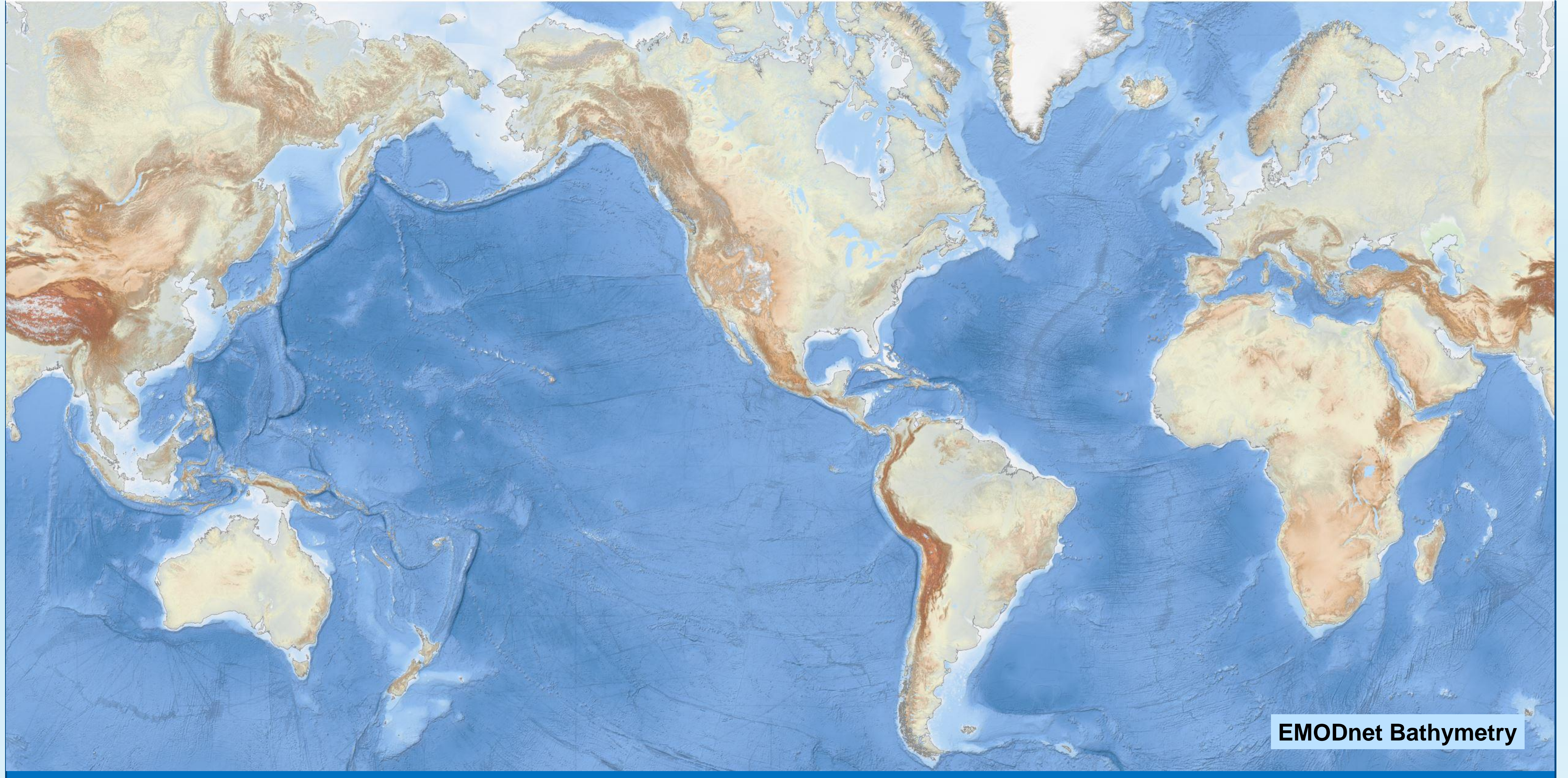EU H2020 Project – Grant Agreement number 101058625

Dick M.A. Schaap – (MARIS) iMagine project scientific director
Alvaro Lopez Garcia – (CSIC) iMagine WP4 leader

EGI 2022 Conference – 22 September 2022

1

Oceans and seas are important

EMODnet Bathymetry

Climate, Energy, Food, Tourism, Trade, Health, ….

Marine environmental management and policy making

How EU Member States develop marine strategies

Assess → Define ideal environmental state of seas → Set targets → Monitor → Identify and implement actions needed

CLEAN, HEALTHY AND PRODUCTIVE SEAS

European Commission

Source: EU MSFD website

Relevant EU Directives and initiatives for aquatic domain, such as:

