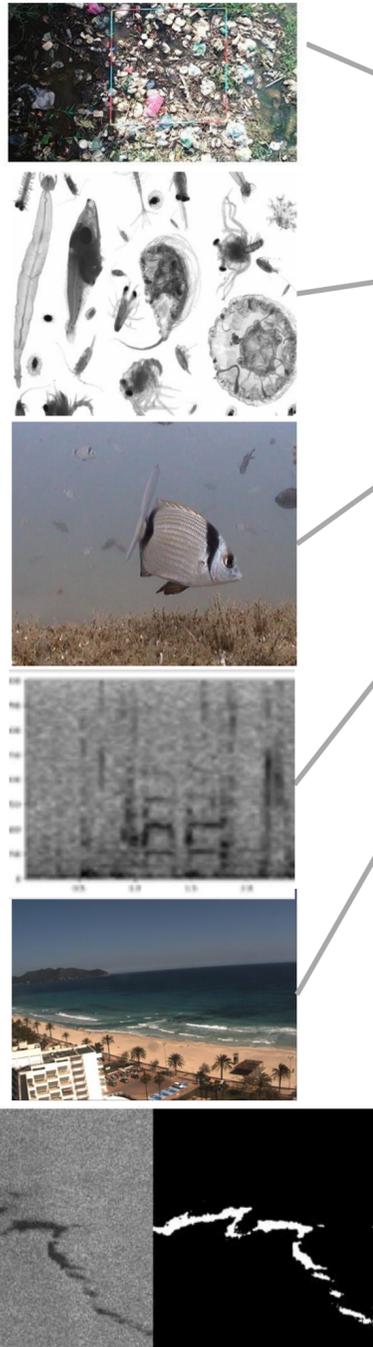
(Plymouth Marine Laboratory)

Use decentralized learning to increase the robustness of automated plankton and deep-water animal imagery processing



# Competence Center: *From Data to Knowledge*

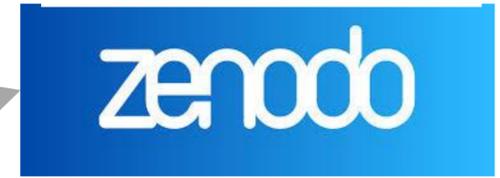
UCx collected raw data



5 Image analysis services  
(powered by trained models)



20 Labeled training datasets



Best practices



# Dashboard

## Modules

iImagine use case modules □  
 Open call use case modules □  
 General purpose modules □

**iImagine**

- Dashboard
- Statistics
- Catalog
  - Modules**
- Tools
- Tasks
  - Try me
  - Deployments
  - Inference
- Platform Services
  - Storage
  - Experiment tracking
  - AI Inference workflows

The iImagine dashboard is a service provided by CSIC, co-funded by [iImagine](#)




Powered by [AI405](#) AI4 [eosc](#)

Libraries Tasks Platform Categories Data Types Tags Add filter

<p><b>Cold coral segmentation</b></p> <p>Cold corals segmentation model</p> <p><b>AUC1</b></p>	<p><b>Conus species classifier</b></p> <p>Classify conus images among 70 species.</p>	<p><b>Deep Species Detection</b></p> <p>Deep Sea Species Detection</p> <p><b>UC3a</b></p>	<p><b>Diatom detection</b></p> <p>Diatoms detection with oriented bounding boxes.</p>	<p><b>Litter assesment</b></p> <p>AI-powered plastic litter counter, from drone footage to cleaner waters.</p> <p><b>UC1</b></p>	<p><b>Object Detection and Classification with Pytorch</b></p> <p>A trained Region Convolutional Neural Network (Faster RCNN) for object detection and classification.</p> <p><b>iImagine</b></p>
<p><b>Object detection with FasterRCNN</b></p> <p>Object detection using FasterRCNN model(s)</p> <p><b>iImagine</b></p>	<p><b>OBSEA Fish Detection</b></p> <p>AI-based fish detection and classification algorithm based on YOLOv8.</p> <p><b>UC3o</b></p>	<p><b>Phytoplankton species classifier (VLIZ)</b></p> <p>Identify the species level of Plankton for 95 classes.</p> <p><b>UC5</b></p>	<p><b>smartbay-marine-types</b></p> <p>AI-based Marine animal types detection and classification algorithm based on YOLOv8. The model has been tuned to detect and classify marine animal types at the Smartbay underwater observatory</p> <p><b>UC3s</b></p>	<p><b>smartbay-prawn-burrow-detection</b></p> <p>AI-based Prawn Burrow detection and classification algorithm based on YOLOv8. The model has been tuned to detect and classify Prawn Burrows in Irish Prawn (Nephrops norvegicus) Fishery Areas.</p> <p><b>UC3s</b></p>	<p><b>smartbay-species-detection</b></p> <p>AI-based Marine Species detection and classification algorithm based on YOLOv8. The model has been tuned to detect and classify marine species at the Smartbay underwater observatory.</p>
<p><b>Train an audio classifier</b></p> <p>Train your own audio classifier with your custom dataset. It comes also pretrained on the 527 AudioSet classes.</p> <p><b>iImagine</b></p>	<p><b>Train an image classifier</b></p> <p>Train your own image classifier with your custom dataset. It comes also pretrained on the 1K ImageNet classes.</p> <p><b>iImagine</b></p>	<p><b>Train an underwater-noise-classification (VLIZ)</b></p> <p>Train your own underwater-noise-classifier with your custom dataset to identify ships</p> <p><b>UC6</b></p>	<p><b>WITOIL-for-iImagine</b></p> <p>Medsluk-II Oil fate lagrangian model</p> <p><b>UC4</b></p>	<p><b>YoloV8 model</b></p> <p>Object detection using YoloV8 model</p> <p><b>iImagine</b></p>	<p><b>ZooProcess Multiple Classifier</b></p> <p>A module to differentiate images containing multiple zooplankton objects from those containing only one object</p> <p><b>UC2</b></p>
<p><b>ZooProcess Multiple Separator</b></p> <p>A module to draw lines between objects to be separated from one another in ZooScan images</p> <p><b>UC2</b></p>					



[iImagine Dashboard](#)

## How to Access

### Try out the AI modules on the iImagine AI Platform for 10 minutes

- Check this [tutorial](#) first
- Log in on the [iImagine AI dashboard](#) with any account
- Select the module of interest
- Click on the TRY button on the right. A Gradio interface will open.

### Request Access

Fill in the form [here](#).

### Thematic Services for Image Analysis

<https://www.imagine-ai.eu/services/image-analysis-services-for-aquatic-sciences>



## iImagine Services Access Request

iImagine has released its imaging analysis services for aquatic sciences. Be the first to request access and start using them.

[In Google anmelden](#), um den Fortschritt zu speichern. [Weitere Informationen](#)

\* [Gibt eine erforderliche Frage an](#)

E-Mail-Adresse \*

Your Name \*

Your Affiliation \*

I work in a project and want to get access to one or more services (use the text box below to give us more details!)

## Available Services

Select the Service You Want to Have Access \*

- Litter Assessment: Identify Floating Plastic for a Cleaner Future
- ZooProcess: Unveiling the Secrets of Plankton
- AI-Powered Fish Monitoring for Healthy Oceans: EMSO-OBSEA
- AI-Powered Fish Monitoring for Healthy Oceans: EMSO-Azores
- AI-Powered Fish Monitoring for Healthy Oceans: EMSO-SmartBay
- WITOil: Predicting Oil Spills for Cleaner Seas
- Uncovering Phytoplankton with AI

Select the Type of Access You're Interested In \*

- Analyse: Analyse Your Whole Image Set With the Analysis Service
- Re-training - Re-train the image analysis model with your training images to reach more precise predictions for your use case.
- Deploy - Download the trained image analysis model and use it on local computing resources - either for image analysis or for re-training.

# Best Practices:

## Publication

- Lessons learned during the whole AI development cycle
- Experiences from 8 aquatic image analysis use cases
- Available since October 2024 at Zenodo: <https://doi.org/10.5281/zenodo.13864196>
- Accepted for publication at the “Ecological Informatics” peer-reviewed journal




# iImagine

Best practices for producers and providers of image sets and image analysis applications in aquatic sciences

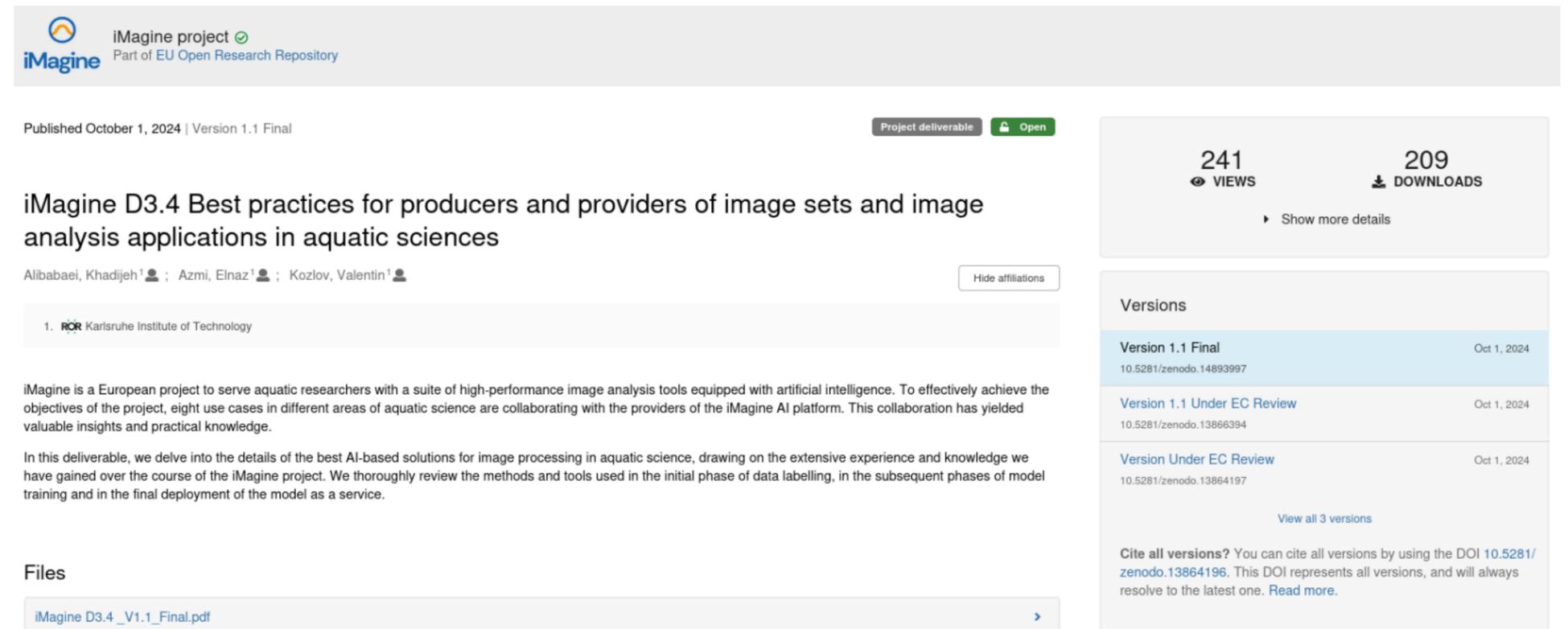
iImagine Deliverable D3.4

01/10/2024



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iImagine project  
Part of EU Open Research Repository

Published October 1, 2024 | Version 1.1 Final

Project deliverable Open

**241** VIEWS **209** DOWNLOADS  
Show more details

### iImagine D3.4 Best practices for producers and providers of image sets and image analysis applications in aquatic sciences

Alibabaei, Khadijeh<sup>1</sup>; Azmi, Elnaz<sup>1</sup>; Kozlov, Valentin<sup>1</sup>

1.  Karlsruhe Institute of Technology

iImagine is a European project to serve aquatic researchers with a suite of high-performance image analysis tools equipped with artificial intelligence. To effectively achieve the objectives of the project, eight use cases in different areas of aquatic science are collaborating with the providers of the iImagine AI platform. This collaboration has yielded valuable insights and practical knowledge.

In this deliverable, we delve into the details of the best AI-based solutions for image processing in aquatic science, drawing on the extensive experience and knowledge we have gained over the course of the iImagine project. We thoroughly review the methods and tools used in the initial phase of data labelling, in the subsequent phases of model training and in the final deployment of the model as a service.

