



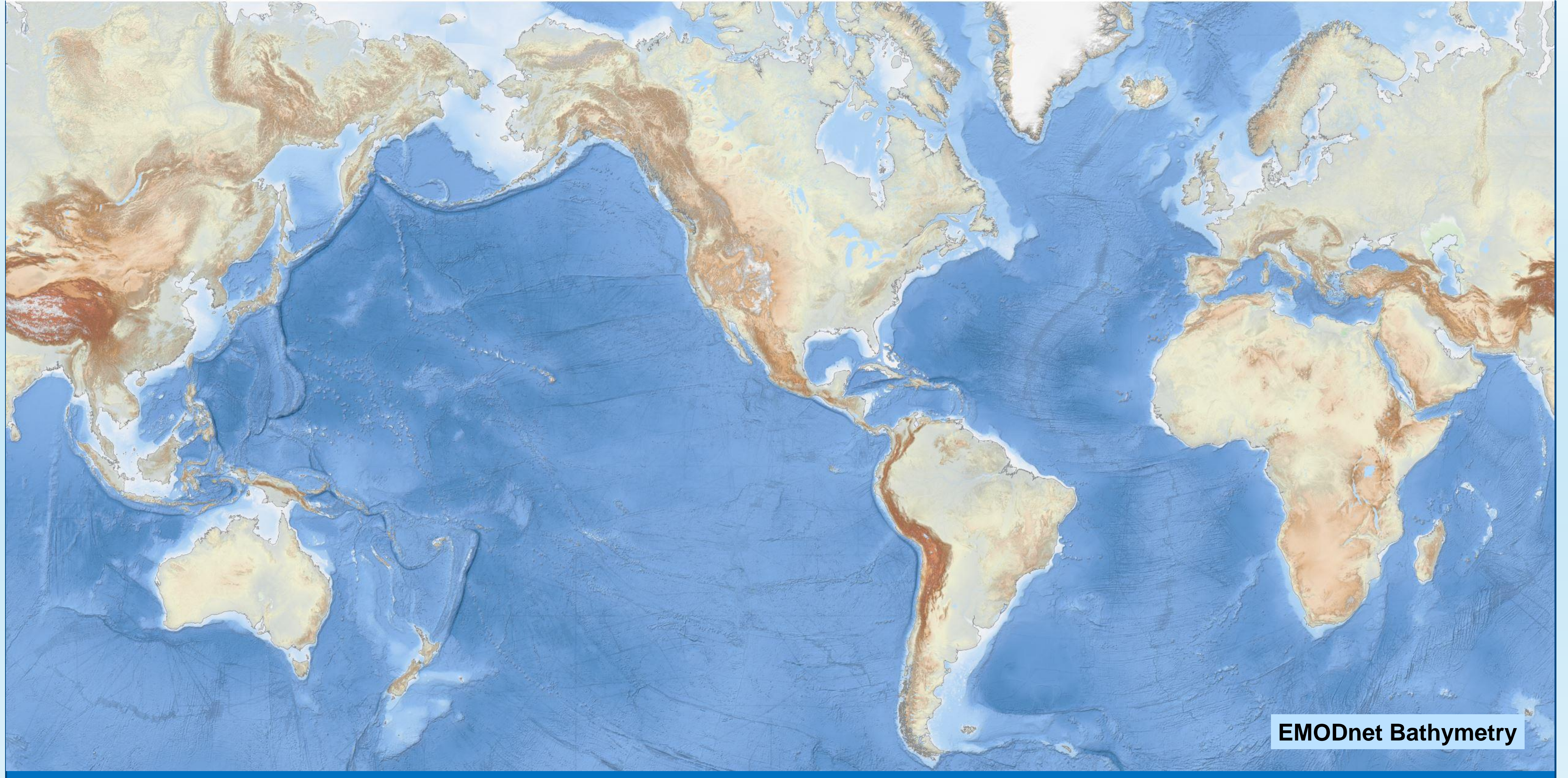
iMagine

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

Oceans and seas are important



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

Marine environmental management and policy making

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)