- Marine Strategy Framework Directive (MSFD)
- Water Framework Directive (WFD)
- European Green Deal
- Mission Starfish 2030 "Healthy oceans, seas, coastal and inland waters"
- United Nation's 2030 Agenda for Sustainable Development
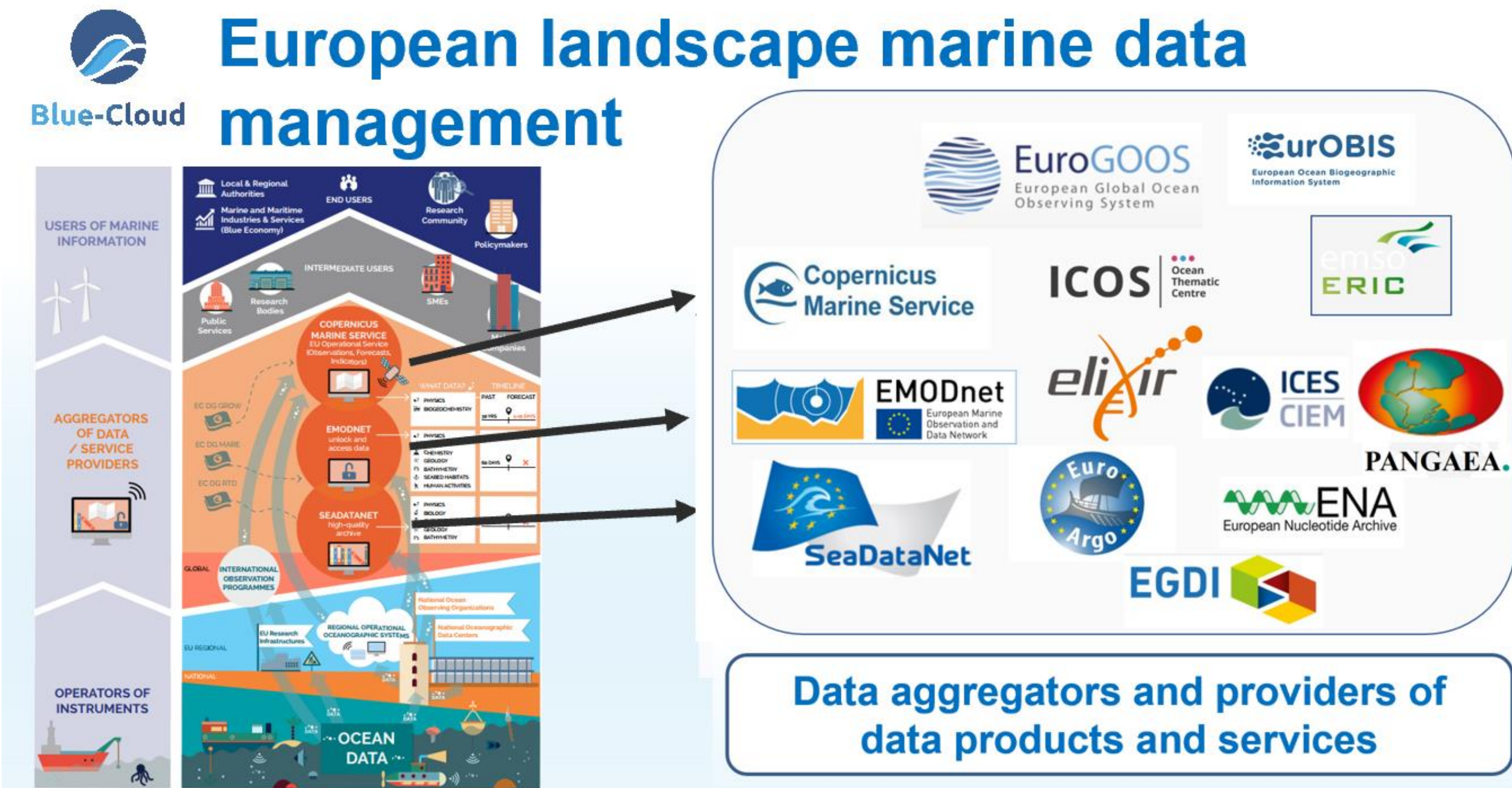- United Nation's Decade of Ocean Science (2021–2030)

Implementation requires knowledge

The implementation requires an increase of our overall knowledge, demanding more science and improved access to observation data and analytical processing.

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)

European landscape marine data management

Data aggregators and providers of data products and services

Europe already has developed an impressive capability for aquatic environmental observation, data–handling and sharing, modelling and forecasting, second to none in the world. This builds upon national environmental observation and monitoring networks and programs, complemented with EU initiatives such as the Copernicus programme (CMEMS) and EMODnet, and European Research Infrastructures (RIs).

H2O2O – iMagine project

Great additional potential in collecting and processing image data using high–performance image analysis tools, including Artificial Intelligence (AI) techniques, and in more sharing of image repositories.

OBJECTIVE:

*To deploy, operate, validate, and promote a dedicated **iMagine AI framework** and platform, connected to EOSC and AI4EU, giving researchers in **aquatic sciences** open access to a **diverse portfolio of AI based image analysis services and image repositories** from multiple RIs, working on and of relevance to the overarching theme of 'Healthy oceans, seas, coastal and inland waters.*

- From **Sept. 2022** until **Aug. 2025**
- **€4.5 million** EC funding
- **24** participants
- **Coordinator – Gergely Sipos (EGI); scientific coordinator – Dick M.A. Schaap (MARIS)**

Consortium Overview
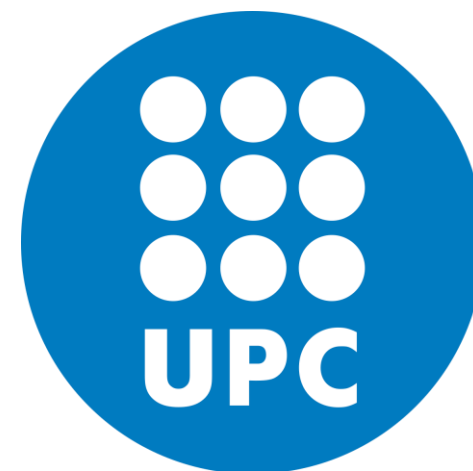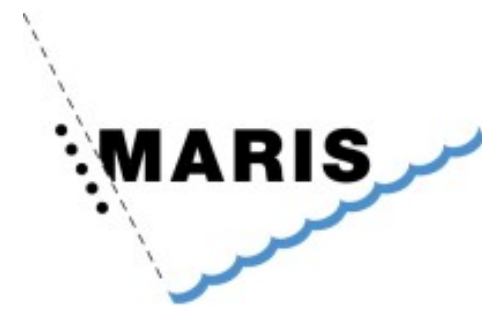
Specific Objectives and indicators