Files

iImagine D3.4\_V1.1\_Final.pdf

Versions

Version	Date
Version 1.1 Final 10.5281/zenodo.14893997	Oct 1, 2024
Version 1.1 Under EC Review 10.5281/zenodo.13866394	Oct 1, 2024
Version Under EC Review 10.5281/zenodo.13864197	Oct 1, 2024

View all 3 versions

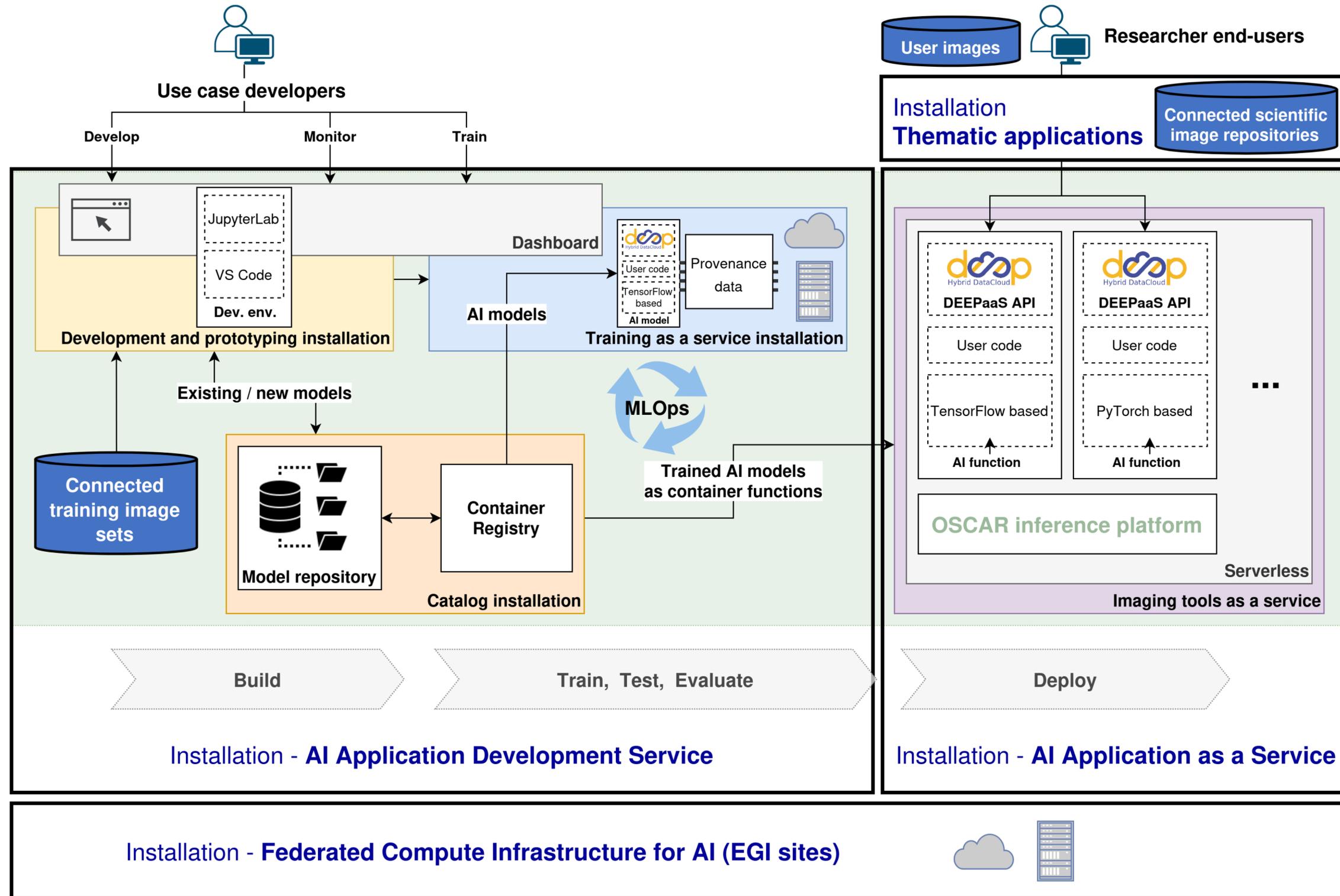
Cite all versions? You can cite all versions by using the DOI [10.5281/zenodo.13864196](https://doi.org/10.5281/zenodo.13864196). This DOI represents all versions, and will always resolve to the latest one. [Read more.](#)



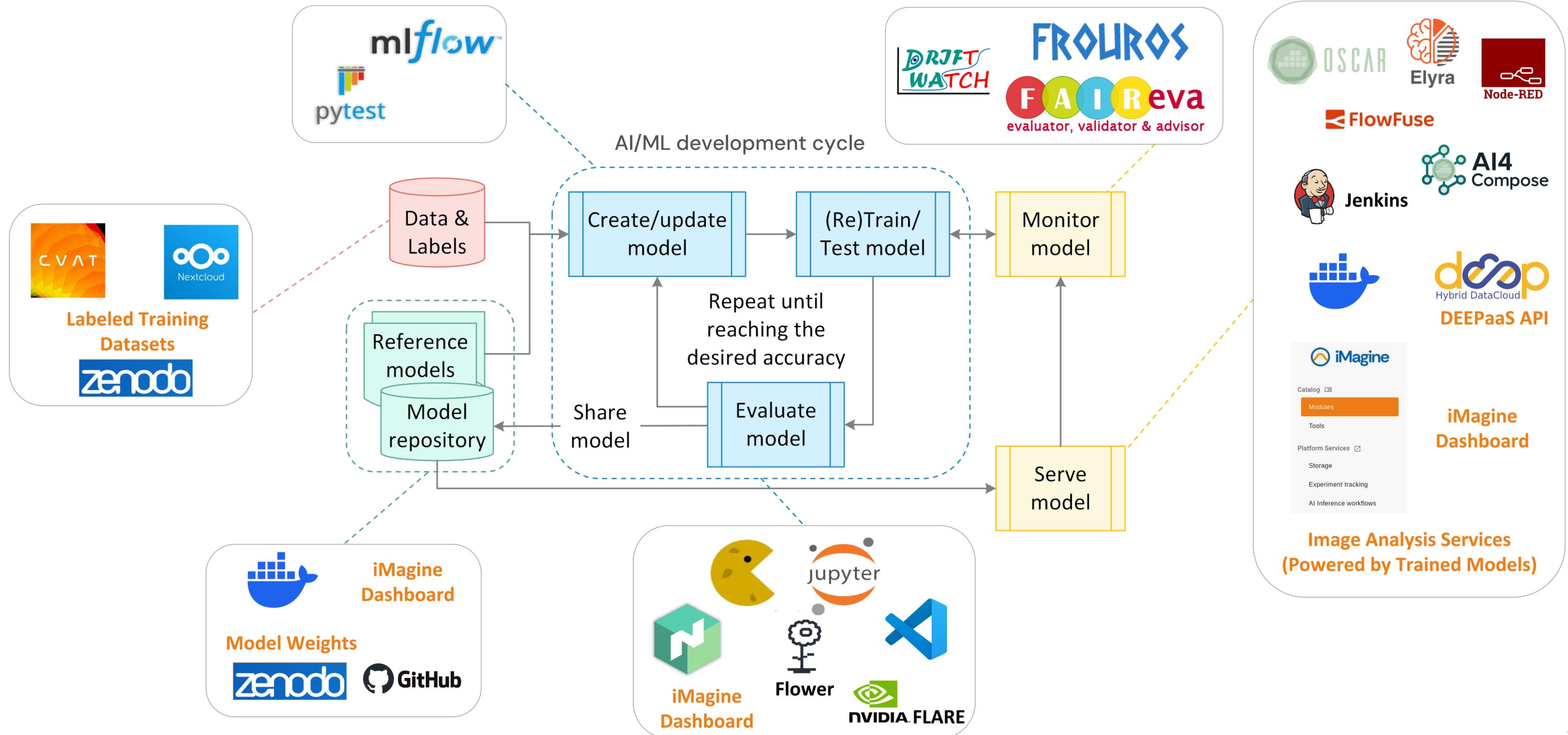
# Diversity in AI development

Use cases	Labeling	Preprocessing	Data biases	Models	Performance metrics
<b>UC1 – Marine litter assessment</b>	prelabeled with in-house litter categories(JLIST)	resizing, <b>augmentation</b> , (horizontal flips, vertical flips, and random rotations)	<b>unbalanced</b> dataset, AI model checked, no need to address	<b>MobileNetV2</b> , SqueezeNet1.1., <b>DenseNet121</b> , ResNet50	<b>accuracy, precision, recall, F1-Score</b>
<b>UC2 – ZooScanNet</b>	labeling with EcoTaxa, segmentation with current version of ZooProcess (both in-house tools)	Before AI: <b>background subtraction</b> on the original image (with a blank scan, by ZooProcess) Classif: <b>data augmentation</b> for (rotation, resizing, cropping, flipping) done just-in-time during training and inference Segment: no augmentation	unbalanced dataset, combination of <b>resampling</b> (for classif and segment) and <b>weights</b> (for classif)	Classif: <b>MobileNet</b> Segment: MaskRCNN, <b>Mask2Former</b>	Classif: binary cross-entropy Segment: <b>accuracy, recall, precision, IoU</b>
<b>UC3o – EMSO OBSEA</b>	labelling, roboflow, label studio, BIIGLE	<b>augmentation</b>	cover the <b>seasonality</b> , one-year dataset, unbalanced dataset, adding dataset of <b>other species</b>	Faster-RCNN, YOLOv8	mAP@50, <b>precision, recall</b>
<b>UC3a – EMSO Azores</b>	annotated by citizens	padding, bounding box corrections, <b>addressing redundancy</b>	unbalanced dataset, focused on <b>two specific species</b>	YOLOv8	<b>precision, recall</b> , mAP50-95
<b>UC3s – Smartbay</b>	annotated by CVAT	<b>augmentation</b> (roboflow noise and contrast)	different sediment types, larger training datasets and <b>more classes</b>	YOLOv8, DOVER VQA	mAP50-95
<b>UC4 – Oil spill detection</b>	proprietary method developed by Orbital EOS	weight-loss	false positives, almost 98% of pixels are not real oil spills	Bayesian optimization	Fractions Skills Score
<b>UC5 – Flowcam plankton identification</b>	in-house developed labeling tool	<b>augmentation</b>	unbalanced dataset, <b>resampling</b>	CNN based on an Xception architecture	<b>precision, recall, F1 score</b>
<b>UC6 – Underwater Noise Identification</b>		window size, <b>features extraction</b> ,	data from <b>different locations</b> and dates during one year	Contrastive Language-Audio model based on the CLAP model	RMSE
<b>UC7 – Shoreline extraction, Beach monitoring</b>	CVAT, in-house tool written in R	label format adaptation, colour space transformation, <b>data scaling</b> , split rows, patchify, <b>augmentation</b>	unbalanced dataset, ( <b>geographic locations</b> and/or camera FOVs)	U-Net, YOLOv8,9,11-seg, Bi-LSTM	<b>accuracy, loss, precision, recall, F1 score, IoU</b>
<b>UC8 – Freshwater diatoms identification</b>	BIIGLE, LabelBox	pre-training on synthetic datasets, padding, <b>bounding box corrections</b> (resizing, rotation), <b>features extraction</b>	unbalanced dataset	YOLOv5, EfficientNet, MAPLE, SAM2	<b>accuracy</b> , Expected Calibration Error, Negative Log-Likelihood, <b>Precision-Recall curve</b>