Source: EU MSFD website

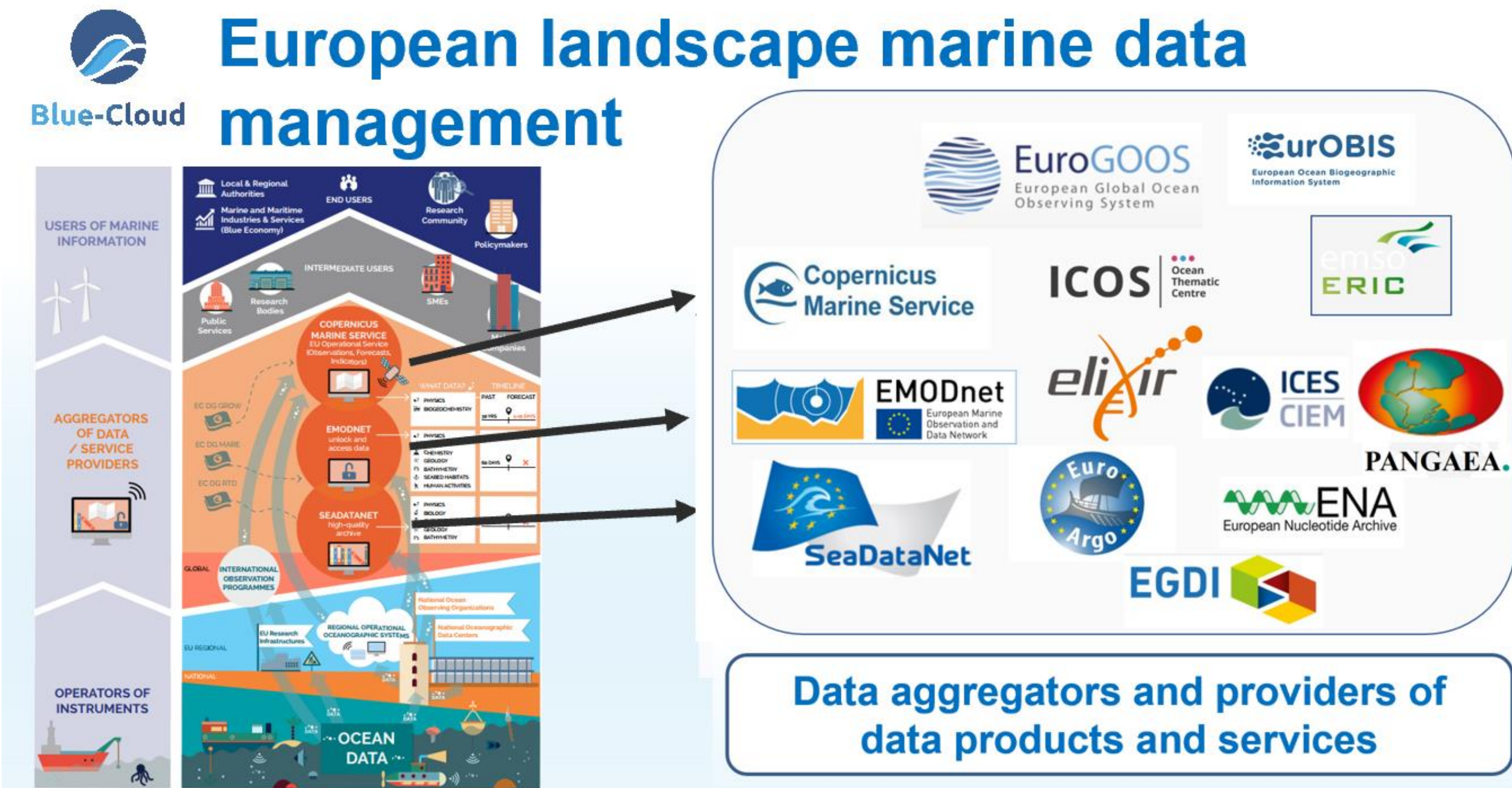


Implementation requires knowledge

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)



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).



H2020 – iImagine project

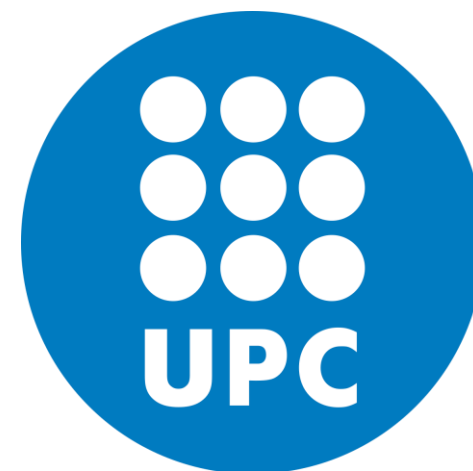
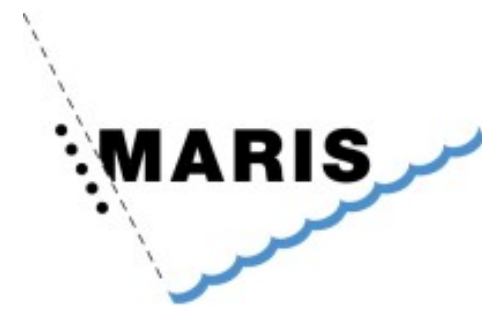
Great additional potential in collecting and processing image data using high-performance image analysis tools, including Artificial Intelligence (AI) techniques, and in more sharing of image repositories.

OBJECTIVE:

To deploy, operate, validate, and promote a dedicated iImagine 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 iImagine 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 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

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, iImagine 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)