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 from TRL 7 to 9

O2

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

Launch of 5 aquatic AI image services, running operationally at 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

Set of AIS–based imaging processing services of relevance to research for healthy oceans, seas, coastal and inland waters

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

Data repositories overview

Research Infrastructures
- **LifeWatch**
- **EMBRC**
- **EcoTaxa**
- **JERICO**
- **EMSO–ERIC**
- **Obsea**
- **Antares**
- **DyFaMed**
- **PAP**
- **EuroArgo**
- **EurOBIS**
- **SeaDataNet**

EU infrastructures:
- **Copernicus Marine (CMEMS)**
- **European Marine Observation and Data network (EMODnet)**

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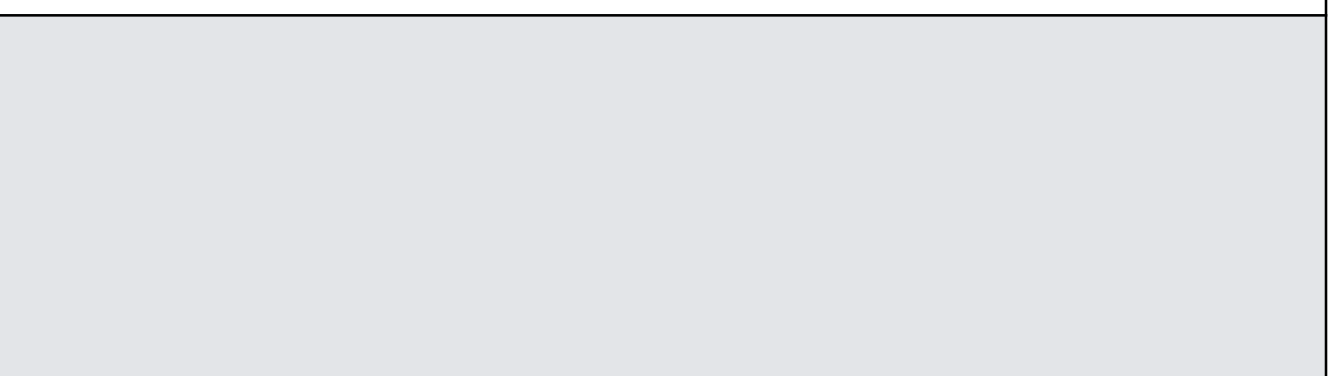
1. **A common iMagine AI framework and computing platform**, based upon earlier DEEP developments and to be built on EGI resources, connected to EOSC, facilitating researchers in development, testing, training, hosting, and operating of AI based image analysis services, following FAIR practices.

1. **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.

1. **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.

Combined with Dissemination, Exploitation & Communication strategy and activities programme, this will maximise impact.

WP structure and coordinators
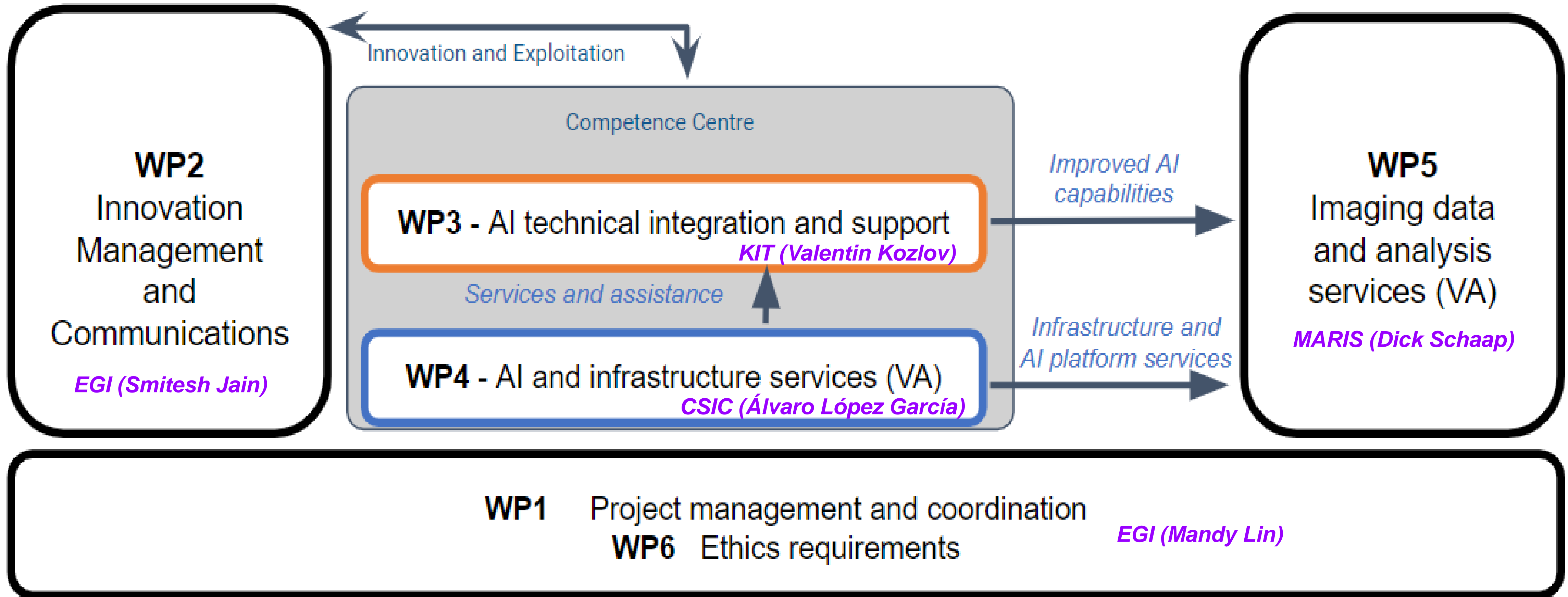
Five mature use cases

