

Internal Research Fellow (PostDoc) in Machine Learning applied to Moon Exploration

Job Req ID: 12382

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Vacancy Type: Internal Research Fellow

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Research Fellowship Opportunity in the Directorate of Human and Robotic Exploration Programmes.

ESA is an equal opportunity employer, committed to achieving diversity within the workforce and creating an inclusive working environment. For this purpose, we welcome applications from all qualified candidates irrespective of gender, sexual orientation, ethnicity, beliefs, age, disability or other characteristics. Applications from women are encouraged.

This post is classified F2.

Location

ESTEC, Noordwijk, The Netherlands or EAC, Cologne, Germany.

Our team and mission

You will be based in the Ground Segment Systems Team, LEO Exploration Group, Directorate of Human and Robotic Exploration Programmes.

The project aims to use machine learning and image recognition to find a location on the Moon's surface, mainly using images from the Planetary Data System at www.pds.nasa.gov.

The purpose of the research is to build a computer system for two main tasks:

1. Teach the system to recognise a location on the Moon's surface by analysing a single image.
2. Teach the system to recognise mineral composition by analysing spectral data from the Moon collected by the Moon Mineralogy Mapper (M3).

Spectral analysis is one of the most widely used methods for data analysis in geophysics, astronomy, oceanography, etc. It is an essential analytical technique for identifying material properties in terms of their chemical and functional structure.

The Moon Mineralogy Mapper, which provides Visible/Near InfraRed (NIR) spectral data (hyperspectral data) of the lunar surface, enables gaining knowledge of the mineralogy of the Moon's surface. Spectral analysis enables band shaping and spectral profiling methods, used for identifying minerals.

The aim is to also use machine learning to recognise minerals from the multispectral data stored and analysed in the Planetary Data System.

The research will therefore include using machine-learning techniques to build an image recognition system that recognises locations on the Moon surface by analysing single images and Moon surface mineral composition recognition by using spectral data collected by M3.

You are encouraged to visit the ESA website: www.esa.int and <https://www.esa.int/esearch?q=machine+learning>

Field(s) of activity/research for the traineeship

The research consists in collecting data (images and spectral data), analysing it and using machine-learning techniques to build a system that can recognise the location and mineral composition of any image analysed. The new system should be able to find the location of any image of the Moon and identify the mineral composition using spectral data.

- Identify different sources to collect the necessary data. This data can be found in the Planetary Data System, but other sources need to be considered.
- Where possible, arrange storage of the data in an ESA-hosted system.
- Develop a comprehensive data-processing and machine-learning workflow concept to support development planning and review by internal ESA experts.
- Analyse and classify the data collected as required.
- Apply the necessary machine-learning algorithms for classification and analysis.
- Identify suitable training and test data sets.
- Implement, configure and test the machine-learning workflow.
- Produce a final report summarising the effectiveness of the developed workflow and its potential application in suitable domains.

Technical competencies

Knowledge relevant to the field of research

Research/publication record

Ability to conduct research autonomously

Breadth of exposure coming from past and/or current research/activities

General interest in space and space research

Ability to gather and share relevant information

Behavioural competencies

Result Orientation

Operational Efficiency

Fostering Cooperation

Relationship Management

Continuous Improvement

Forward Thinking

Education

You should have recently completed, or be close to completion of a PhD in physics, chemistry or computer science.

Preference will be given to applications submitted by candidates within five years of receiving their PhD.

Additional requirements

The following is required:

Knowledge on spectral analysis is relevant to understanding the data collected by the Moon Mineralogy Mapper, so you can analyse and classify it.

Knowledge of machine learning and machine-learning algorithms techniques is key for the project.

The working languages of the Agency are English and French. A good knowledge of one of these is required. Knowledge of another Member State language would be an asset.

Other information

For behavioural competencies expected from ESA staff in general, please refer to the [ESA Competency Framework](#).

The Agency may require applicants to undergo selection tests.

In addition to your CV and your motivation letter, please add your proposal of no more than 5 pages outlining your proposed research in the "additional documents" field of the "application information" section.

At the Agency we value diversity and we welcome people with disabilities. Whenever possible, we seek to accommodate individuals with disabilities by providing the necessary support at the workplace. The Human Resources Department can also provide assistance during the recruitment process. If you would like to discuss this further please contact us at contact.human.resources@esa.int.

Please note that applications are only considered from nationals of one of the following States: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the United Kingdom. Nationals from Latvia and Slovenia, as Associate Member States, or Canada as a Cooperating State, can apply as well as those from Bulgaria, Cyprus, Lithuania and Slovakia as European Cooperating States (ECS). Priority will first be given to candidates from under-represented Member States.

In accordance with the European Space Agency's security procedures and as part of the selection process, successful candidates will be required to undergo basic screening before appointment