



H2020-INFRAIA-2019-1

Europlanet 2024 RI has received funding from the European Union's Horizon 2020 Research and Innovation Programme under

Grant agreement no: 871149

Deliverable D10.6

Deliverable Title: Demonstrator and Documentation of the General Classification Toolset
Due date of deliverable: 31/07/2023
Nature¹: R
Dissemination level²: PU
Work package: 10
Lead beneficiary: INAF
Contributing beneficiaries: KNOW
Document status: Final

Start date of project: 01 February 2020
Project Duration: 54 months
Co-ordinator: Prof Nigel Mason, University of Kent

1. **Nature:** D

2. **Dissemination level:**

PU

Public Restricted to other programme participants (including the Commission Service)

PP

RE

Restricted to a group specified by the consortium (including the Commission Services)

CO

Confidential, only for members of the consortium (excluding the Commission Services)

Executive Summary / Abstract:

Below is a list of all repositories including datasets, ML techniques and EXPLORE dissemination links, as well as a version of a Jupyter book on our GitHub repository (<https://github.com/e pn-ml/europlanet-ml-book>), which serves as a tutorial and reference book for the activity of the work package.

1. Overview of Science Cases and Demonstrators

Number	Science Case	Overview/Description
1.	Mercury Surface Classification	<ul style="list-style-type: none"> Data: Messenger MASCS IR dataset ML technique: unsupervised classification of spectral data, compare with chemical composition and surface ages from crater counting Link Repo: https://github.com/e pn-ml/MESSENGER-Mercury-Surface-Cassification-Unsupervised_DLR Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/01_mercury_surface_classification
2.	ICME Detection	<ul style="list-style-type: none"> Data: Space craft WIND, STEREO A, STEREO B ML technique: supervised, segmentation, ResU-Net++ Link Repo: https://github.com/e pn-ml/IWF-ICMEs Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/02_icme_detection_classification
3.	Mercury Boundary Crossings	<ul style="list-style-type: none"> Data: Messenger Magnetometer data ML technique: active learning, supervised, CRNN Link Repo: https://github.com/e pn-ml/Freddie Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/03_mercury_boundaries
4.	GMAP Deep Landforms	<ul style="list-style-type: none"> Data: Mars Reconnaissance Orbiter High Resolution Imaging Science Experiment ML technique: supervised, collection of deep learning-based computer vision techniques Link Repo: https://github.com/e pn-ml/DeepLandforms Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/04_gmap_deeplandforms
5.	IAP Boundary Crossings	<ul style="list-style-type: none"> Data: WHISPER spectrograms, FGM total magnetic field, CIS-HIA ion density, speed and energy spectrum ML technique: supervised, CNN Link Repo: https://github.com/e pn-ml/Tutorial_IAP_Boundaries Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/05_magnetospheric_boundaries

6.	PITS	<ul style="list-style-type: none"> • Data: Mars Reconnaissance Orbiter (HiRISE) and Lunar Reconnaissance Orbiter (NAC) imagery • ML techniques: unsupervised k-means clustering, silhouette analysis • Link Repo: https://github.com/dlecorre387/Pit-Topography-from-Shadows • Link Explore: https://explore-platform.eu/sda/pits_epn-ml_science_case_06
7.	Chorus Wave Segmentation	<ul style="list-style-type: none"> • Data: magnetic spectra • ML techniques: active learning, supervised, segmentation, FPN • Link Repo: https://github.com/epn-ml/Chorus-Wave • Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/07_chorus_wavesegmentation
8.	GMAP mound detetcion	<ul style="list-style-type: none"> • Data: mound segmentation data • ML techniques: supervised, segmentation, FPN, Unet • Link Repo: https://github.com/epn-ml/GMAP-mound-classification- • Link Explore: https://gitlab.acri-cwa.fr/project-explore/europlanetml/08_gmap_mound_detection
9.	Mars Dust Storm segmentation	<ul style="list-style-type: none"> • Data: Mars Dust Storm Sequence Data Set (MDSSD) • ML techniques: supervised, segmentation, FPN, Unet, LinkNet • Link Repo: https://github.com/epn-ml/Mars-Dust-Storm-Segmentation • Link Explore: N/A • Remark: Use case complete, not all code checked into repo yet
10.	Meteor Trajectories	<ul style="list-style-type: none"> • Data: Armagh Observatory • ML techniques: unsupervised, supervised, in progress • Link Repo: https://github.com/epn-ml/Meteor-Trajectories • Link Explore: N/A • Remark: Use case not complete, code will become available soon
11.	INAF Spectral use case	<ul style="list-style-type: none"> • Data: • ML techniques: unsupervised (clustering), supervised (classification/regression) • Link Repo: pending • Link Explore: NA • Remark: ML tool to be completed.