Use Case	Partners	
Aquatic Litter Drones: Aquatic Litter monitoring system using drones	**DFKI (DE)** + MARIS (NL) + OGS (IT)	
EcoTaxa pipeline: Taxonomic identification of zooplankton using Zooscan	**Sorbonne Université (LOV+IMEV) (FR)**	
Ecosystem monitoring at EMSO sites by video imagery	**EMSO ERIC (IT)** + UPC (ES) + Ifremer (FR) + MI (IE)	
Oil Spill Detection: Oil spill detection from satellite images	**CMCC (IT)** + OrbitalEOS (ES) + University of Trento (IT)	
Flowcam phytoplankton identification: Taxonomic identification of phytoplankton using Flowcam images	**VLIZ (BE)**	

Three prototype use cases

Underwater Noise Identification: Underwater noise identification from acoustic recordings using spectrograms	**VLIZ (BE)**	LifeWatch ERIC
Beach Monitoring: Posidonia oceanica berms and rip-currents detection from beach monitoring systems	**SOCIB (ES)**	JERICOs3 · EMODnet · Copernicus Marine Service
Freshwater diatoms identification: Identification of freshwater diatoms using microscopic images	**UL–LIEC (FR)** + CNRS–IRL2958 (FR) + SU–LOCEAN (FR)	LifeWatch ERIC

DEEP background

- https://deep-hybrid-datacloud.eu

- DEEP delivered **specialized cloud services** to develop, exploit and share machine learning, artificial intelligence and deep learning applications → **Service-Oriented Architectures and platforms**
  - Covering the whole machine learning application development cycle
  - Focused on all types of users and user knowledge

- Transparent **access to specialized computing resources** (accelerators, high performance computing) → **reduce entry barrier**

- Build an **EOSC machine learning marketplace** as an application exchange → **ease of use, foster collaboration, knowledge dissemination**

- **Run the same application everywhere** (laptop, cloud, HPC, etc.) → ease of use

ML/AI development cycle
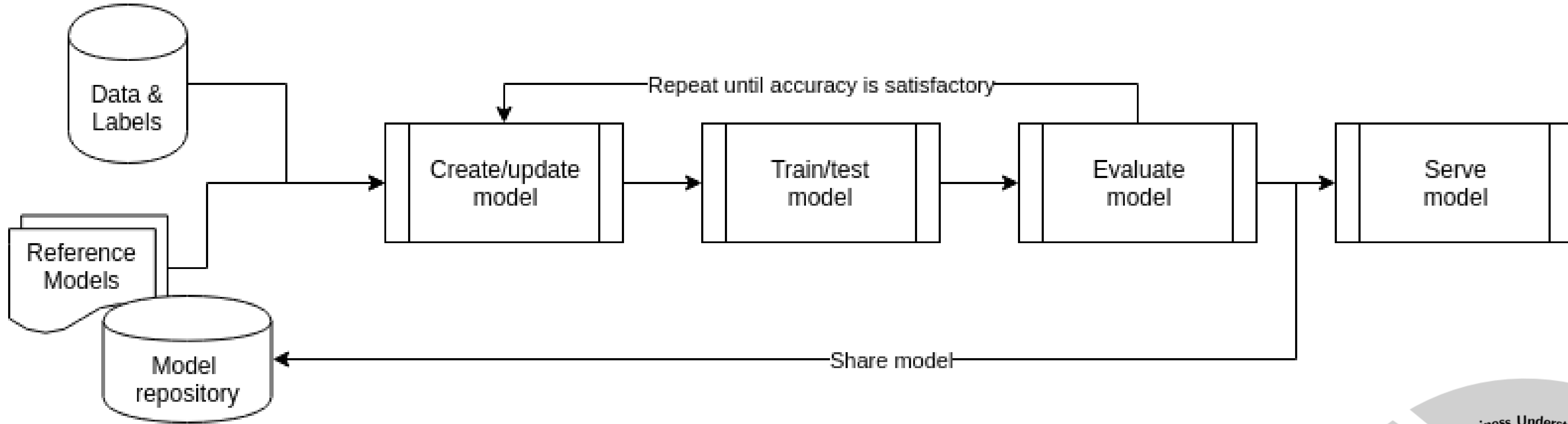
The DEEP Platform covers **all development phases** of a machine learning/artificial intelligence application:

- Creation, update, improvement of a model (existing or new)
- Model training, test, evaluation
- Model deployment as a service
- Model publication for sharing and reuse
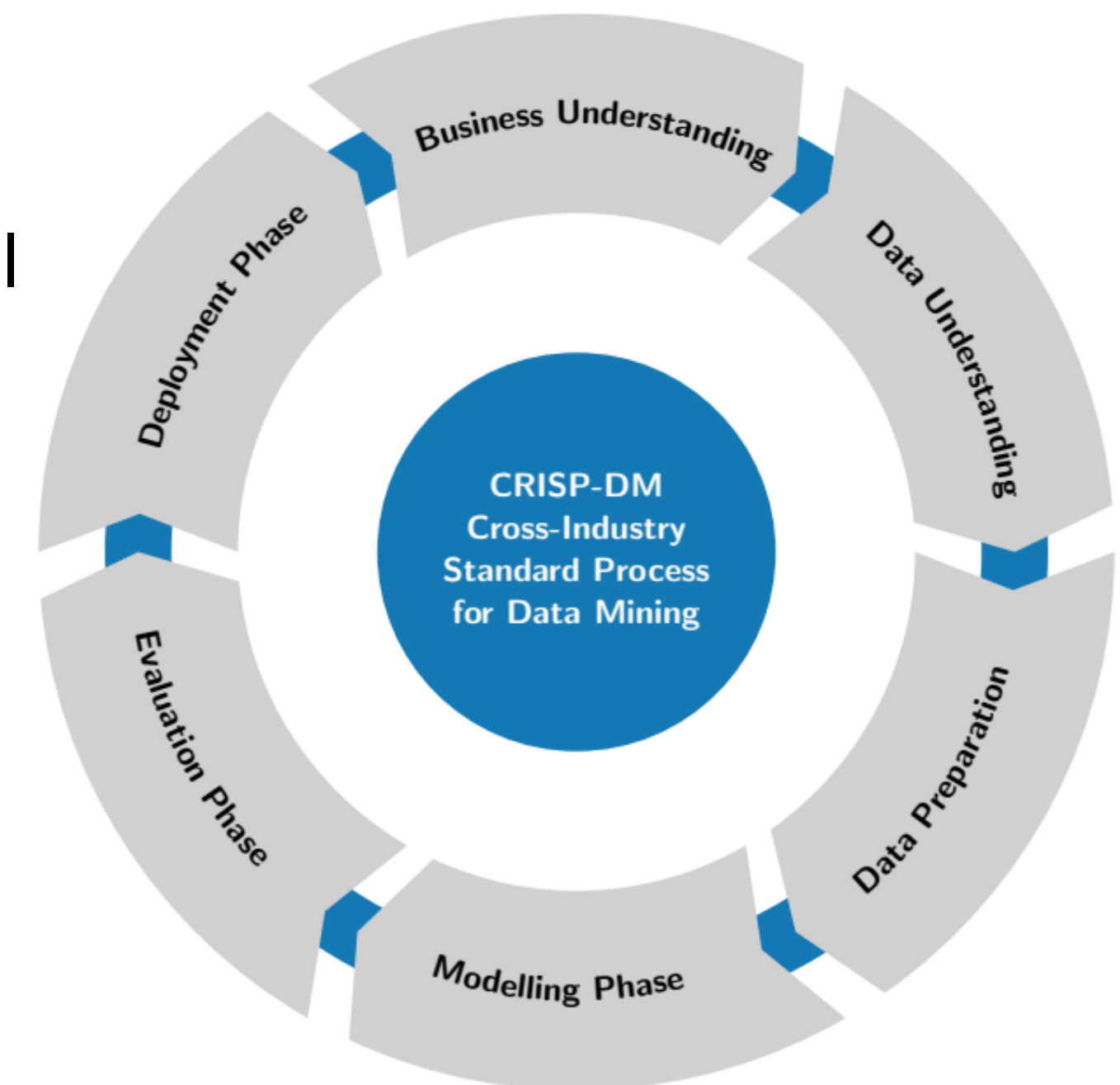
The DEEP services
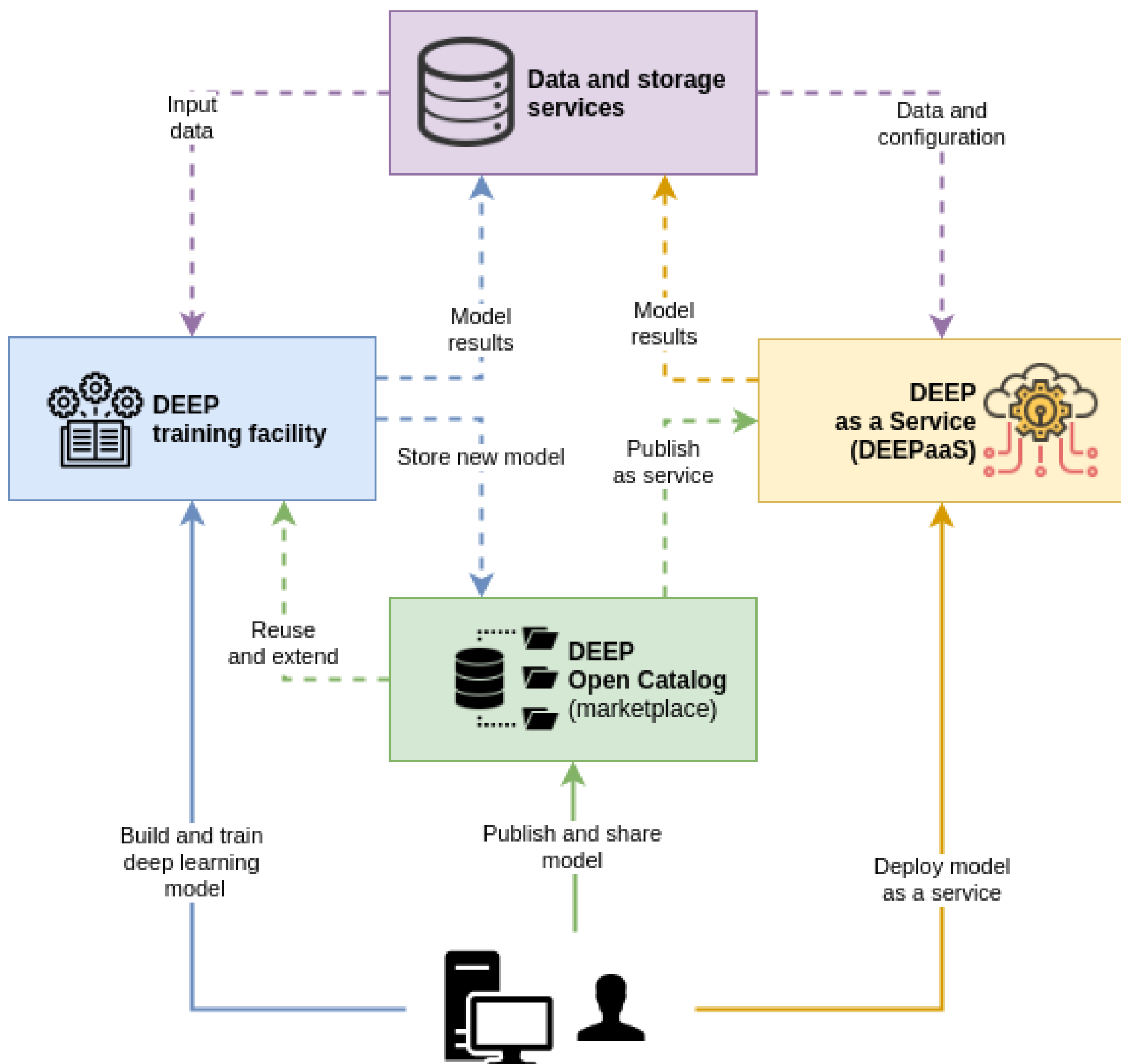
- High level specialized services for exploitation through EOSC, covering the whole model lifecycle:
  - **DEEP Open Catalog** → sharing
  - **DEEP training facility** → training
  - **DEEP as a Service** → deployment