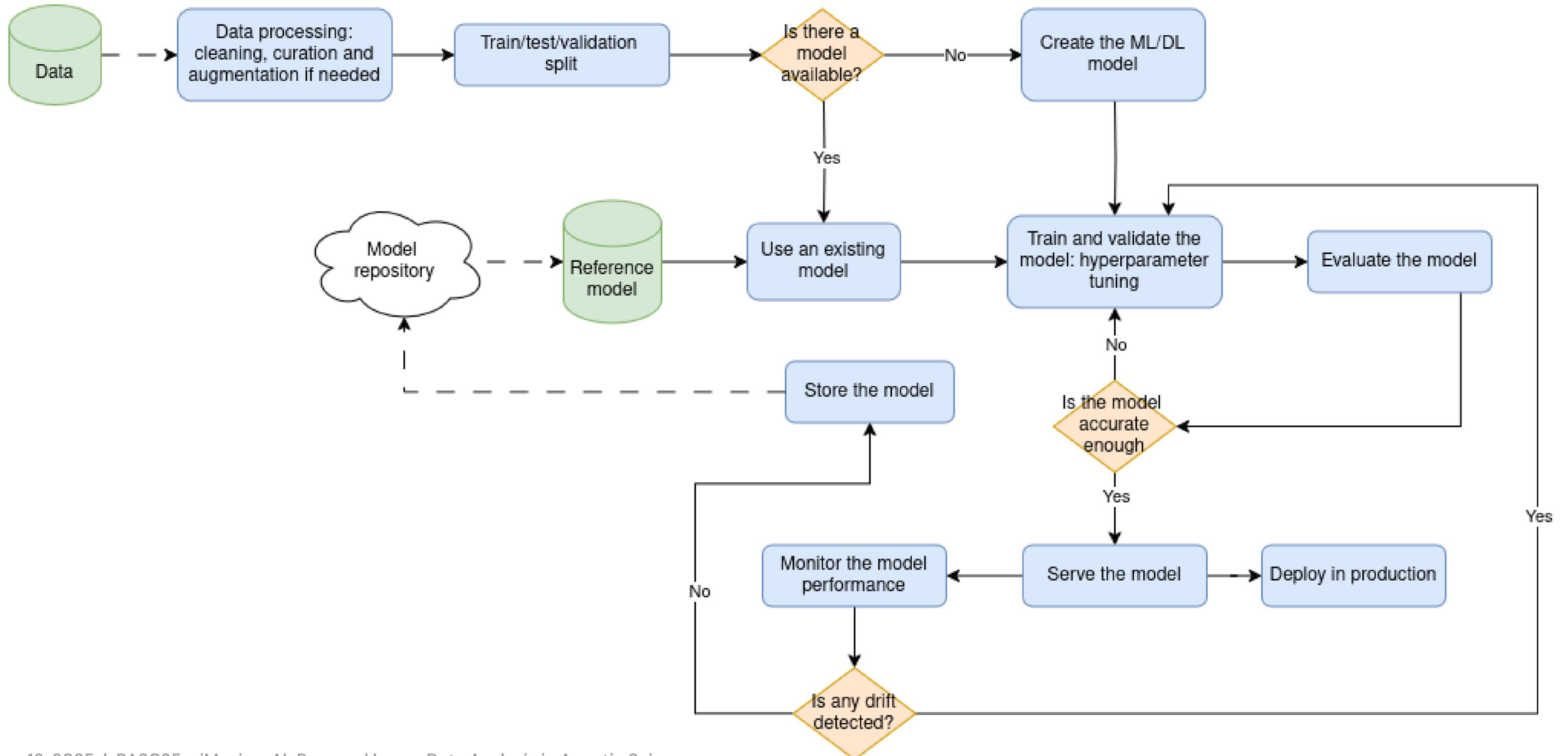
# AI4OS Architecture



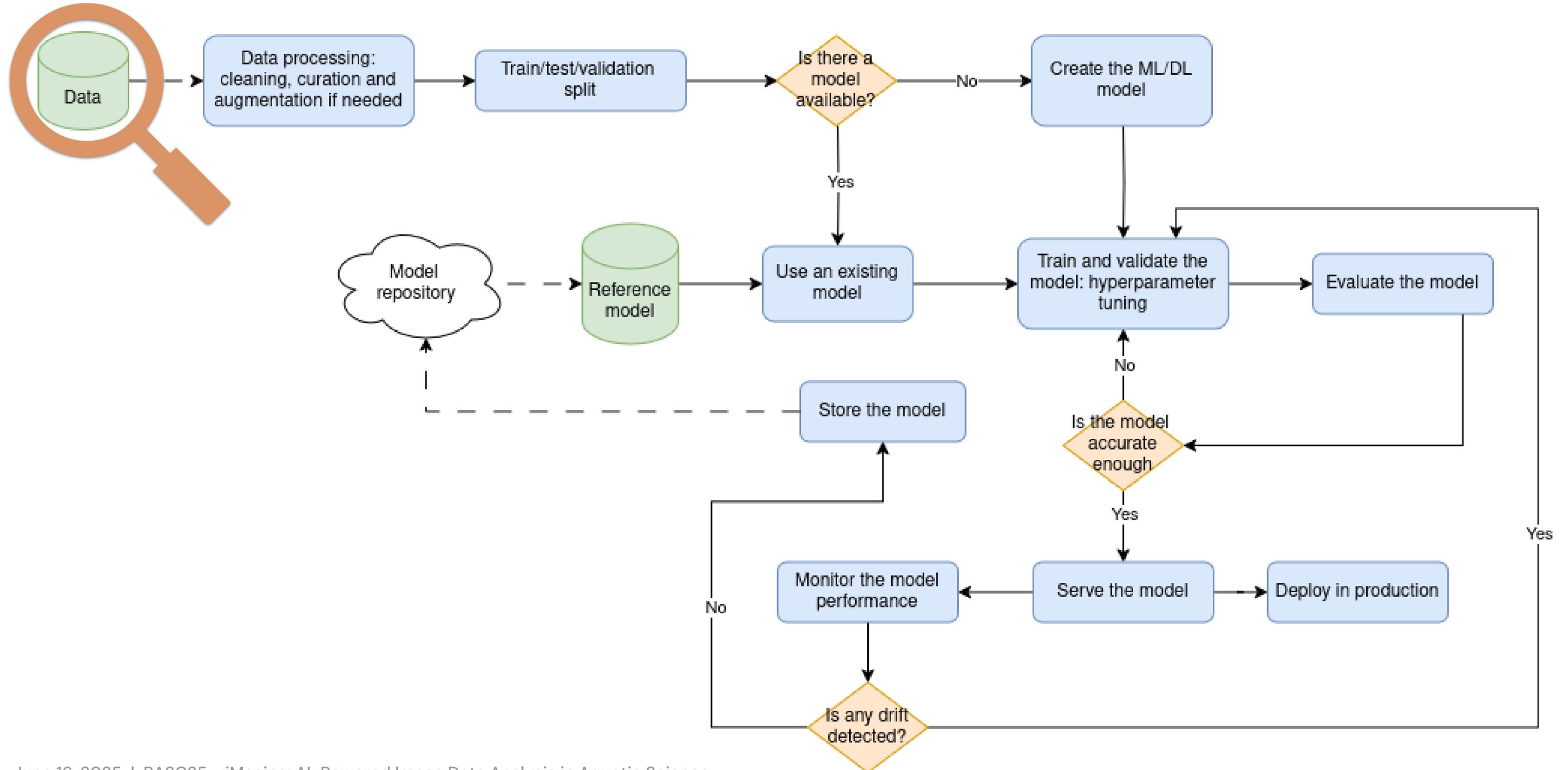
# Tools and Infrastructures



# AI/ML Application Development

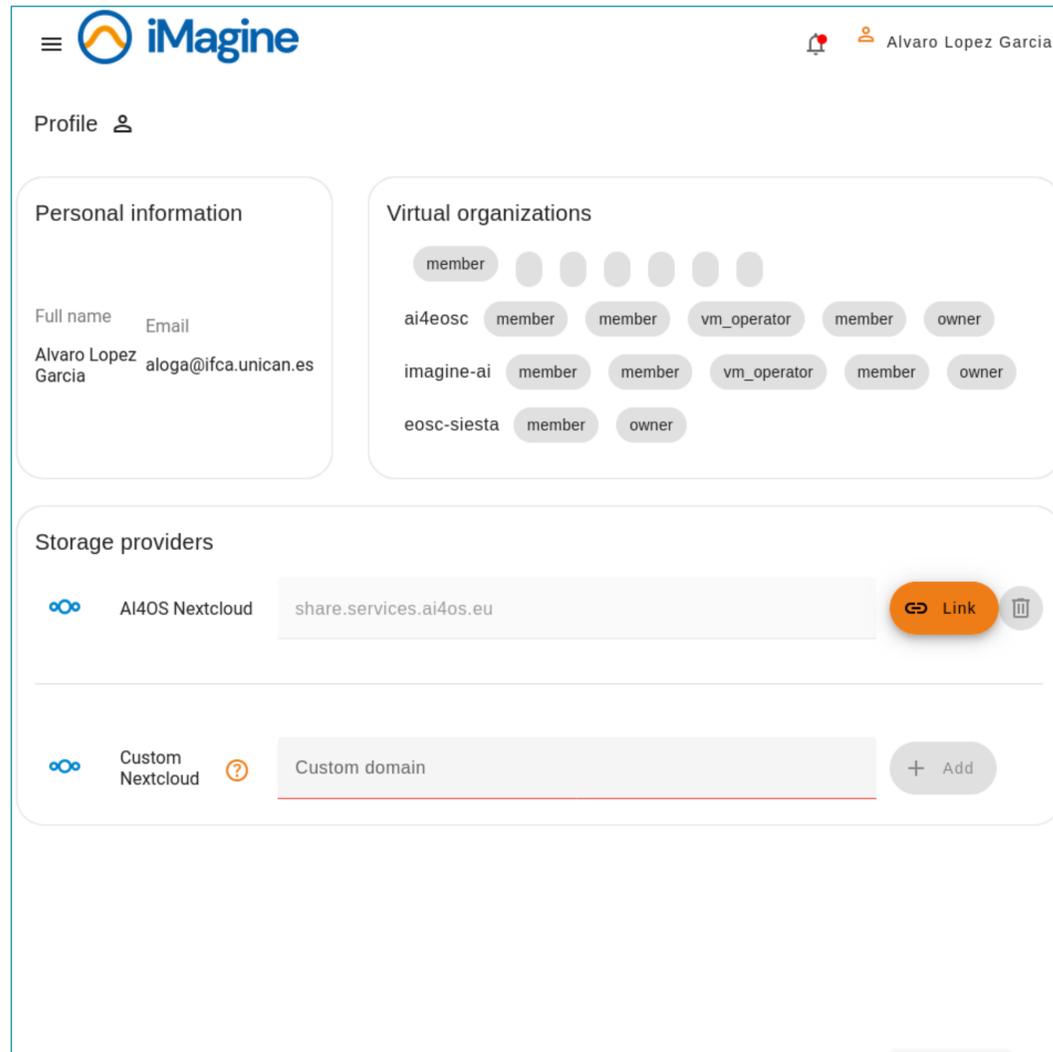


# AI/ML Application Development

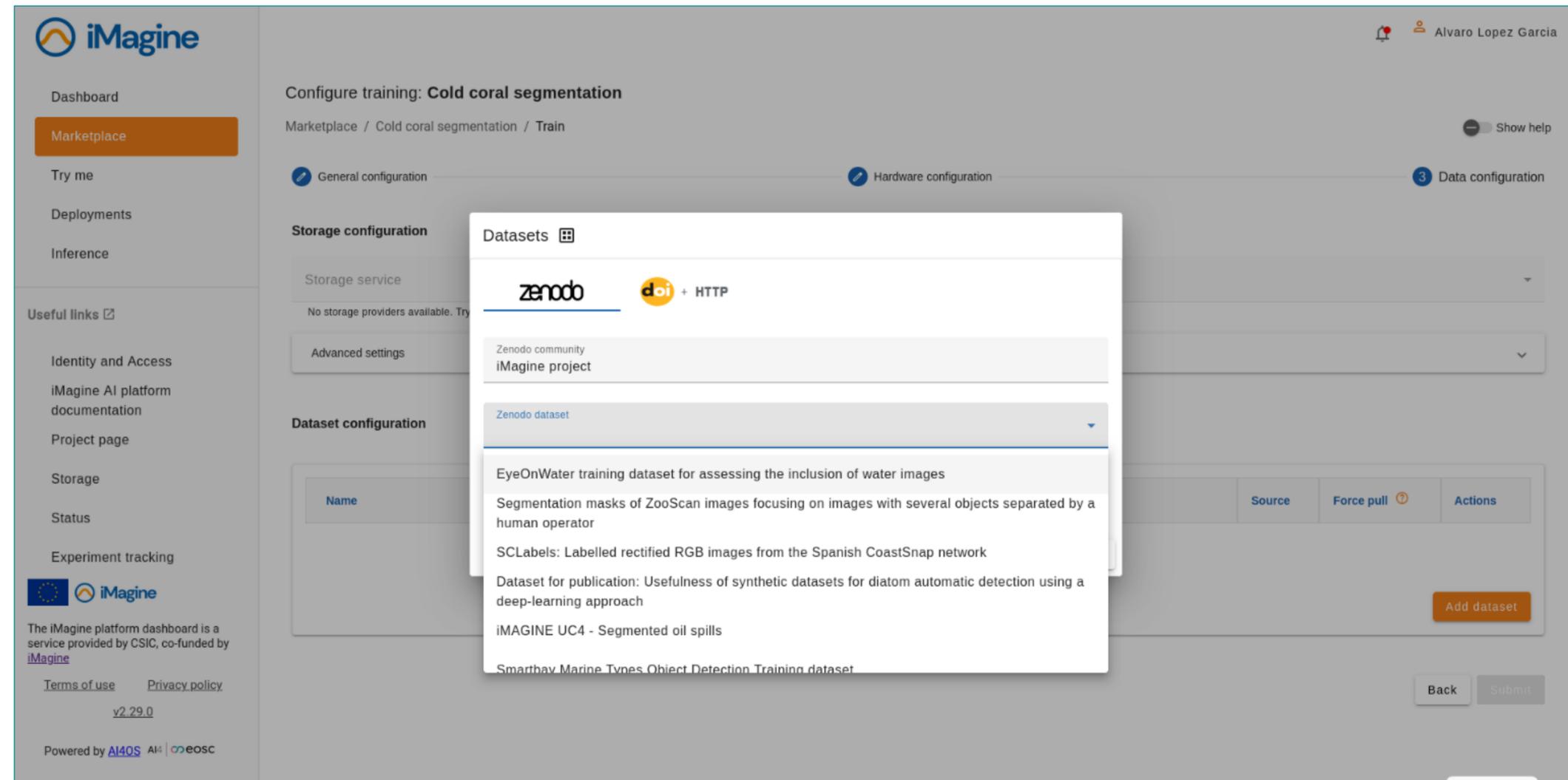


# AI-Platform Features

## Storage Services & Data Synchronization



The screenshot shows the user profile page for Alvaro Lopez Garcia. It includes sections for Personal information (Full name: Alvaro Lopez Garcia, Email: aloga@ifca.unican.es), Virtual organizations (ai4eos, imagine-ai, eosca-siesta), and Storage providers (AI4OS Nextcloud, Custom Nextcloud).