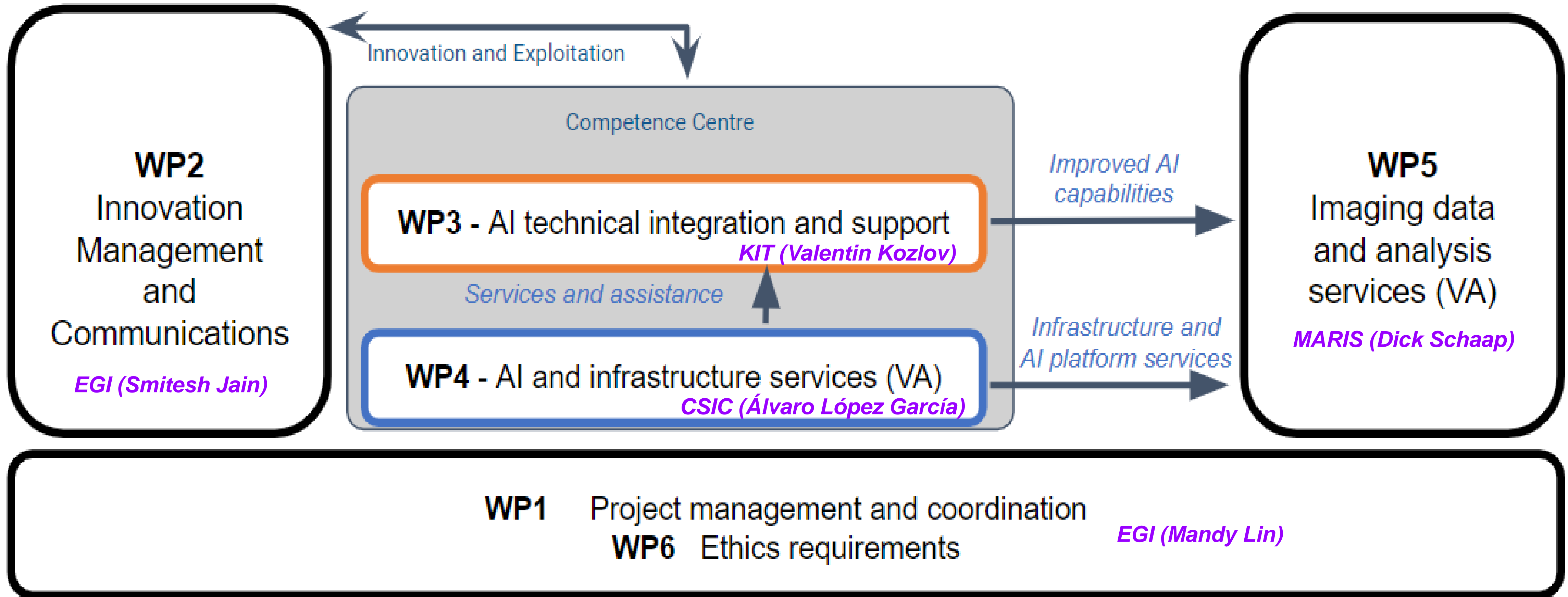


Overall approach to achieve impact





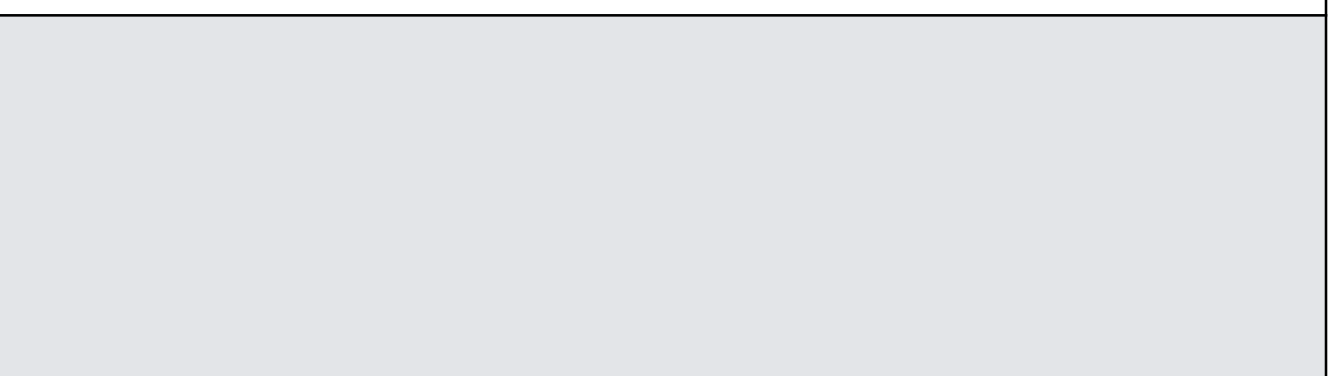
1. **A common iImagine AI framework and computing platform**, based upon earlier DEEP developments and to be built on EGI resources, connected to EOSC, facilitating researchers in development, testing, training, hosting, and operating of AI based image analysis services, following FAIR practices.
1. **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.
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 iImagine portfolio, and to **research engineers** who wish to develop and deliver similar services, making use of the facilities of the iImagine AI platform.

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






WP structure and coordinators



Five mature use cases

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

Three prototype use cases

<p>Underwater Noise Identification: Underwater noise identification from acoustic recordings using spectrograms</p>	<p>VLIZ (BE)</p>	
<p>Beach Monitoring: Posidonia oceanica berms and rip-currents detection from beach monitoring systems</p>	<p>SOCIB (ES)</p>	  
<p>Freshwater diatoms identification: Identification of freshwater diatoms using microscopic images</p>	<p>UL-LIEC (FR) + CNRS-IRL2958 (FR) + SU-LOCEAN (FR)</p>	

