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Matching seismic activity with potential sources using machine Learning

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Detecting seismic signals and identifying their origin is more and more used for understanding environmental activity. This usually depends on a good signal/noise ratio (S/N), especially for the more distant sources.

A test area for detection and identification is the urban setting of the University of Vienna, a challenging environment with more than 4000 strong-acceleration events per day. These repetitive noise events would normally classify the site as "too noisy" for any advanced earthquake research.

With the real-time open database from Wiener Linien it is possible to attribute many of the repetitive seismic signals (e.g. on a Raspberry Shake Citizen Science Station) to the surrounding trams and train lines. The detection challenge was initiated in a Citizen Science Hackathon, where public interest sparked this research. The available train schedule and more than one year of continuous seismic records is sufficient to train and test a machine learning classifier which finds most characteristic features in the signals of commuter trains and trams, such as the energy in each frequency band.

The labeled dataset can be used to train our detection algorithm to find similar signals and to help determine whether a certain signal is present or not. An additional second seismic Raspberry Shake sensor is installed in the vicinity, to further constrain the directionality of the trains.

Studying the vibrations of train signals and solving the classification task of these repetitive patterns first can help develop robust methods
for seismically loud environments, and might lead to the detection of lower magnitude events such as regional earthquakes or landslides.