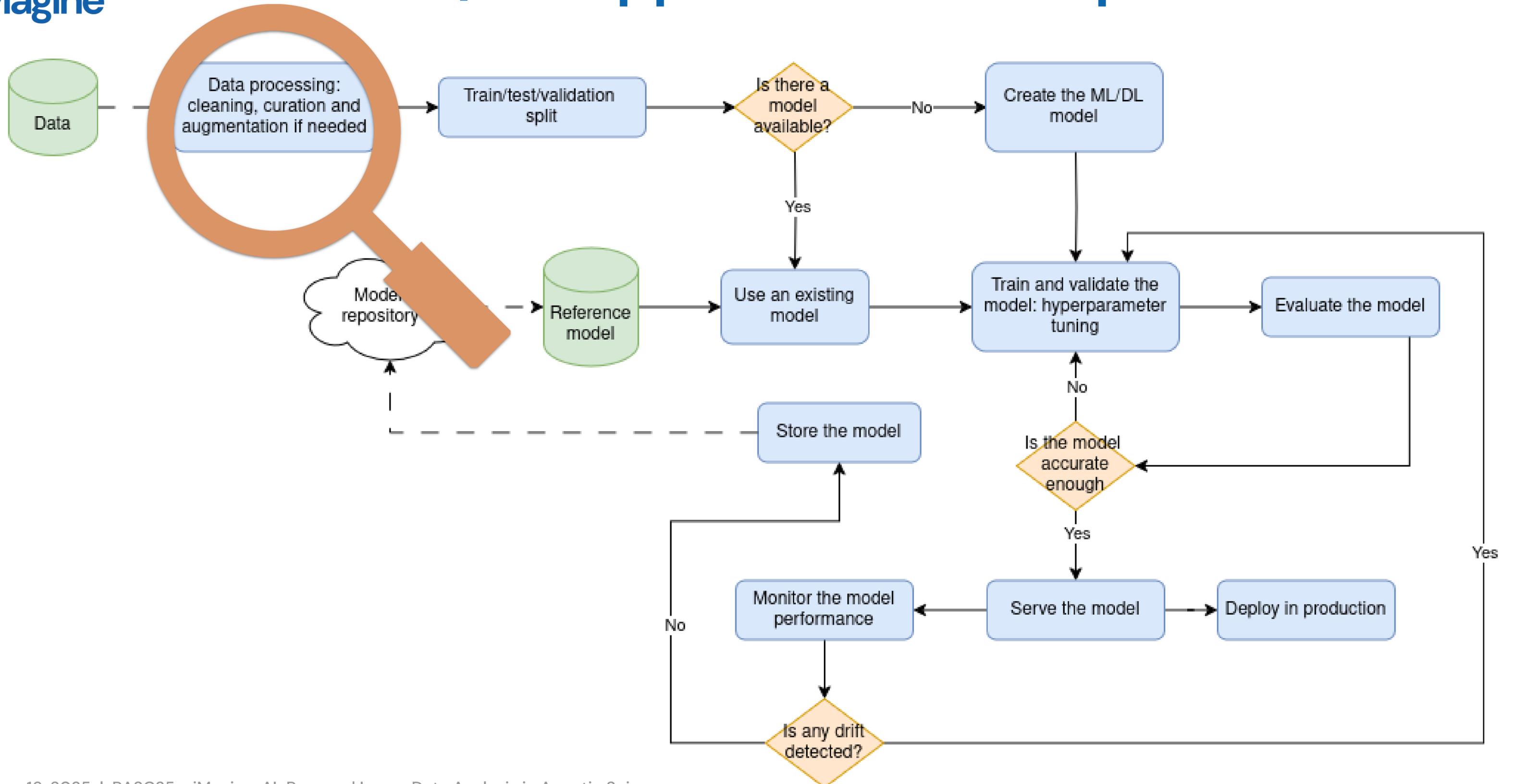


The screenshot shows the configuration page for 'Cold coral segmentation' in the 'Train' mode. A modal window titled 'Datasets' is open, displaying a list of datasets from Zenodo. The modal includes a search bar, a dropdown menu for 'Zenodo community', and a table of dataset entries with columns for Name, Source, Force pull, and Actions. The background shows the 'Storage configuration' and 'Dataset configuration' sections.

- The platform allows to link with external storage systems (currently NextCloud)
- Once linked, it allows to download and sync data from external sources (default Zenodo) via DOI
- FAIR evaluation of datasets performed via FAIR-EVA: <https://fair.dev.imagine-ai.eu/en>