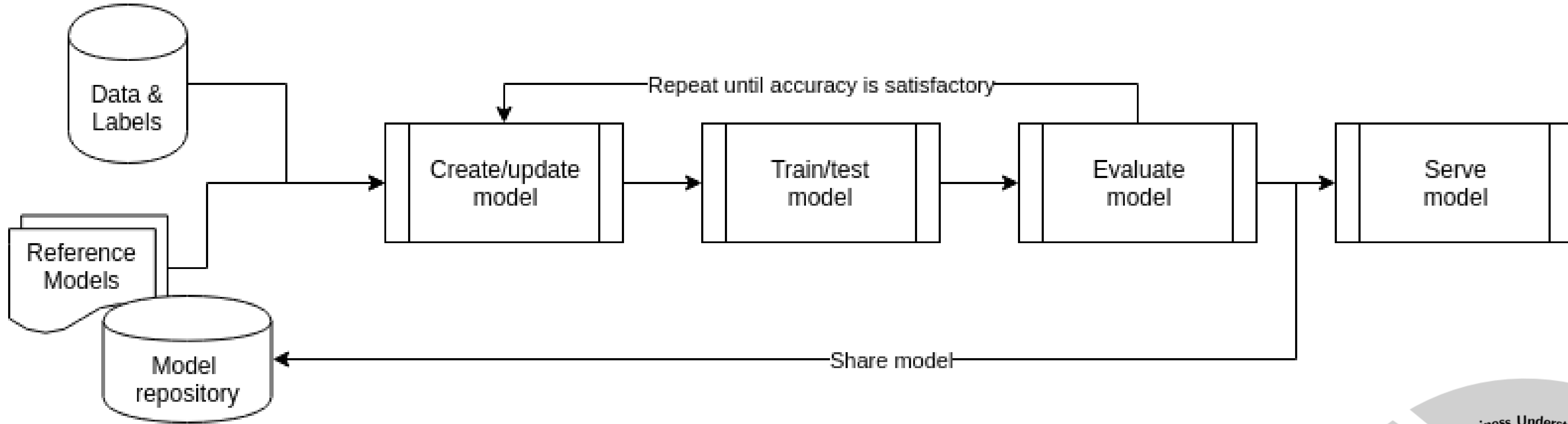
DEEP background

- <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

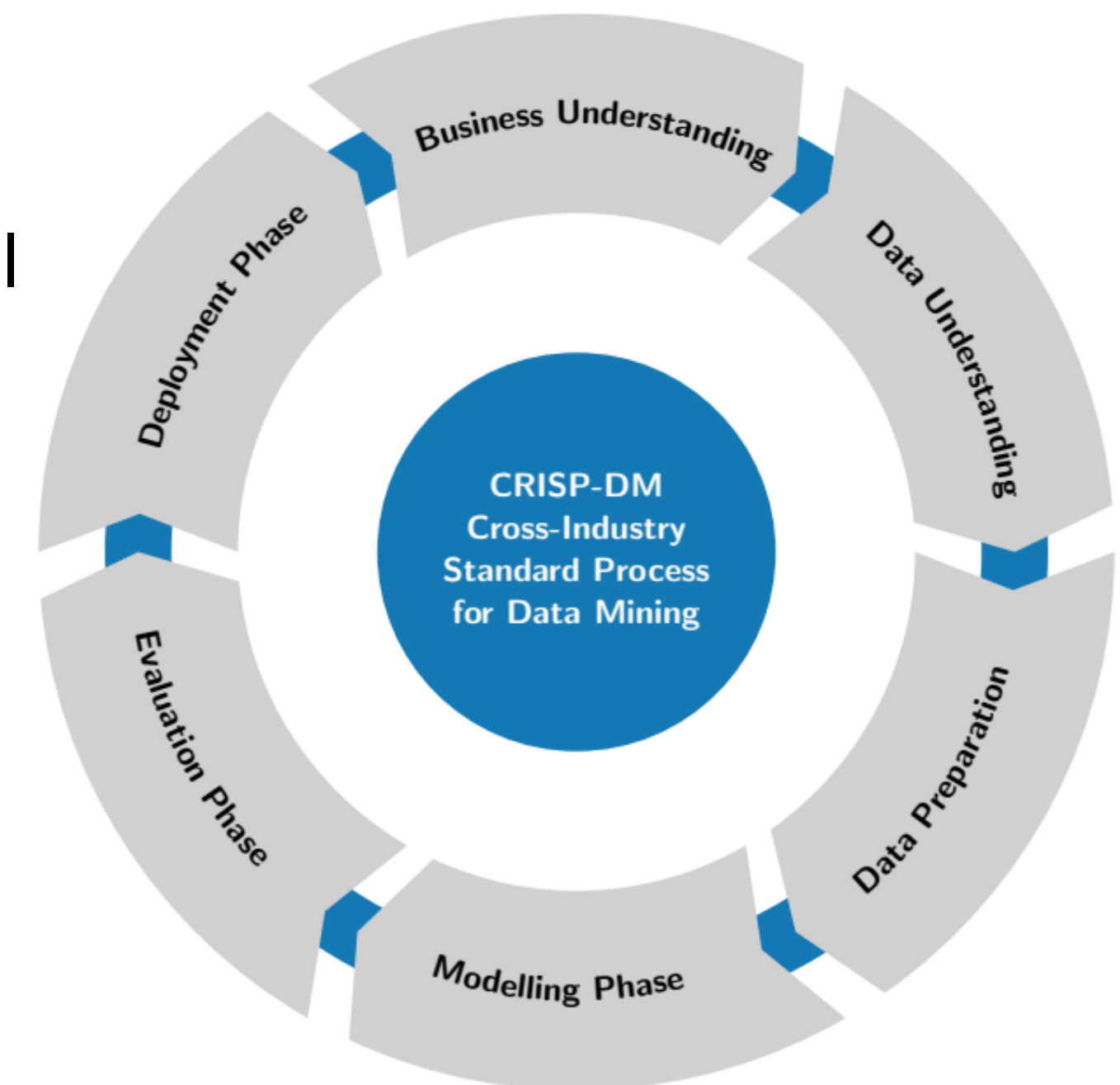


ML/AI development cycle

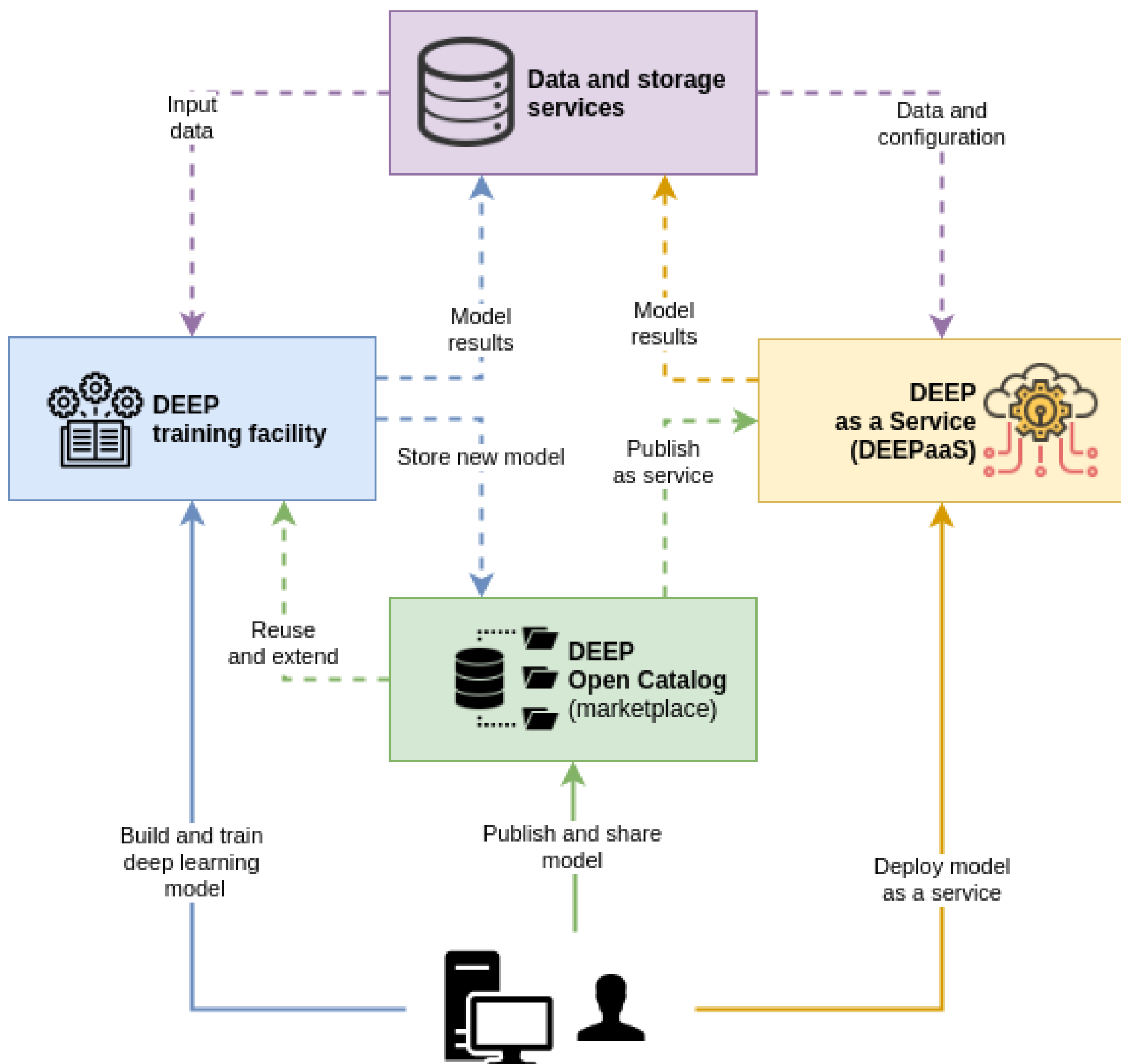


The DEEP Platform covers **all development phases** of a machine learning/artificial intelligence application:

- 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>

Explore our marketplace!

Artistic style transfer

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

A module to apply artistic style transfer using pytorch.

[KNOW MORE >>](#)

Bird sound classifier

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

Classify audio files among bird species from the Xenocanto dataset.

[KNOW MORE >>](#)

TF Benchmarks

Model | [Trainable](#)

tf_cnn_benchmarks accessed via DEEPaaS API

[KNOW MORE >>](#)

Object Detection and Classification with Pytorch

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

A trained Region Convolutional Neural Network (Faster RCNN) for object detection and classification.

[KNOW MORE >>](#)

2D semantic segmentation