- Accesible through the EOSC Portal:
  - https://marketplace.eosc-portal.eu/services/deepaas-training-facility

Diagram labels:
- Input data
- Data and storage services
- Data and configuration
- Model results
- Model results
- DEEP training facility
- Store new model
- Publish as service
- DEEP as a Service (DEEPaaS)
- Reuse and extend
- DEEP Open Catalog (marketplace)
- Build and train deep learning model
- Publish and share model
- Deploy model as a service

DEEP marketplace

DEEP marketplace entry

DEEP local inference

```
(udocker) alvaro:~ $ udocker pull deephdc/deep-oc-obj_detect_pytorch
Info: downloading layer sha256:2746a4a261c9e18bfd7ff0429c18fd7522acc1
(...)
(udocker) alvaro:~ $ udocker create deephdc/deep-oc-obj_detect_pytorch
(udocker) alvaro:~ $ udocker run -p 5000:5000  deephdc/deep-oc-obj_detec
Warning: this container exposes TCP/IP ports
Warning: non-existing user will be created

***********************************************************
*                                                         *
*         STARTING 9bb8179d-c731-348c-bbf4-e43045ee8936   *
*                                                         *
***********************************************************

executing: deepaas-run

    ##      ###
    ##     ###### ##
  .#####  #####  #######. .#####.
  ##  ## ## //  ## // ## ##  ##
  ##. .## ### ###  // ### ##  ##
   ## ##  ####    ####  #####.
       Hybrid-DataCloud  ##


Welcome to the DEEPaaS API API endpoint. You can directly browse to the
API documentation endpoint to check the API using the builtin Swagger UI
or you can use any of our endpoints.

  API documentation: http://0.0.0.0:5000/ui
  API specification: http://0.0.0.0:5000/swagger.json
      V2 endpoint: http://0.0.0.0:5000/v2

------------------------------------------------------------
```
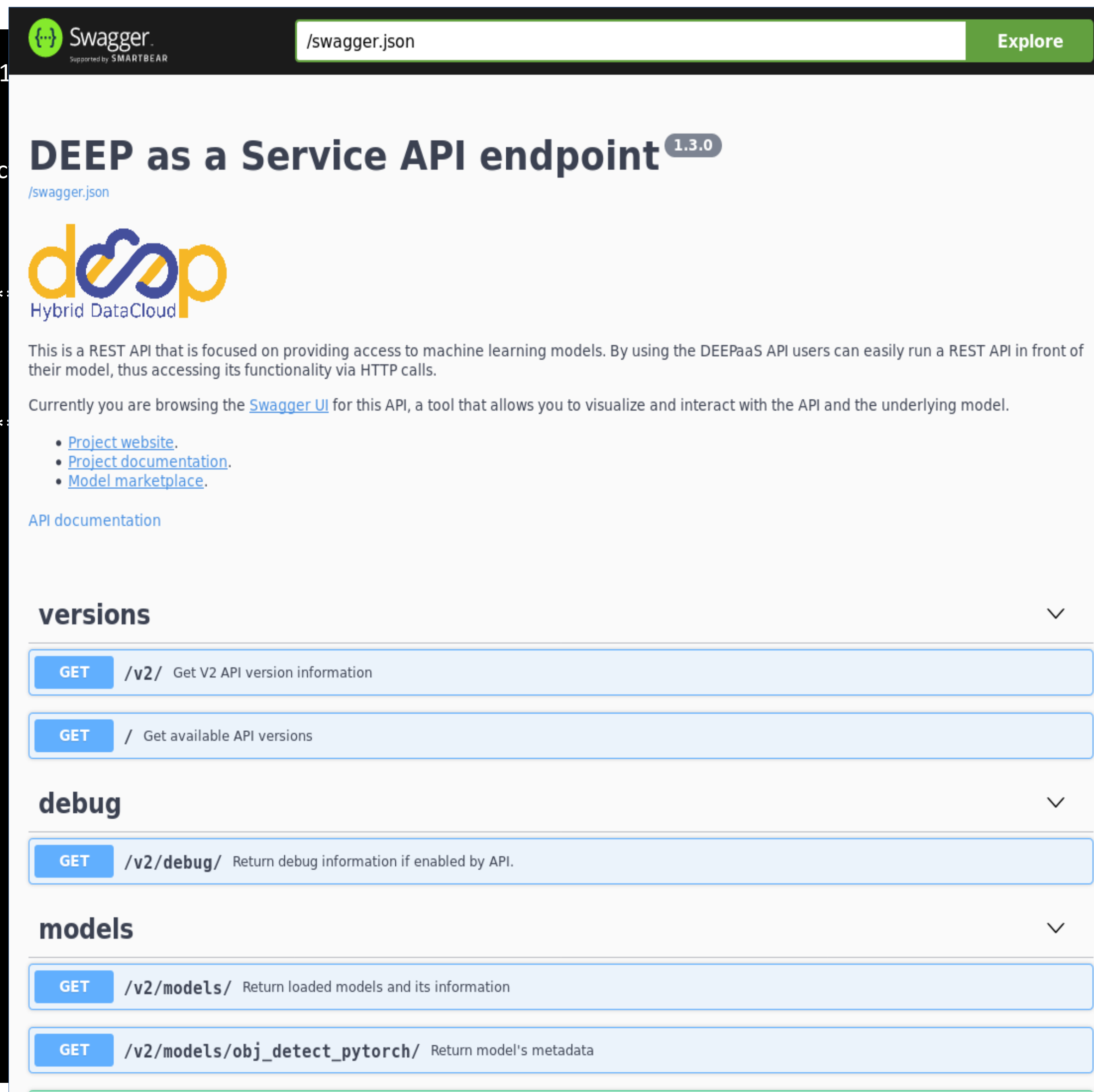
Swagger Supported by SMARTBEAR