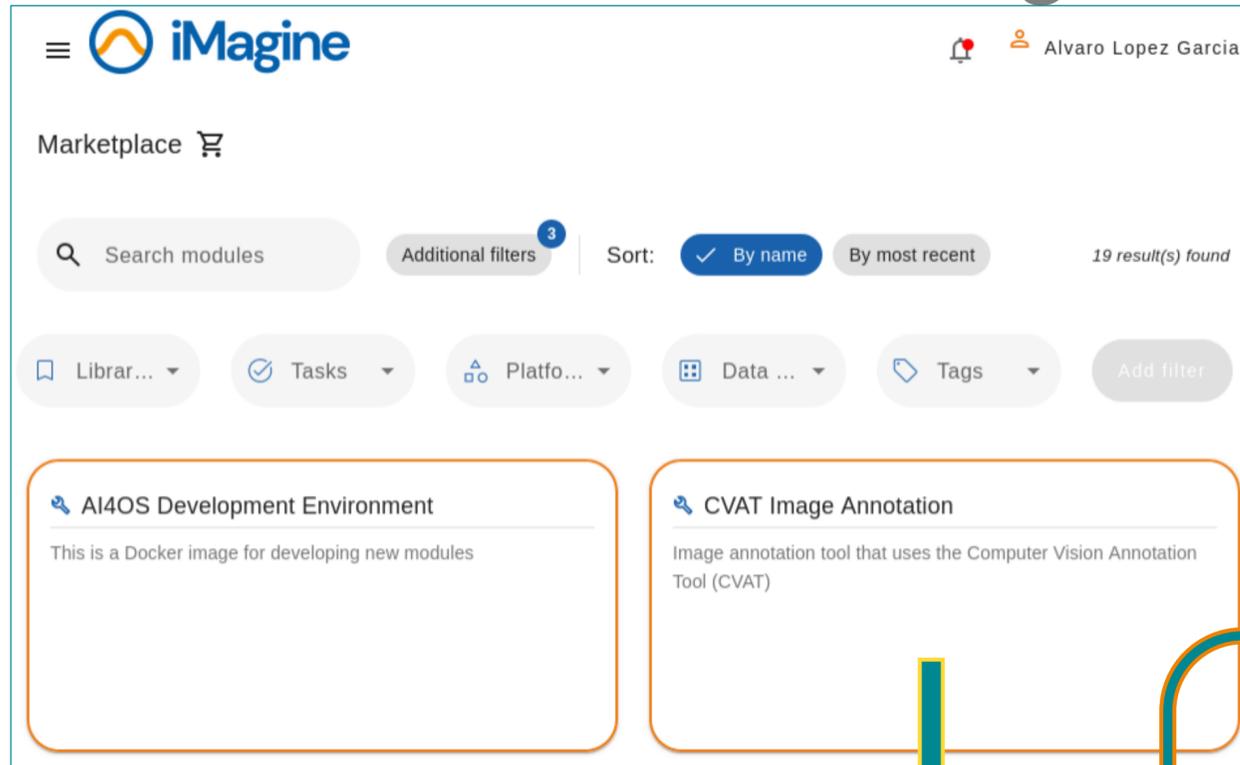


# AI/ML Application Development

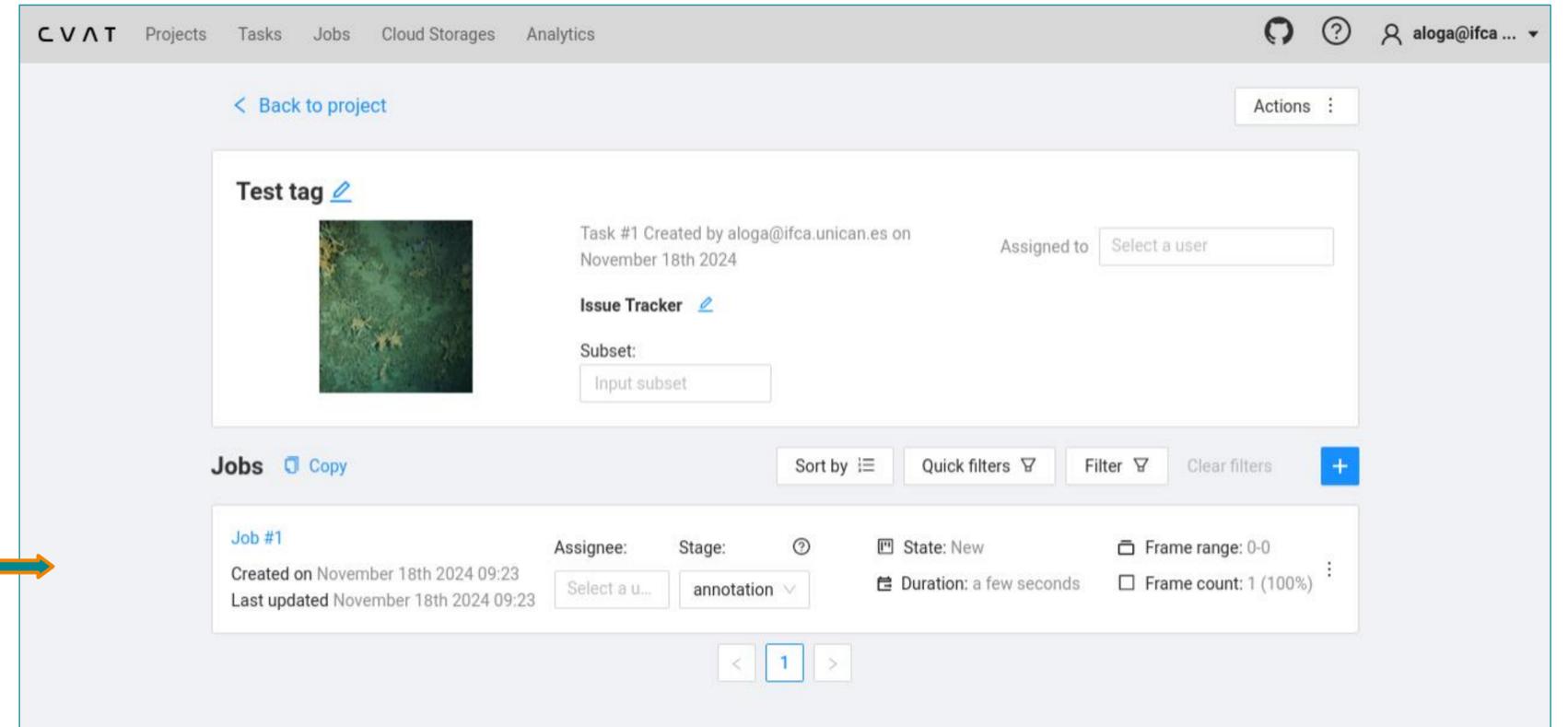


# Data Preparation

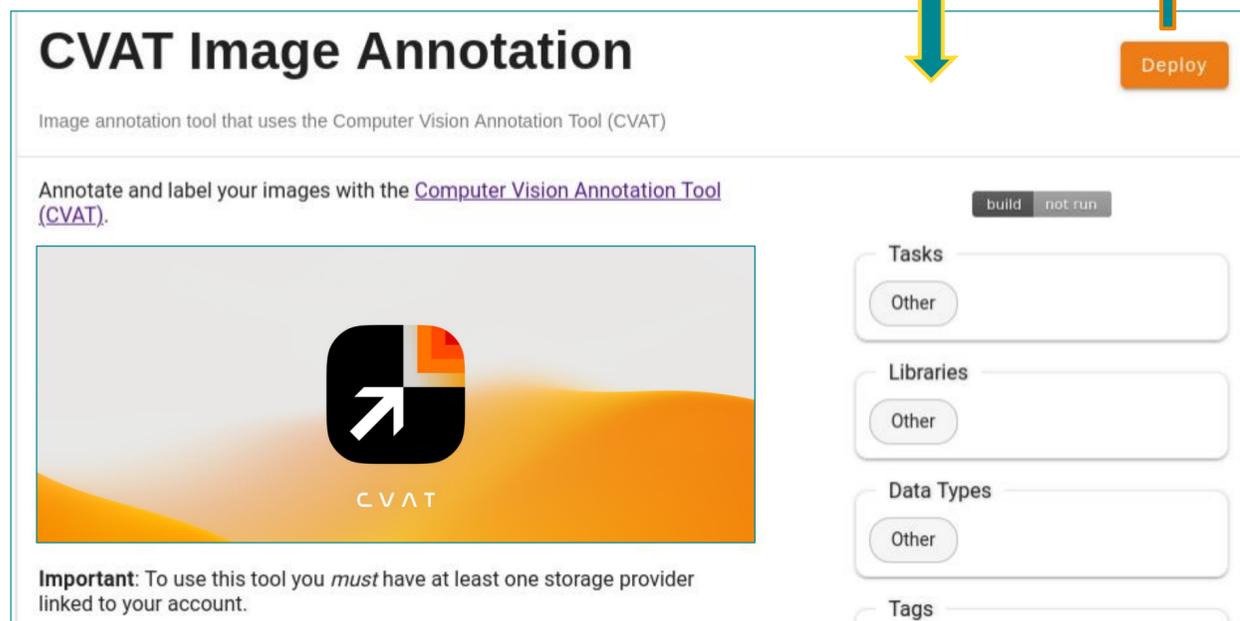
## Image Annotation Tool via Dashboard



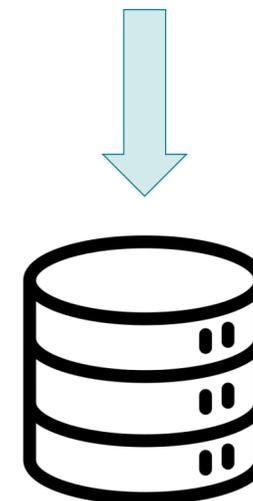
The screenshot shows the iImagine Marketplace interface. At the top, there's a search bar with 'Search modules' and 'Additional filters' (3). Below the search bar, there are navigation tabs for 'Librar...', 'Tasks', 'Platfo...', 'Data ...', and 'Tags'. The search results show two items: 'AI4OS Development Environment' and 'CVAT Image Annotation'. The 'CVAT Image Annotation' item is highlighted with an orange box and has an arrow pointing to the right.



The screenshot shows the CVAT web interface. At the top, there's a navigation bar with 'CVAT', 'Projects', 'Tasks', 'Jobs', 'Cloud Storages', and 'Analytics'. Below the navigation bar, there's a 'Back to project' link and an 'Actions' menu. The main content area shows a 'Test tag' configuration page. It includes a task configuration section with a task name, a description, and an 'Assigned to' field. Below that, there's an 'Issue Tracker' section and a 'Subset' field. At the bottom, there's a 'Jobs' section with a table of jobs. The table has columns for 'Job #1', 'Assignee', 'Stage', 'State', 'Duration', 'Frame range', and 'Frame count'.

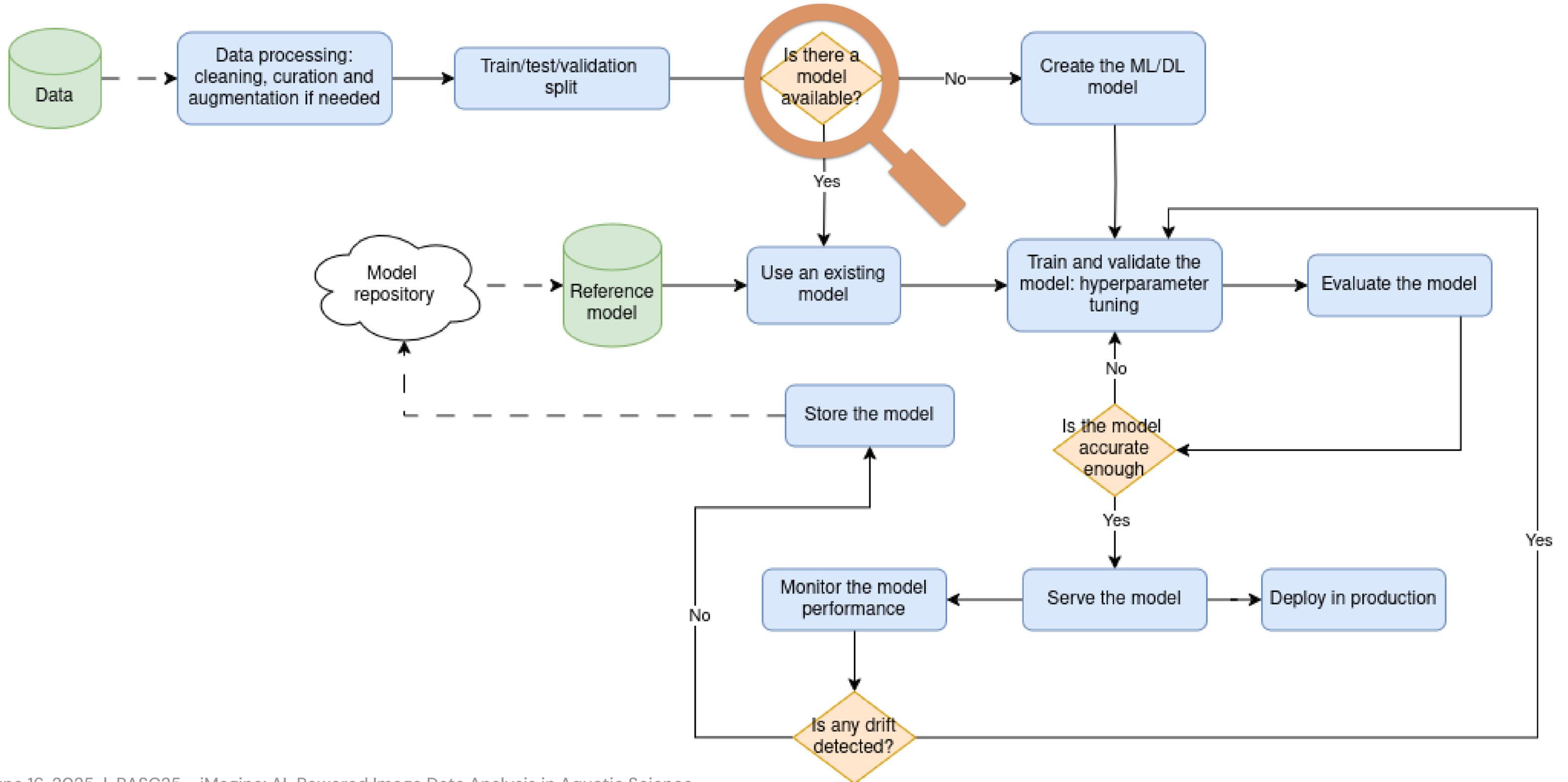


The screenshot shows the CVAT Image Annotation tool interface. At the top, there's a 'Deploy' button. Below that, there's a description of the tool and a link to the 'Computer Vision Annotation Tool (CVAT)'. The main content area shows a large image placeholder with the CVAT logo. To the right of the image, there are several input fields for 'Tasks', 'Libraries', 'Data Types', and 'Tags'. At the bottom, there's an 'Important' note: 'To use this tool you must have at least one storage provider linked to your account.'

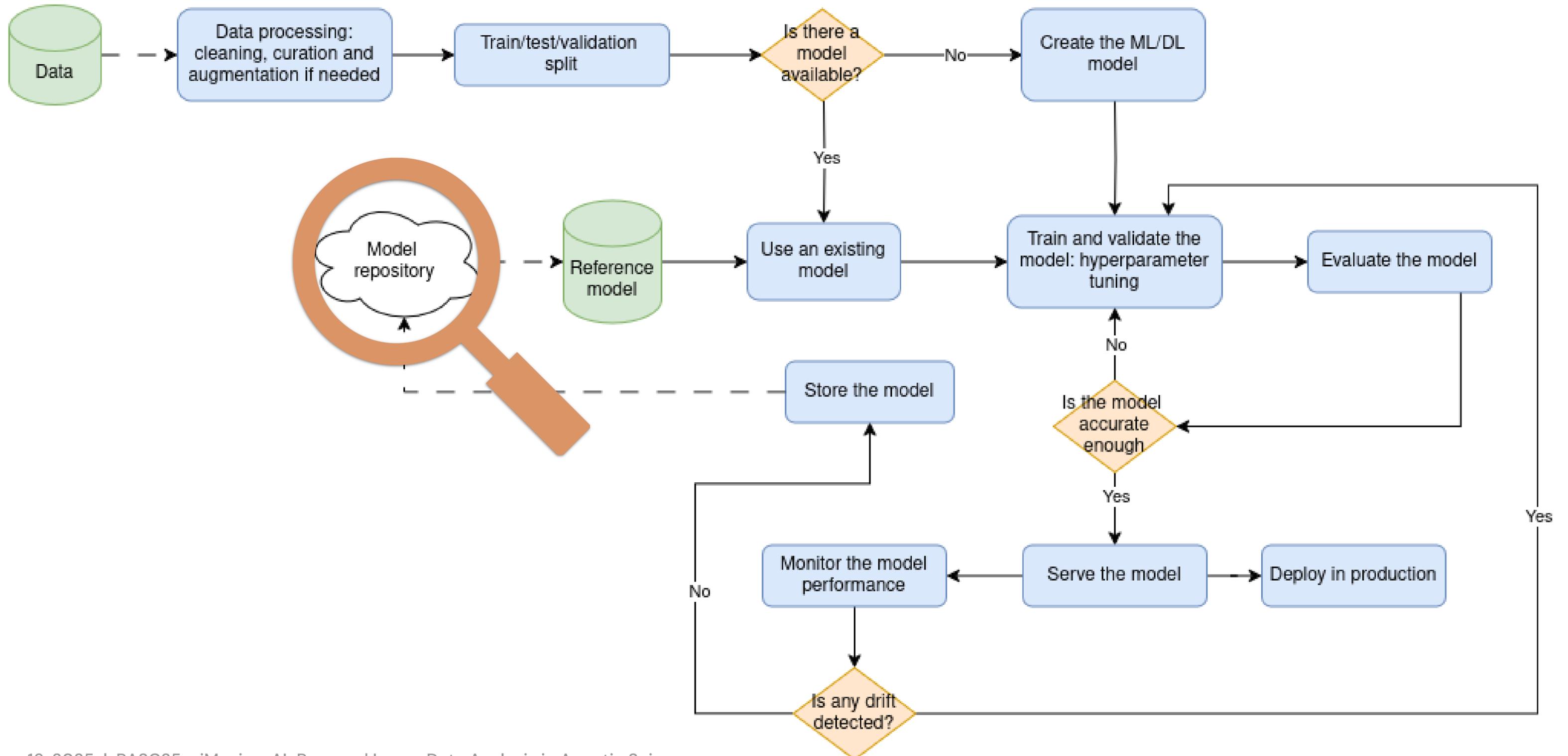


- Annotations synced with linked storage <https://share.services.ai4os.eu>
- No need to work offline and sync data with the platform