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

2D semantic segmentation trained on the Vaihingen dataset


[KNOW MORE >>](#)

Train an audio classifier

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

Train your own audio classifier with your custom dataset. It comes also pretrained on the 527 AudioSet classes.

[KNOW MORE >>](#)

DEEP OPEN CATALOG PROJECT PAGE DOCS MODULES CATEGORIES 

Object Detection and Classification with Pytorch

A trained Region Convolutional Neural Network (Faster RCNN) for object detection and classification.

Model | [Trainable](#) | [Inference](#) | [Pre-trained](#)

Published by DEEP-Hybrid-DataCloud Consortium
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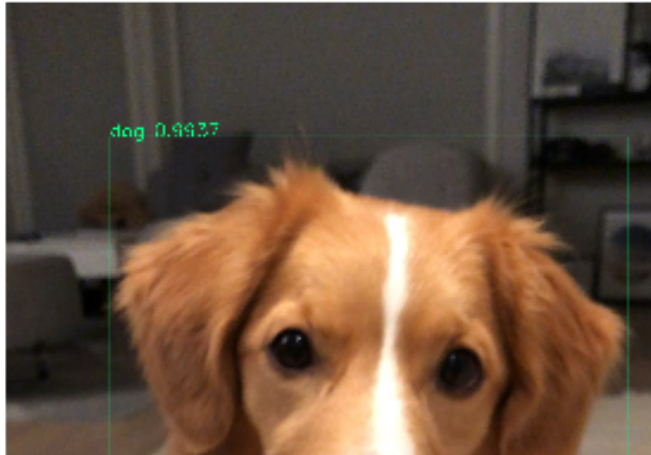
Model Description

build passing

This is a plug-and-play tool for object detection and classification using deep neural networks (Faster R-CNN ResNet-50 FPN Architecture [1]) that were already pretrained on the [COCO Dataset](#). The code uses the Pytorch Library, more information can be found at [Pytorch-Object-Detection](#).

