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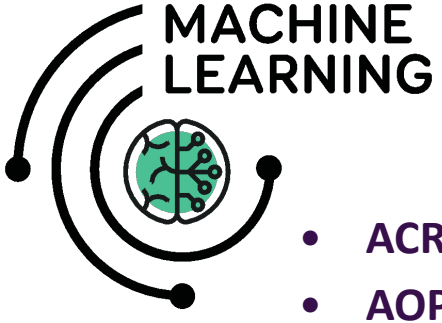
Machine Learning Solutions for Data Analysis and Exploitation in Planetary Science

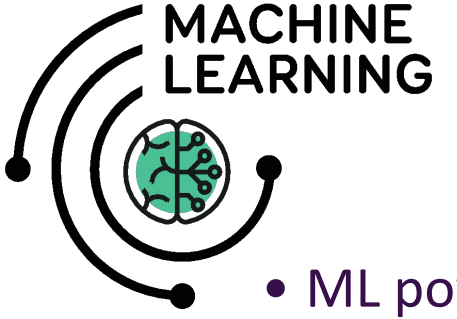
Coordination: Ute Amerstorfer, Space Research Institute, Austrian Academy of Sciences, Graz, Austria

Deputy: Andreas Windisch, Know Center GmbH, Graz, Austria



Beneficiaries

- **ACRI-ST,** France
- **AOP**, Armagh Observatory and Planetarium, Ireland
- **DLR**, Deutsches Zentrum für Luft- und Raumfahrt, Germany
- **KNOW**, Know-Center GmbH, Austria
- **IAP**, Institute of Atmospheric Physics, Academy of Sciences of Czech Republic, Czech Republic
- **INAF**, National Institute for Astrophysics, Italy
- **IWF**, Space Research Institute, Austrian Academy of Sciences, Austria
- **LMSU**, M.V. Lomonosov Moscow State University, Russia
- **UNIPASSAU**, University of Passau, Germany

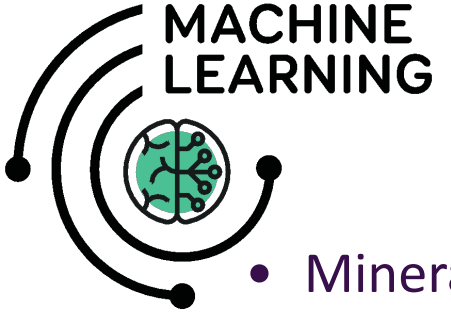


Aims and objectives

- ML powered data analysis tools optimized for planetary science
- integrate expert knowledge on ML into planetary community
- provide sustainable, open access to resulting products
- demonstrate ML capabilities
- foster use of ML technologies in data driven space research
- generate discussion on further possible applications of ML

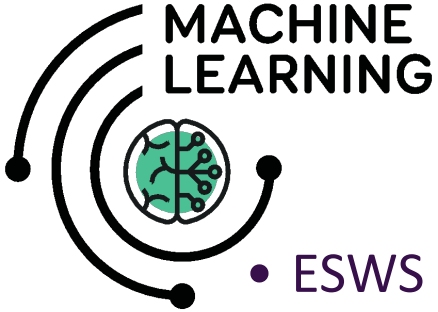
Science cases

- Detection of plasma boundary crossings at planetary magnetospheres and solar wind (Mercury, Earth)
- Detection and classification of interplanetary coronal mass ejections in in-situ solar wind data
- Analysis and forecasting of space weather events and solar wind conditions
- Classification of surface composition on the surface of Mercury



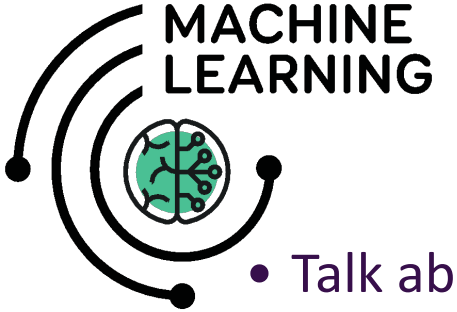
Science cases

- Mineral identification via reflectance spectra
- Automatic recognition and analysis of planetary surface features on Mars (e.g. mounds or pits)
- Automatic detection and classification of meteor and asteroid signal
- Classification of plasma wave emissions in electromagnetic spectra



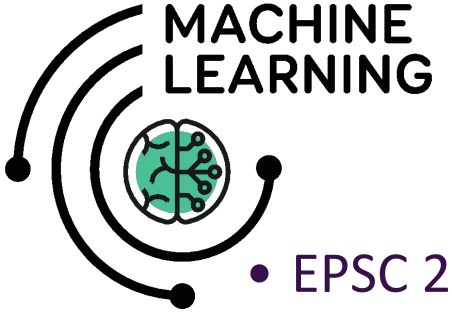
Sessions, presentations, etc.