# AI/ML Application Development

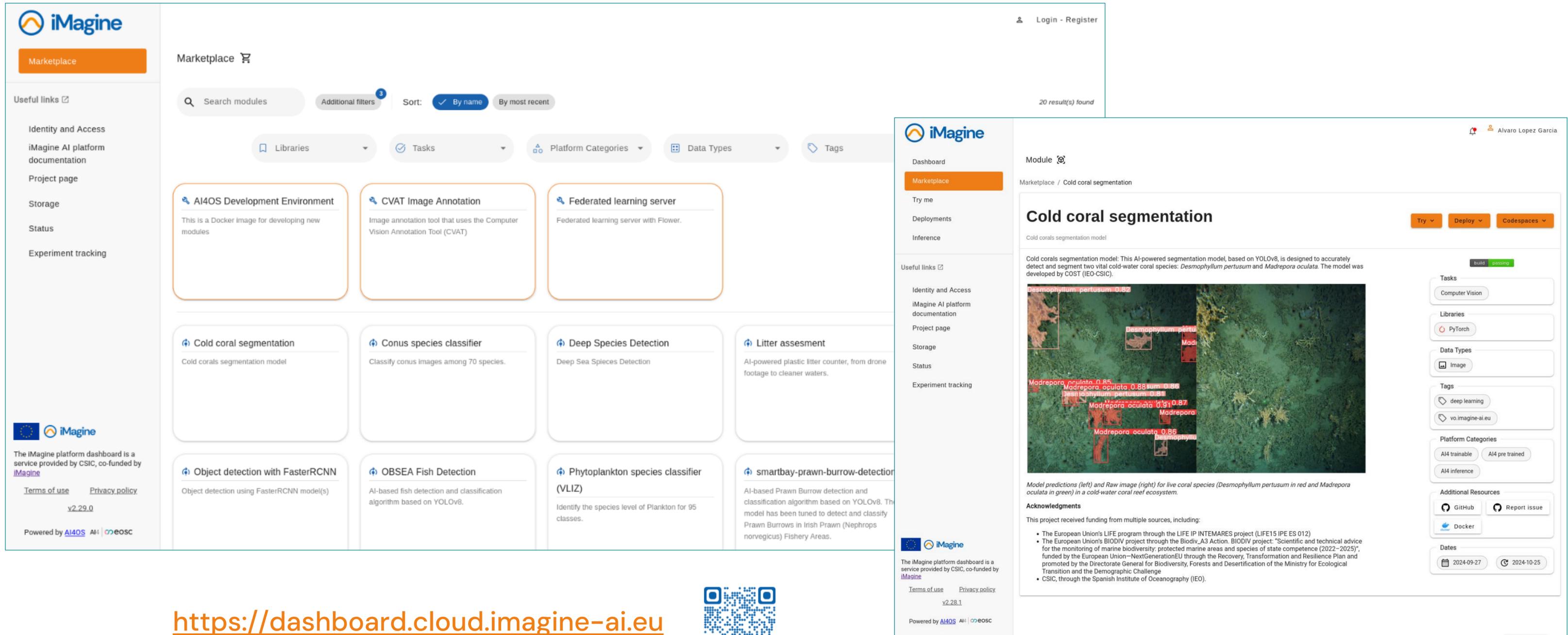


# AI/ML Application Development



# Models Available

## Dashboard & Marketplace



The image displays the iImagine dashboard and marketplace interface. The dashboard features a grid of model cards, each representing a different AI model available on the platform. The marketplace view shows a search for 'Cold coral segmentation' with a detailed view of the model, including a description, a sample image with bounding boxes, and a list of additional resources like GitHub and Docker.

**Dashboard Models:**

- AI4OS Development Environment:** This is a Docker image for developing new modules.
- CVAT Image Annotation:** Image annotation tool that uses the Computer Vision Annotation Tool (CVAT).
- Federated learning server:** Federated learning server with Flower.
- Cold coral segmentation:** Cold corals segmentation model.
- Conus species classifier:** Classify conus images among 70 species.
- Deep Species Detection:** Deep Sea Species Detection.
- Litter assesment:** AI-powered plastic litter counter, from drone footage to cleaner waters.
- Object detection with FasterRCNN:** Object detection using FasterRCNN model(s).
- OBSEA Fish Detection:** AI-based fish detection and classification algorithm based on YOLOv8.
- Phytoplankton species classifier (VLIZ):** Identify the species level of Plankton for 95 classes.
- smartbay-prawn-burrow-detection:** AI-based Prawn Burrow detection and classification algorithm based on YOLOv8. The model has been tuned to detect and classify Prawn Burrows in Irish Prawn (Nephrops norvegicus) Fishery Areas.

**Marketplace View: Cold coral segmentation**

**Module:** Cold coral segmentation

**Try** **Deploy** **Codespaces**

**Tasks:** Computer Vision

**Libraries:** PyTorch

**Data Types:** Image

**Tags:** deep learning, vo.imagine-ai.eu

**Platform Categories:** AI4 trainable, AI4 pre trained, AI4 inference

**Additional Resources:** GitHub, Report issue, Docker

**Dates:** 2024-09-27, 2024-10-25

**Acknowledgments:** This project received funding from multiple sources, including:

- The European Union's LIFE program through the LIFE IP INTEMARES project (LIFE15 IPE ES 012)
- The European Union's BIODIV project through the Biodiv\_A3 Action. BIODIV project: "Scientific and technical advice for the monitoring of marine biodiversity: protected marine areas and species of state competence (2022-2025)", funded by the European Union—NextGenerationEU through the Recovery, Transformation and Resilience Plan and promoted by the Directorate General for Biodiversity, Forests and Desertification of the Ministry for Ecological Transition and the Demographic Challenge
- CSIC, through the Spanish Institute of Oceanography (IEO).

<https://dashboard.cloud.imagine-ai.eu>





# Model Deployment & Serving

## Dashboard for Model Management

**Cold coral segmentation**

Try Deploy Codespaces

**User Interface**  
Create a short 10min deployment using Gradio

Cold corals segmentation model: This AI-powered segmentation model, based on YOLOv8, is designed to accurately detect and segment two vital cold-water coral species: *Desmophyllum pertusum* and *Madrepora oculata*. The model was developed by COST (IEO-CSIC).

Model predictions (left) and Raw image (right) for live coral species (*Desmophyllum pertusum* in red and *Madrepora oculata* in green) in a cold-water coral reef ecosystem.

**Acknowledgments**

This project received funding from multiple sources, including:

- The European Union's LIFE program through the LIFE IP INTEMARES project (LIFE15 IPE ES 012)
- The European Union's BIODIV project through the Biodiv-4E Action

application/json application/pdf image/png video/mp4

### cold\_coral\_segmentation

This is a temporary deployment that will automatically delete itself after 10 minutes. To access more permanent inference options, [become a member of one of the supported projects](#). Take into account that this deployment runs on *limited resources*, therefore some resource-intensive functionalities (like processing videos or very big images) might not work as expected.

files

model-predictions.png 468.5 KB ↓

Input an image or Video. accepted image formats: .bmo, .dng, .jpg, .jpeg, .mpo, .png, .tif, .tiff, .pfm, and .webp. accepted video formats: .asf, .avi, .gif, .m4v, .mkv, .mov, .mp4, .mpeg, .mpg, .ts, .wmv, .webm

model

The timestamp inside the 'models' directory indicates the time when you saved your trained model. The directory structure should resemble 'models/your\_timestamp/weights/best.pt'. To see the available timestamp, please run the `get_metadata` function and check `model_local`. If not provided, either a model from the MLflow registry will be loaded (if `mlflow_fetch=true`) or the pre-trained default model will be loaded depending on the task type.

yolov8\_corals\_large

Load a model from your MLflow model registry. Please set the `MLFLOW_MODEL_NAME` in the `yolov8_api/config.py` file to be loaded for prediction. Make sure you have passed the environment variables related to your MLflow (See readme).

mlflow\_fetch

task\_type

The type of task for load the pretrained model: "det" for object detection model "seg" for object segmentation model "cls" for object classification model "obb" for oriented bounding boxes object detection The default is "det"

