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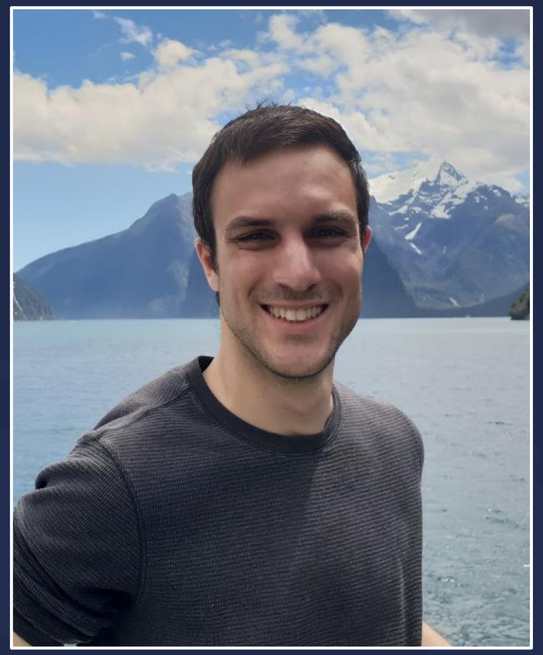

# Solving difficult problems in Lunar Seismology using simple algorithms

Presented by: Francesco Civilini
Research Space Scientist @NASA Goddard Space Flight Center

Date: 03 December 2024, 16:00 - 17:00

Live Webinar: Join Teams Meeting
Meeting ID: 349 644 428 541
Passcode: xw3PG9UC

You are also invited to attend the webinar at Aula Magna (Via Weiss 1)

FOR INFORMATION:
units.student.chapter@gmail.com

# Abstract:

The costly power and data volume limitations of delivering seismic data back to Earth from planetary missions requires the development of algorithms for lander-side signal analysis for telemetry prioritization. This is difficult to explicitly program, especially if no prior seismic data are available from the planetary body. We demonstrate that Convolutional Neural Networks (CNN) can be used to accurately catalog planetary seismicity without local training data by building binary noise/signal classifiers from a single Earth seismic station and applying the models to moonquakes from the Apollo Passive Seismic Experiment (PSE) and the Lunar Seismic Profiling Experiment (LSPE). The model with highest accuracy is used to create the first systematic seismic detection catalog for the LSPE continuous seismic data. In addition to the CNN methodology, we test the ability of Long Short-Term Memory (LSTM) algorithms for both denoising the time series and detecting seismic events. We find that the LSTM denoising algorithm is very effective in improving waveform signal-to-noise ratio and CNN detections. Lastly, we introduce a real-time seismic detection technology for assessing the power usage of the CNN and LSTM detection methods for varied hardware and data configurations.

# Biography:

Francesco Civilini is a seismologist and research space scientist at NASA Goddard Space Flight Center in Greenbelt, MD. His research expertise is using data analysis and algorithm design to understand the mechanisms driving geophysical systems. His current active research is in lunar seismology, specifically the assessment of lunar surface and internal processes using moonquakes. He is particularly interested in extracting further information from legacy datasets using novel techniques. Additional research interests include the expansion of scientific return of future planetary missions through the development of machine learning algorithms for lander-side signal assessment. Prior to his position at Goddard, Dr. Civilini was a postdoc researcher at Caltech, NASA Marshall Space Flight Center, and the US Geological Survey. During this time, he conducted or advised research in numerous areas including ambient noise tomography, remote sensing, geothermal signal detection, and subsurface imaging.