- ESWS 2020: IWF ICME science case
- vEGU 2021
  - Session „Machine Learning in Planetary Sciences and Heliophysics“
  - DLR Mercury science case
  - GMAP Mounds science case
  - IWF ICME science case
  - LMSU Boundaries science case



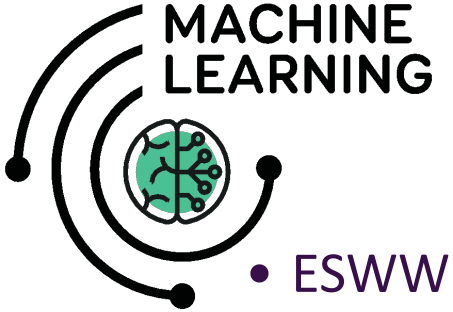
Sessions, presentations, etc.

- Talk about IWF ICME science case in international working group „CMEs, CIRs, HCS and large-scale structure“ (20 May 2021)
- OpenPlanetary Lunch talk „ML activities in Europlanet 2024 Research Infrastructure“ (1 June 2021)



Sessions, presentations, etc.

- EPSC 2021
  - Session „Machine Learning in Planetary Sciences“
  - IWF ICME science case
  - LMSU Boundaries science case



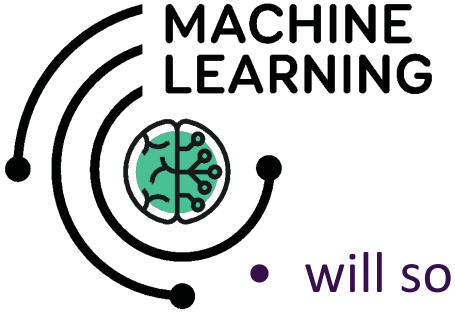
Upcoming presentations

- ESWW 2021 (25 - 29 Oct 2021)
  - IWF ICME science case

- AGU Fall Meeting 2021 (13 - 17 Dec 2021)
  - ML activities in Europlanet 2024 Research Infrastructure
  - IWF ICME science case
  - IAP Boundaries science case

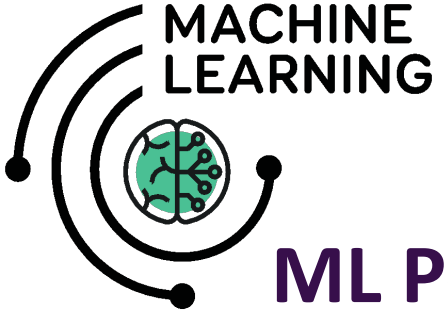
Workshops

- Virtual Fireballs Workshop #1 on Fireball Databases and Machine Learning (11-12 June 2021; with NA2)
- Machine Learning Pipeline for Automated Detection of Boundaries around Mercury (16 September 2021)
- Machine Learning Pipeline for Automated Detection of ICMEs (24 September 2021)



EXPLORE, VESPA

- will soon start to integrate tools into EXPLORE platform (https://explore-platform.eu/space-browser)
- will start to link data sets/data products to VESPA
  - workshop: November 2021



Dissemination

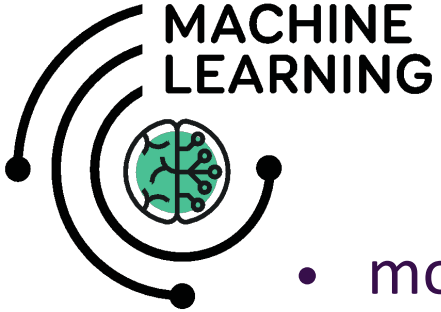
ML Portal ml-portal.oeaw.ac.at

- information about our activity
- description and results of science cases
- ML tutorials
- announcements of conferences, sessions, workshops, etc.

Dissemination

GitHub organisation github.com/epn-ml

- code for science cases
  - Python scripts
  - trained models
- documentation
- code for ML tutorials



Covid-19 issues

- most of us were/are in home office
- first two ML workshops were virtual
- next ones will also be virtual

Proposed amendments

- shift milestone MS51 from month 24 to month 30
  - *ML Demonstrators implemented and tested*
- shift deliverable D10.3 from month 25 to month 31
  - *Tutorial on Machine Learning and Basic How To's (initial release)*
- shift milestone MS86 from month 36 to month 42
  - *ML Demonstrators fully validated and integrated*