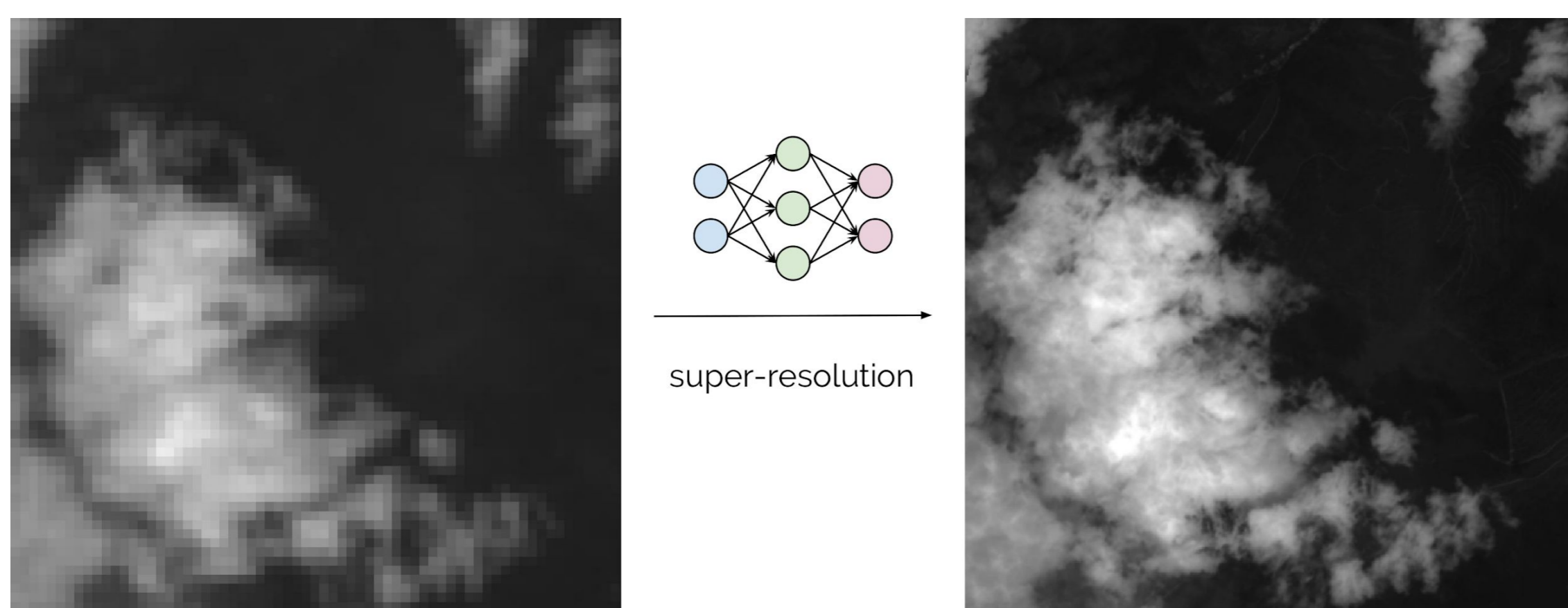


Satellite imagery super-resolution

The problem of performing we try to solve is what we call multi-spectral imagery super-resolution. Satellites usually take images at different light frequencies and these different bands usually have different resolutions. For example in the case of ESA's Sentinel-2 satellite it has 4, 6 and 3 bands with 10m, 20m and 60m resolutions respectively.

The idea is to take these low resolution bands (20m and 60m) and to super-resolve them to high resolution (10m). Several methods have been implemented to do this, but we choose to follow [1] that is based on deep neural networks and has shown to outperform previous state-of-the-art pansharpening methods. The results of using this method can be seen in the figure below:



We have modified the original code of [1] in order to make it general enough to be trained on any satellite. In fact we plan to launch services to perform super-resolution on other satellites like LandSat 8 in addition to the current service for Sentinel 2.

The DEEP Hybrid DataCloud project

DEEP Hybrid DataCloud project aims to support intensive computing techniques that require specialized HPC hardware, like GPUs or low-latency interconnects, to explore very large datasets.