The PREDICT method expects an image as input and will return a JSON with the predictions that are greater than the probability threshold. Let's say you have an image of a cat and a dog together and the probability output was 50% a dog and 80% a cat, if you set the threshold to 70%, the only detected object will be the cat, because its probability is grater than 70%.

This module works on uploaded images and gives as output the rectangle coordinates x1,y1 and x2,y2 were the classified object is located. It also provides you the probability of the classified detected object.



Categories

[services](#), [pytorch](#), [rcnn](#), [faster-rcnn](#), [object detection](#), [trainable](#), [inference](#), [pre-trained](#), [api-v2](#)

License

License: MIT

Try it live! beta

[WEB UI](#) [API](#)

[API SPECIFICATION](#)

Configure and train

[TRAINING DASHBOARD](#)

Get the code

[GITHUB](#) [DOCKER HUB](#)

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_detect_pytorch
Warning: this container exposes TCP/IP ports
Warning: non-existing user will be created

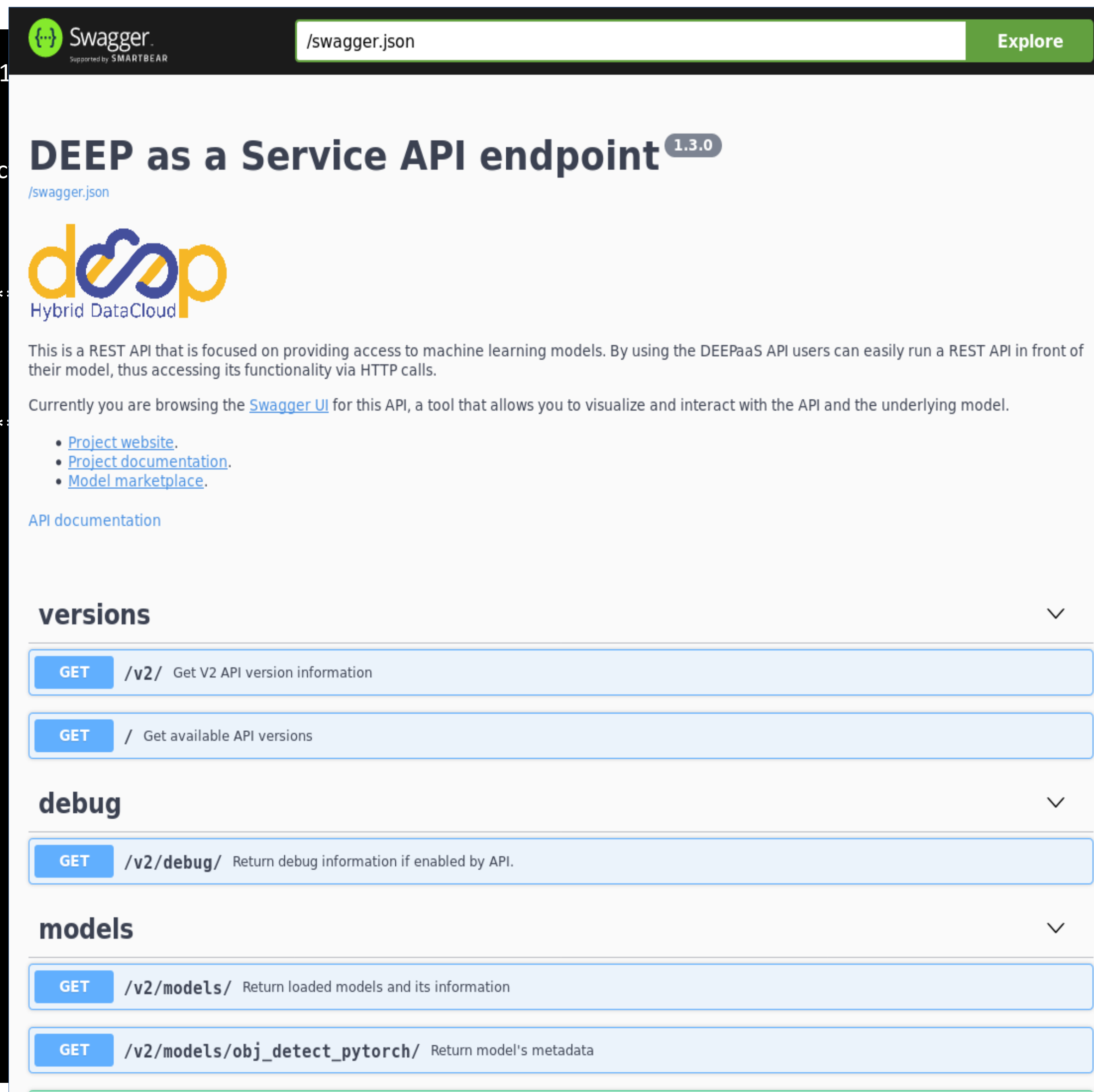
*****
*                                     *
*          STARTING 9bb8179d-c731-348c-bbf4-e43045ee8936          *
*                                     *
*****

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 [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.