`/swagger.json` **Explore**

DEEP as a Service API endpoint 1.3.0

/swagger.json

This is a REST API that is focused on providing access to machine learning models. By using the DEEPaaS API users can easily run a REST API in front of their model, thus accessing its functionality via HTTP calls.

Currently you are browsing the Swagger UI for this API, a tool that allows you to visualize and interact with the API and the underlying model.

- Project website.
- Project documentation.
- Model marketplace.

API documentation

versions

GET	/v2/ Get V2 API version information

GET	/ Get available API versions

debug

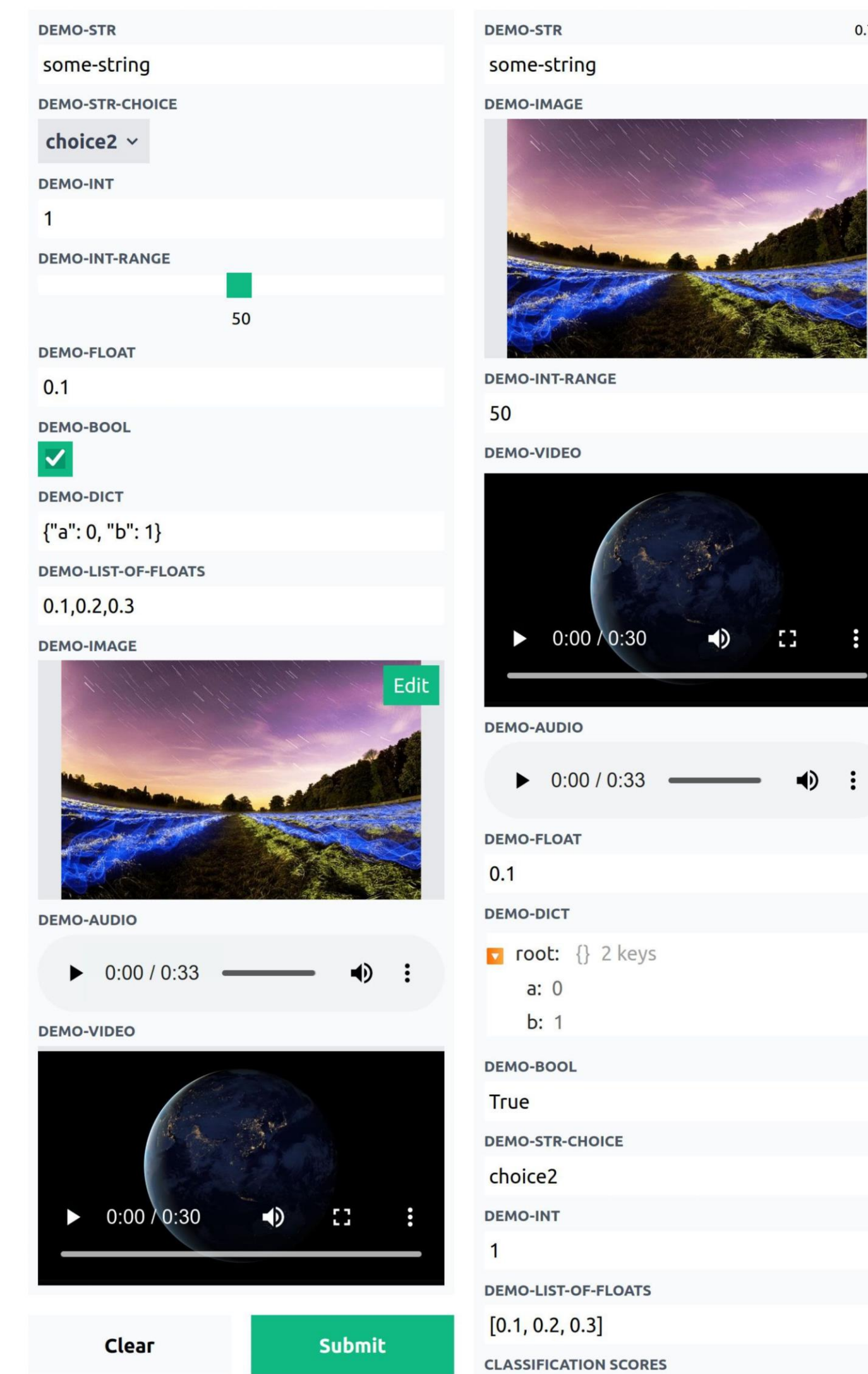| GET	/v2/debug/ Return debug information if enabled by API.
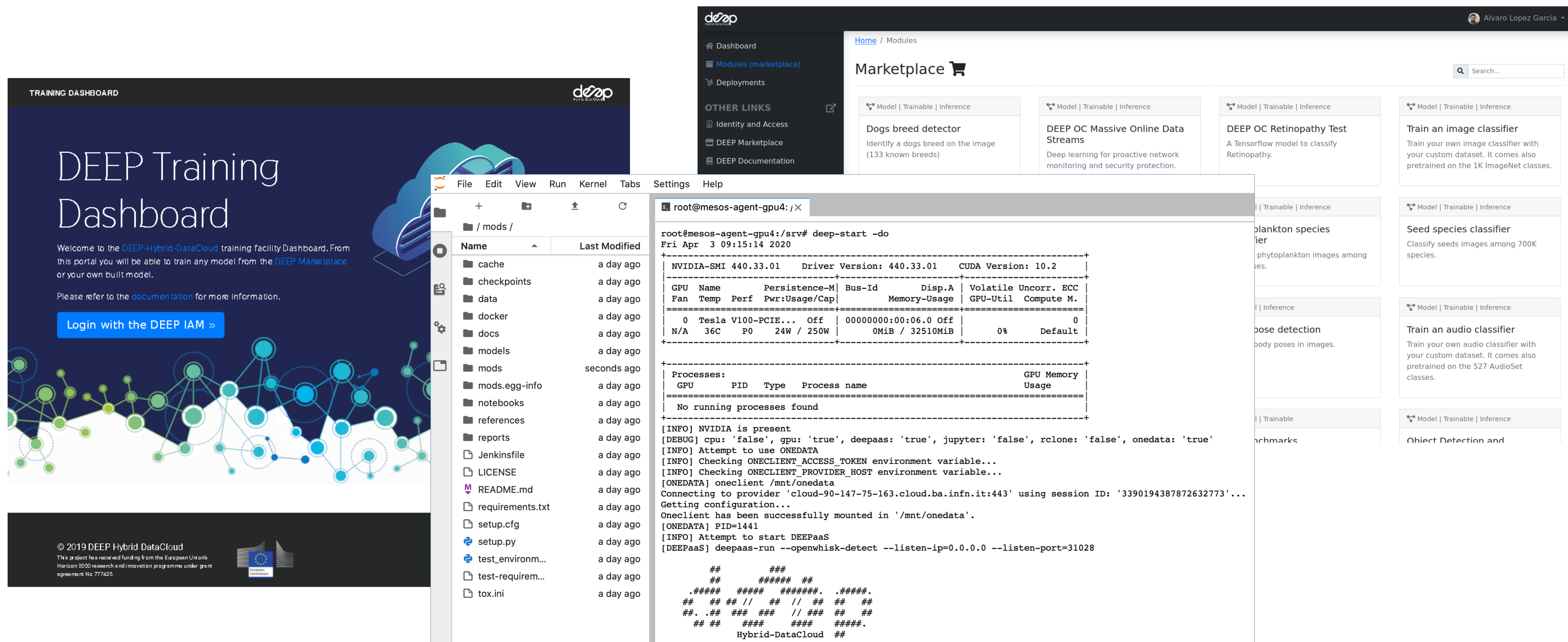
models

GET	/v2/models/ Return loaded models and its information

GET	/v2/models/obj_detect_pytorch/ Return model's metadata

DEEP training and development

1-click development and training environments in Cloud and HPC

https://train.deep-hybrid-datacloud.eu

DEEP platform in iMagine

- DEEP training platform and marketplace in production at EOSC portal (TRL9)
  - Imaging use cases to exploit it to develop AI/ML/DL applications
  - Exploitation of resources from EGI Federated Cloud sites → onboarding of new providers
  - Transparent access to accelerators
  - Integration with training and inference APIs

- Evolution of DEEPaaS towards on-premises deployments (i.e. self-hosted) and automated deployment of imaging services

- Enhancements on DEEPaaS API as required by user communities
  - E.g. adoption of community standards for inference
  - Integration with friendly web user interfaces, with special focus on images

Thank you!

website