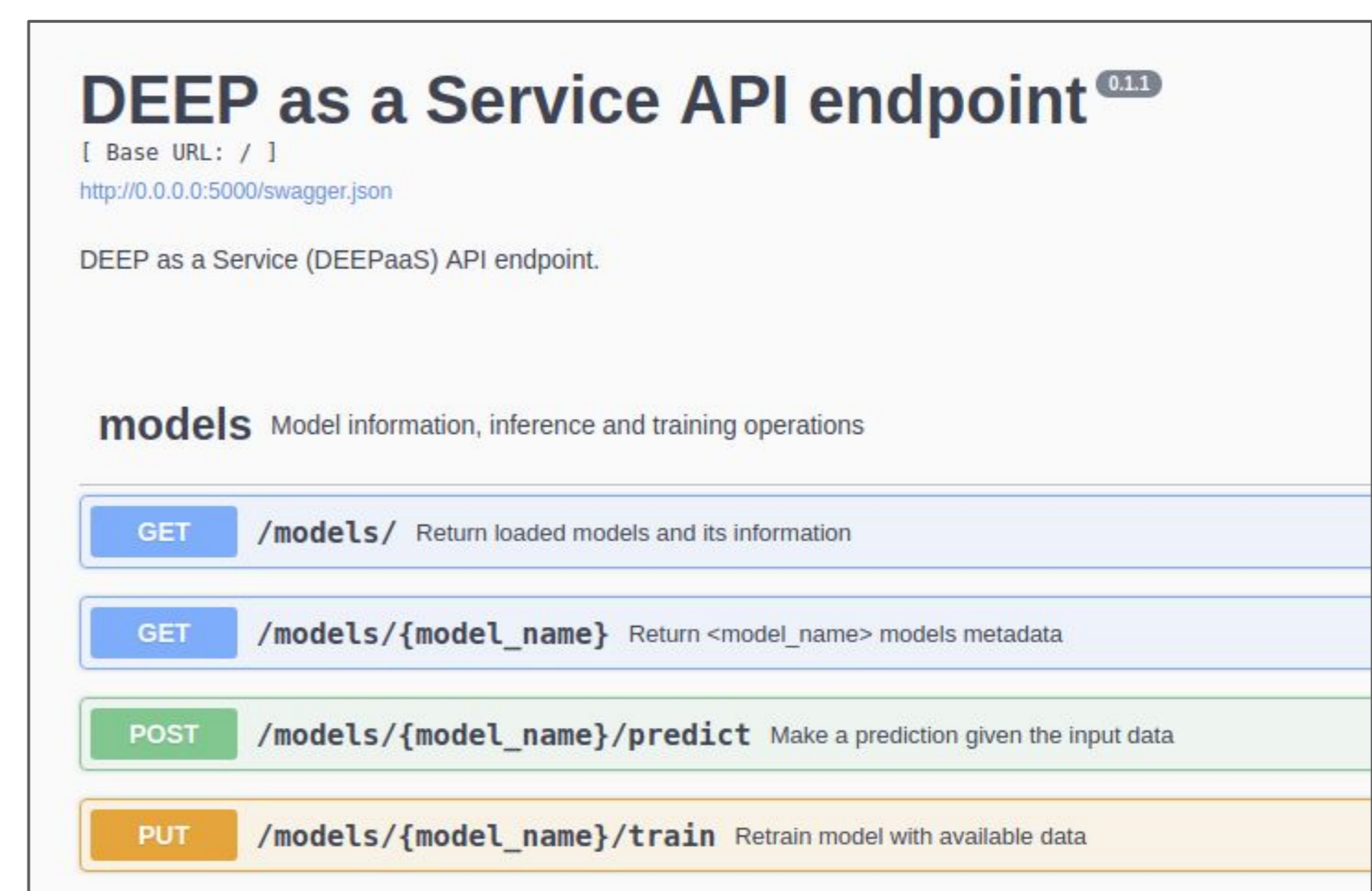
Under the common label of DEEP as Service, the project provides a set of building blocks that enable the easy development of applications requiring cutting-edge techniques: artificial intelligence (machine learning and deep learning), parallel post-processing of very large data, and analysis of massive online data streams. These services will be deployed in the project testbed, offered to the research communities linked to the project through pilot applications, and integrated under the EOSC framework.

The services we provide (including this one about satellite super-resolution) can be deployed via a Docker Container both on local and external resources like the Cloud. All services are designed to be compatible with CPUs and GPUs, both for training and inference.

DEEPaaS: Deep Learning as a Service

DEEPaaS has an API with standard HTTP methods to interact with the model. The most relevant are:

- **TRAIN** where we can train a super-resolution service for a new satellite or for the same satellite but for a different processing level, like L1C or L2A (after atmospheric corrections) for Sentinel 2. To train for a different satellite one just needs to define how to interact with the specific band data of the new satellite, with no additional changes to the code.
- **PREDICT** where the user selects a trained model and uploads the satellite tile he wants to super-resolve.



Conclusions

By offering this tool (integrated in the DEEP ecosystem) to the community we hope to provide an useful service to the scientists working with remote sensing data as well as demonstrate the power and flexibility of the DEEP framework for integrating other (new or existing) machine learning tools.

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References

- [1] Lanaras, C., Bioucas-Dias, J., Galliani, S., Baltasavias, E., & Schindler, K. (2018). Super-resolution of Sentinel-2 images: Learning a globally applicable deep neural network. ISPRS Journal of Photogrammetry and Remote Sensing, 146, 305-319.

Useful Links

DEEP project

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

DEEP marketplace

<https://marketplace.deep-hybrid-datacloud.eu/modules/deep-oc-sentinel-2-super-resolution.html>

DEEPaaS API

<https://github.com/indigo-dc/DEEPaaS>