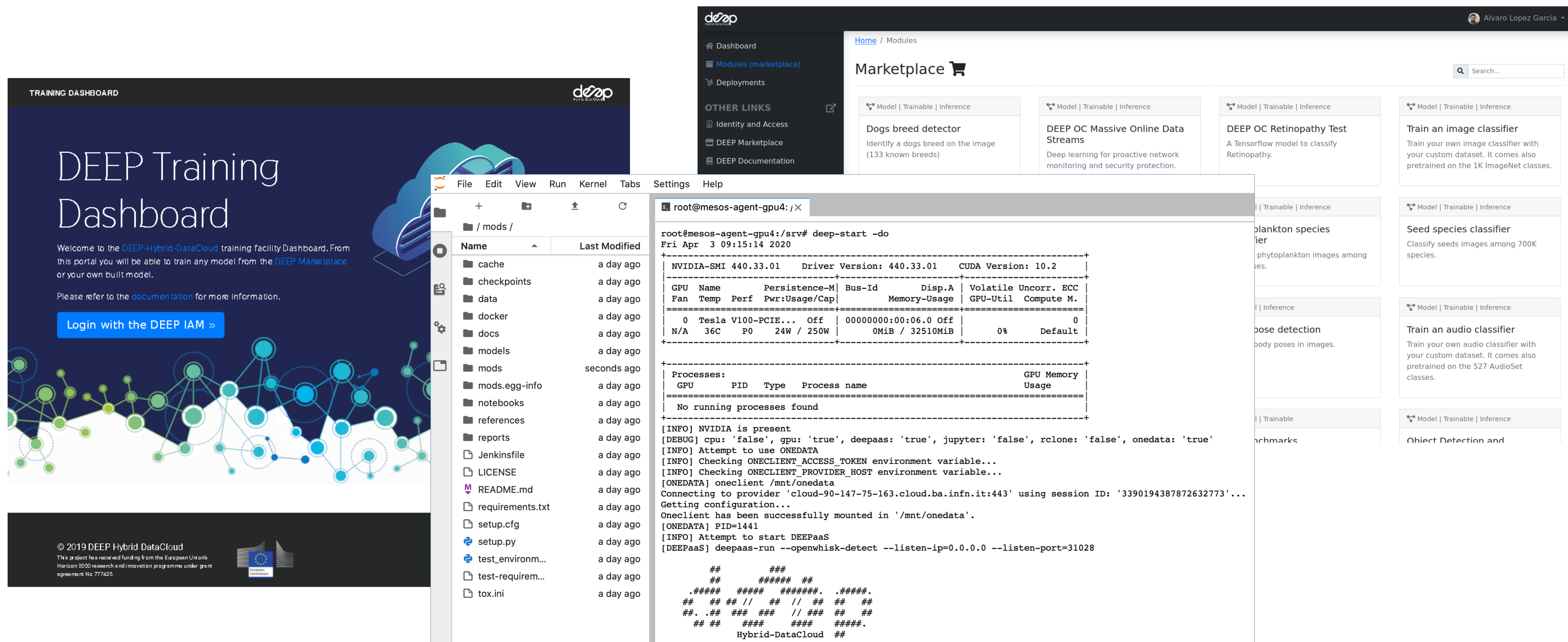
models

- [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>



The image displays the DEEP Training Dashboard interface and a terminal window. The dashboard includes a 'TRAINING DASHBOARD' header, a 'DEEP Training Dashboard' title, and a 'Login with the DEEP IAM' button. A sidebar on the right contains navigation links: Dashboard, Modules (marketplace), Deployments, and OTHER LINKS (Identity and Access, DEEP Marketplace, DEEP Documentation). The main content area shows a 'Marketplace' with various model cards such as 'Dogs breed detector', 'DEEP OC Massive Online Data Streams', 'DEEP OC Retinopathy Test', and 'Train an image classifier'.