seg

output

Desmophyllum pertusum 0.71

Desmophyllum pertusum 0.92

Madrepora oculata 0.88

Madrepora oculata 0.89

Desmophyllum pertusum 0.83

Madrepora oculata 0.94

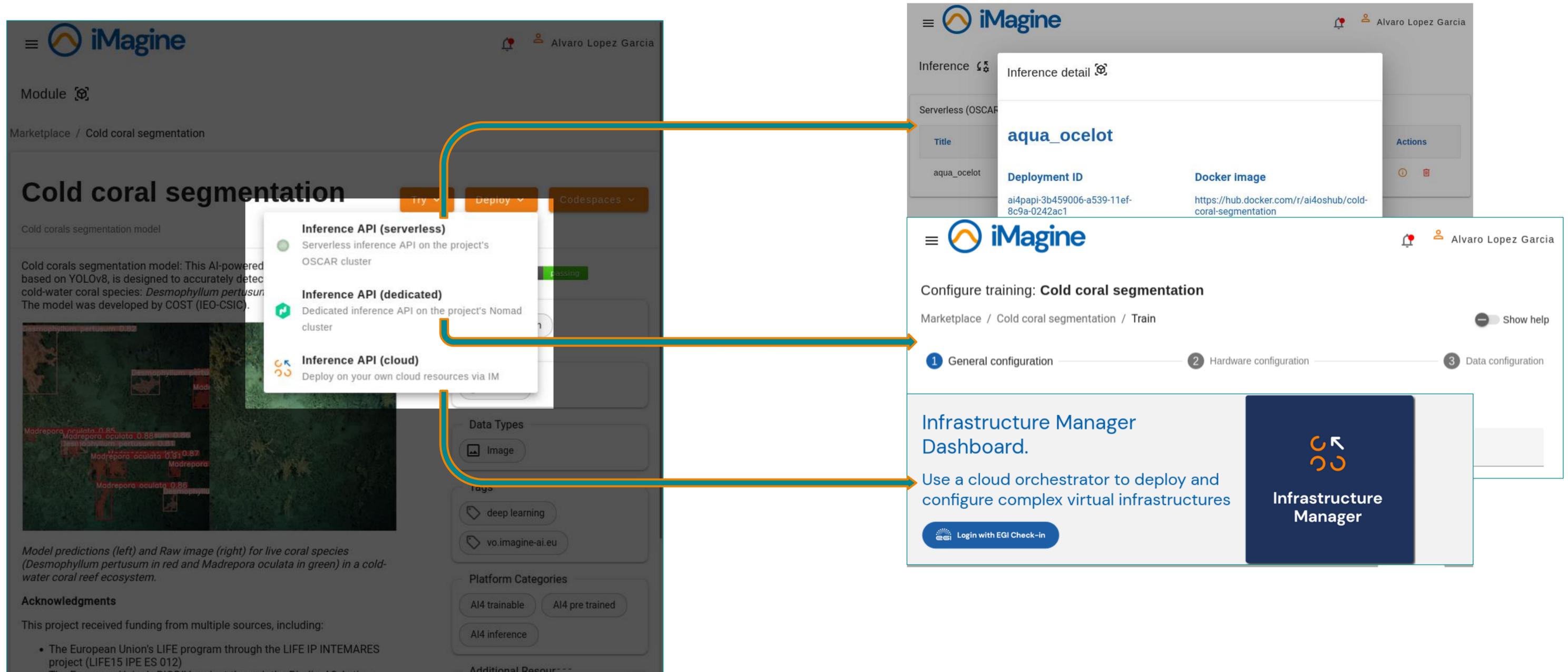
Madrepora oculata 0.89

Madrepora oculata 0.86

Flag

# Model Deployment & Serving

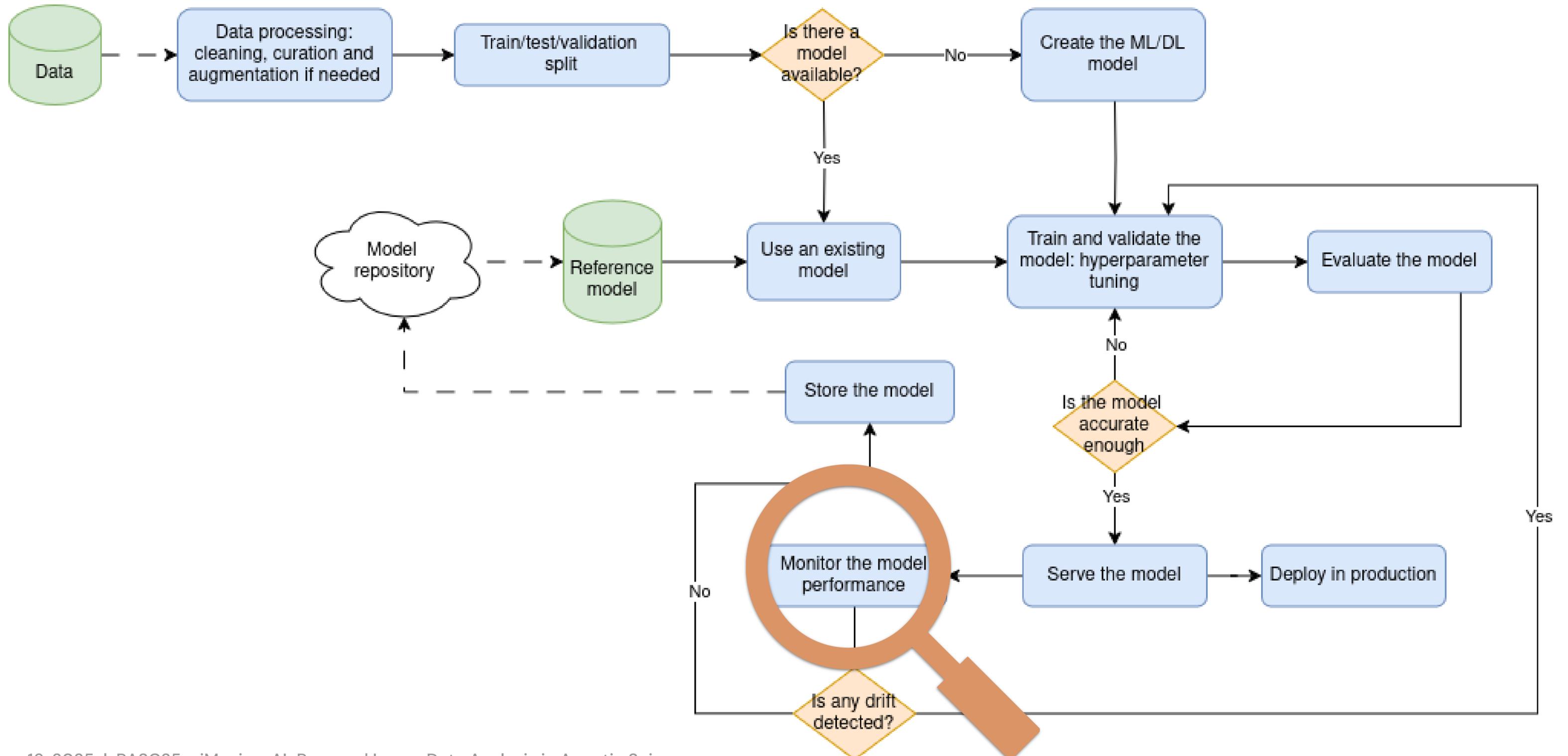
## *Dashboard for Model Management*



The image illustrates the iImagine dashboard for model deployment and serving. It is divided into several key sections:

- Main Dashboard (Left):** Shows the 'Cold coral segmentation' model page. It includes a 'Deploy' button and a modal for selecting deployment options:
  - Inference API (serverless):** Serverless inference API on the project's OSCAR cluster.
  - Inference API (dedicated):** Dedicated inference API on the project's Nomad cluster.
  - Inference API (cloud):** Deploy on your own cloud resources via IM.
- Inference Detail (Top Right):** A popup window showing details for the 'aqua\_ocelot' deployment, including its title, deployment ID (ai4papi-3b459006-a539-11ef-8c9a-0242ac1), and Docker image (https://hub.docker.com/r/ai4oshub/cold-coral-segmentation).
- Configure Training (Bottom Right):** A page for configuring training for 'Cold coral segmentation'. It features a progress bar with three steps:
  - General configuration
  - Hardware configuration
  - Data configuration
- Infrastructure Manager (Bottom Right):** A section titled 'Infrastructure Manager Dashboard' with the text 'Use a cloud orchestrator to deploy and configure complex virtual infrastructures' and a 'Login with EGI Check-in' button.

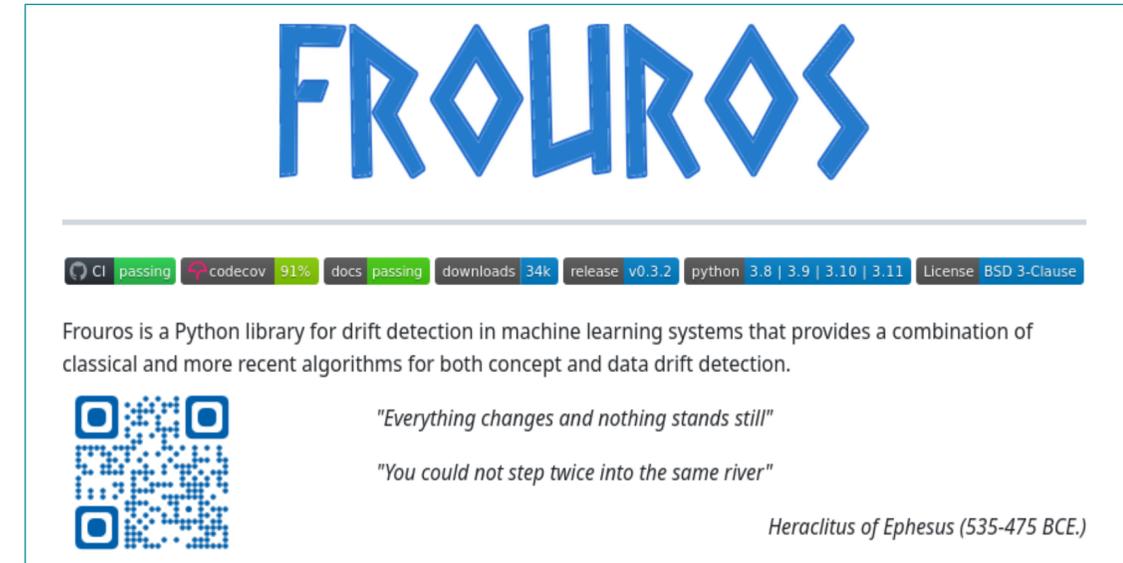
# AI/ML Application Development



# Monitoring the Model Performance

## *Drift Detection*

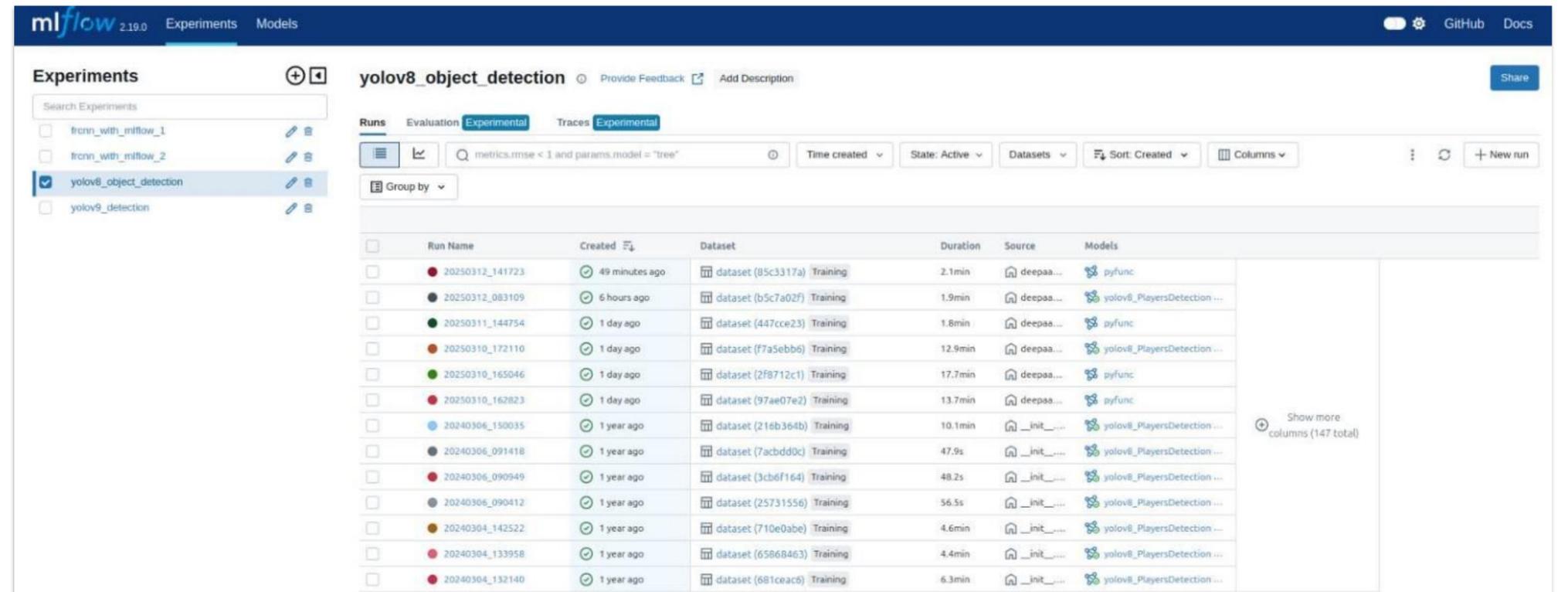
- Monitoring of models in production is not enough
  - Model learns from data, data is not stationary
  - Concept learnt by the model may change over time
- Data and concept drift detection is essential to build more robust models
- Frouros: A library for drift detection in ML
- Drift monitoring (DriftWatch): Monitor data drift change over time from multiple Drift detection libraries



# Monitoring the Model Performance

## *MLflow Experiment Tracking Tool*

- Package code into reproducible runs, and sharing and deploying models
- Track experiments to record and compare parameters and results
- Manage and deploy models from a variety of ML libraries to a variety of model serving and inference platforms



The screenshot displays the MLflow web interface for an experiment named 'yolov8\_object\_detection'. The interface includes a search bar for experiments, a list of experiment runs, and a detailed view of the runs. The runs table is as follows:

Run Name	Created	Dataset	Duration	Source	Models
20250312_141723	49 minutes ago	dataset (85c3317a) Training	2.1min	deepaa...	pyfunc
20250312_083109	6 hours ago	dataset (b5c7a02f) Training	1.9min	deepaa...	yolov8_PlayersDetection ...
20250311_144754	1 day ago	dataset (447cce23) Training	1.8min	deepaa...	pyfunc
20250310_172110	1 day ago	dataset (f7a5ebb6) Training	12.9min	deepaa...	yolov8_PlayersDetection ...
20250310_165046	1 day ago	dataset (2f8712c1) Training	17.7min	deepaa...	pyfunc
20250310_162823	1 day ago	dataset (97ae07e2) Training	13.7min	deepaa...	pyfunc
20240306_150035	1 year ago	dataset (216b364b) Training	10.1min	__init__...	yolov8_PlayersDetection ...
20240306_091418	1 year ago	dataset (7acbddd0c) Training	47.9s	__init__...	yolov8_PlayersDetection ...
20240306_090949	1 year ago	dataset (3cb6f164) Training	48.2s	__init__...	yolov8_PlayersDetection ...
20240306_090412	1 year ago	dataset (25731556) Training	56.5s	__init__...	yolov8_PlayersDetection ...
20240304_142522	1 year ago	dataset (710e0abe) Training	4.6min	__init__...	yolov8_PlayersDetection ...
20240304_133958	1 year ago	dataset (65868463) Training	4.4min	__init__...	yolov8_PlayersDetection ...
20240304_132140	1 year ago	dataset (681ceac6) Training	6.3min	__init__...	yolov8_PlayersDetection ...

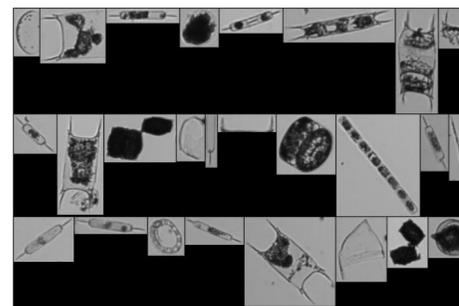
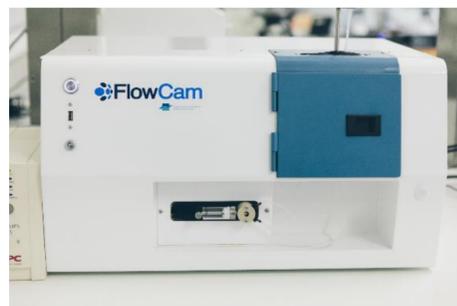
# FlowCam Phytoplankton Identification

## Case Study

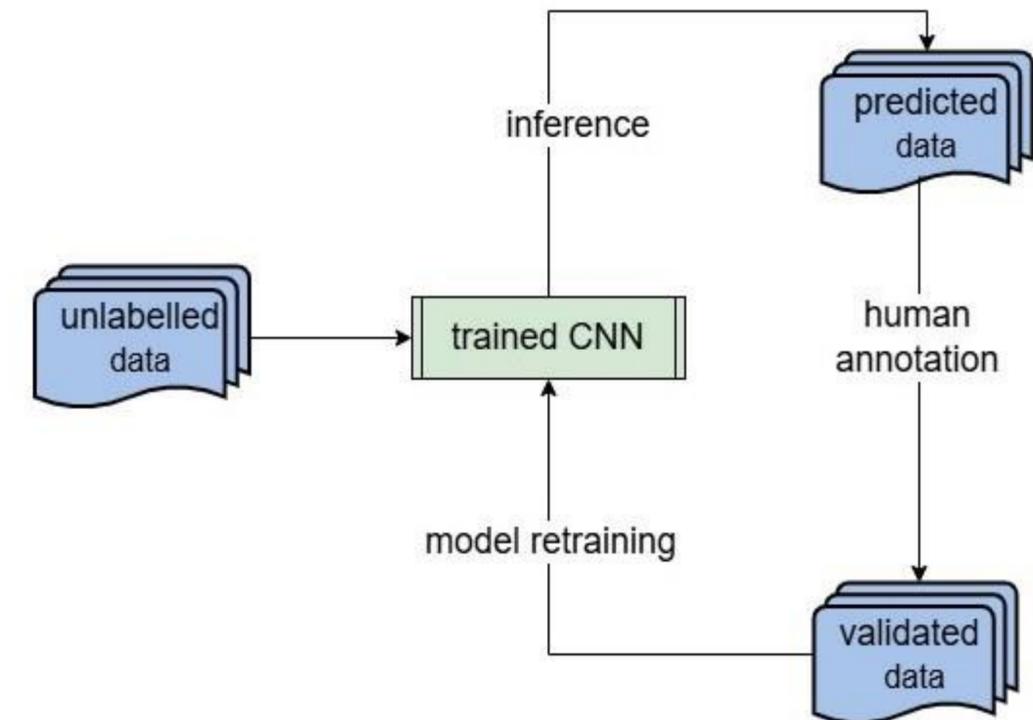
- Since 2017: monthly monitoring of phytoplankton in the Belgian North Sea
- Data acquisition using high-throughput imaging device: FlowCam



- Semi-automated pipelines to process raw output data
- Trained CNNs + Manual validation check
- + 1.2 M validated FlowCam images



- 300 – 400,000 images to be analyzed annually + Infrastructure provisioning



# FlowCam Phytoplankton Identification

## *Objectives*

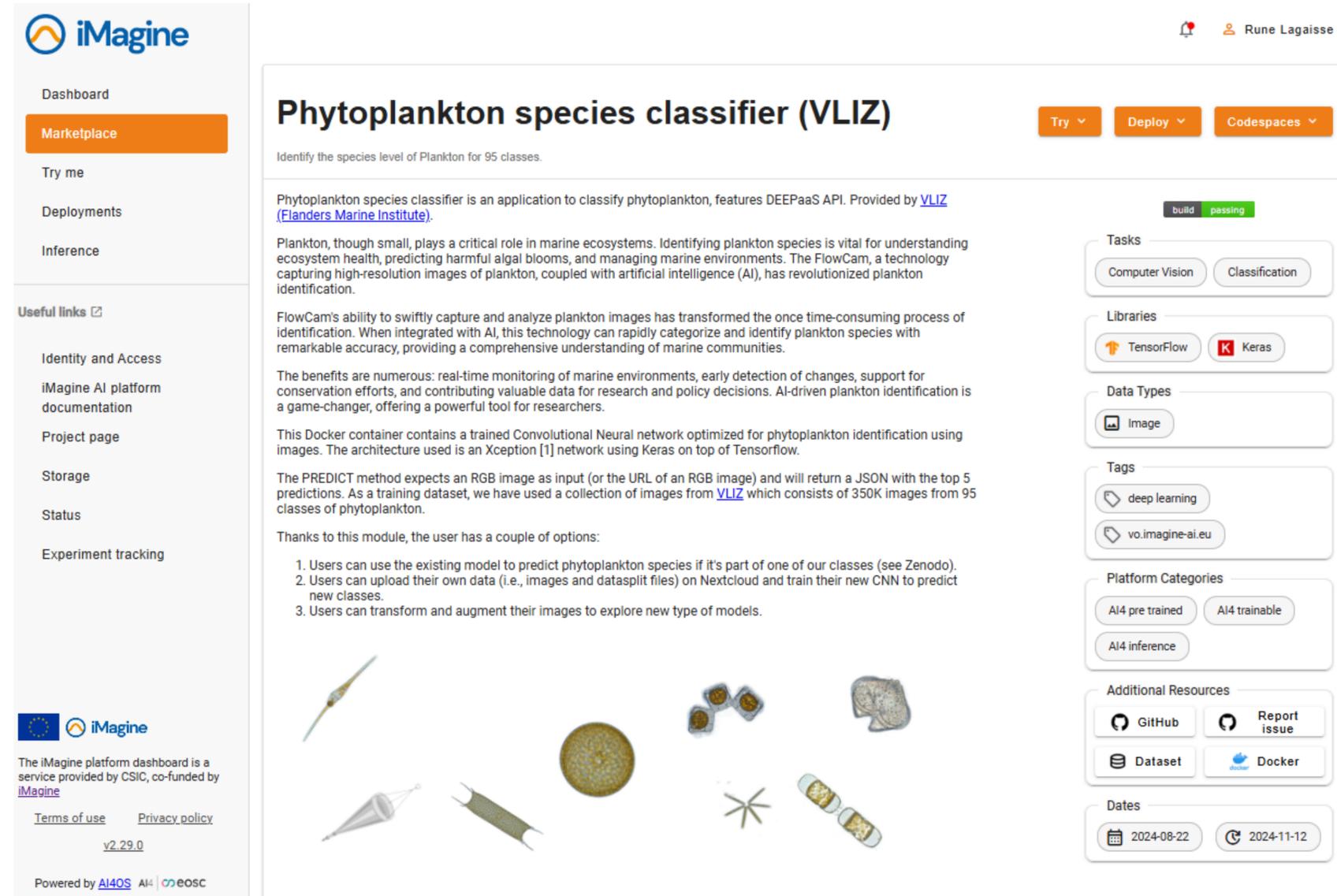


- Optimize existing pipeline from sensor to database
- Improve current metadata & data output formats towards compliance with community-based standards and vocabularies
- Improve the service to incorporate the context input and increase the classification accuracy
- Extend the training dataset by identification of additional particles currently grouped under a rest class
- Prepare the data and processing components for connection, synchronization and migration to enable access from the iImagine platform

# Experience with the iImagine Platform

## FlowCam Phytoplankton Identification Service

- User friendly
- Clear documentation and tutorials
- Efficient user support communication and follow-up
- Continuous improvement through regular updates
- Adequate storage space and computing resources for current needs



The screenshot shows the iImagine platform interface for the 'Phytoplankton species classifier (VLIZ)' service. The left sidebar contains navigation options: Dashboard, Marketplace (highlighted), Try me, Deployments, Inference, Useful links, Identity and Access, iImagine AI platform documentation, Project page, Storage, Status, and Experiment tracking. The main content area features the service title, a description of the classifier's purpose (identifying 95 classes of plankton), and details about its capabilities and benefits. It includes a list of three options for users: using the existing model, uploading their own data for training, or transforming and augmenting images. Below the text are several microscopic images of various phytoplankton species. The right sidebar shows the service's status (build passing), task categories (Computer Vision, Classification), libraries (TensorFlow, Keras), data types (Image), tags (deep learning, vo.imagine-ai.eu), platform categories (AI4 pre trained, AI4 trainable, AI4 inference), additional resources (GitHub, Report issue, Dataset, Docker), and dates (2024-08-22, 2024-11-12).

# FlowCam Phytoplankton Identification

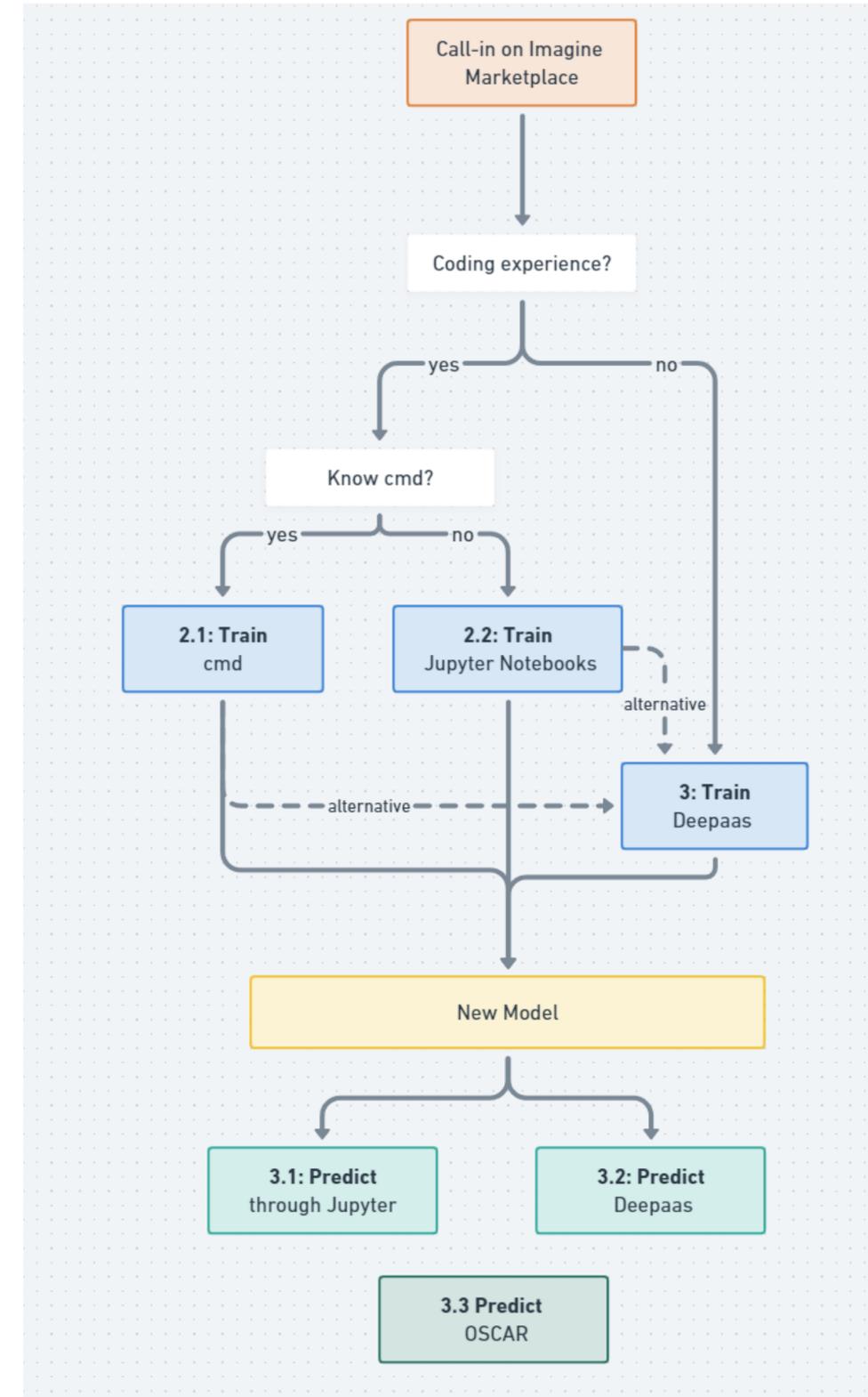
- Dashboard:

<https://dashboard.cloud.imagine-ai.eu/catalog/modules/phyto-plankton-classification>



- Webinar:

<https://www.youtube.com/watch?v=GanTZ5nbxm0>



# Summary



- Empowering aquatic scientists with IT/AI infrastructure for healthy oceans
- Ready to use labeled datasets and AI-powered image analysis services
- Open-source AI platform and models
- Generated best practices for the aquatic science community
- Collaboration between researchers, developers, and infrastructure providers



[Marketplace](#)



[Best Practices](#)



[imagine-ai.eu](https://imagine-ai.eu)



[twitter.com](https://twitter.com)



[zenodo.org](https://zenodo.org)



**iMagine**

# Thank you for your attention

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