The terminal window shows the following output:

```

root@mesos-agent-gpu4: /srv# deep-start -do
Fri Apr 3 09:15:14 2020
-----
| NVIDIA-SMI 440.33.01    Driver Version: 440.33.01    CUDA Version: 10.2     |
|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----|
| GPU   Name               Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----|
|  0    Tesla V100-PCIE...    Off          | 00000000:00:06:0 Off |                    0 |
| N/A   36C    P0      24W / 250W |  0MiB / 32510MiB |           0%      Default |
|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----|

+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Processes:                                                       GPU Memory Usage |
| GPU      PID  Type   Process name                               |      Memory Usage |
|-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| No running processes found |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

[INFO] NVIDIA is present
[DEBUG] cpu: 'false', gpu: 'true', deepaas: 'true', jupyter: 'false', rclone: 'false', onedata: 'true'
[INFO] Attempt to use ONEDATA
[INFO] Checking ONECLIENT_ACCESS_TOKEN environment variable...
[INFO] Checking ONECLIENT_PROVIDER_HOST environment variable...
[ONEDATA] oneclient /mnt/onedata
Connecting to provider 'cloud-90-147-75-163.cloud.ba.infn.it:443' using session ID: '3390194387872632773'...
Getting configuration...
Oneclient has been successfully mounted in '/mnt/onedata'.
[ONEDATA] PID=1441
[INFO] Attempt to start DEEPaaS
[DEEPaaS] deepaas-run --openwhisk-detect --listen-ip=0.0.0.0 --listen-port=31028

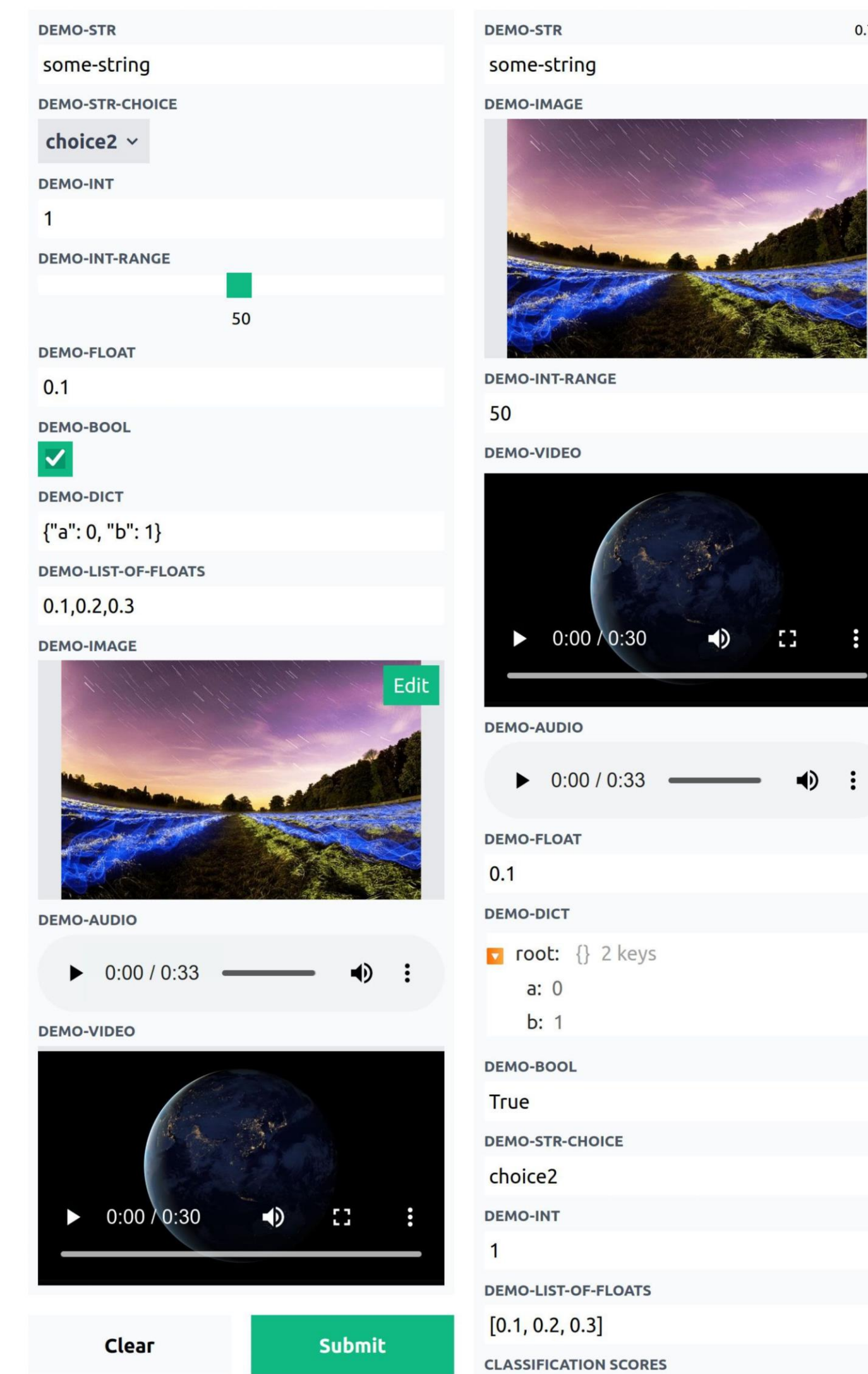
#####
##          ##
.#####  #####  #####.  #####.
## ## ## // ## // ## ## ##
##. ## ## ## // ## ## ##
## ##  ## ##  ##  #####.
Hybrid-DataCloud ##
  
```


DEEP platform in iImagine

- 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

demo_app

A minimal toy application for demo and testing purposes. We just implemented dummy inference, ie. we return the same inputs we are feed.



The screenshot displays a web interface for a demo application. It features two columns of input fields on the left and a corresponding column of output fields on the right. The input fields include: DEMO-STR (text input with 'some-string'), DEMO-STR-CHOICE (dropdown menu with 'choice2'), DEMO-INT (text input with '1'), DEMO-INT-RANGE (range slider with '50'), DEMO-FLOAT (text input with '0.1'), DEMO-BOOL (checkbox with 'checked'), DEMO-DICT (text input with '{"a": 0, "b": 1}'), DEMO-LIST-OF-FLOATS (text input with '0.1,0.2,0.3'), and DEMO-IMAGE (image input with a landscape photo and an 'Edit' button). The output fields on the right show: DEMO-STR (text output with 'some-string' and a timestamp '0.73s'), DEMO-IMAGE (image output with the same landscape photo), DEMO-INT-RANGE (range slider output with '50'), DEMO-VIDEO (video player output with a video of Earth and a timestamp '0:00 / 0:30'), DEMO-AUDIO (audio player output with a timestamp '0:00 / 0:33'), DEMO-FLOAT (text output with '0.1'), DEMO-DICT (JSON output with 'root: {} 2 keys', 'a: 0', 'b: 1'), DEMO-BOOL (text output with 'True'), DEMO-STR-CHOICE (text output with 'choice2'), DEMO-INT (text output with '1'), DEMO-LIST-OF-FLOATS (text output with '[0.1, 0.2, 0.3]'), and CLASSIFICATION SCORES (empty field). At the bottom, there are 'Clear' and 'Submit' buttons.



Thank you!

[website](#)



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