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Performance of Deep Learning pickers in routine network processing applications

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In recent years there have been a great progress in earthquake detection and picking arrival times of P and S phases using Deep Learning algorithms. However, the general adoption of these methods for the routine processing of monitoring networks has been held back by factors such as the availability of well documented software, computational resources, and a gap in knowledge of these methods. We have analyzed recent available Deep Learning pickers, comparing the results against data picked by a human operartor and against non-Deep Learning programs. We have used data recorded in several locations, with different characteristics and triggering mechanisms, such as volcanic eruptions, induced seismicity and local eartquakes, recorded using different types of instruments. We have found that the Deep Learning algorithms are able to achieve results comparables to a human operator, and several times better than a classical program, specially in data with a low signal to noise ratio. They are very efficient at ignoring large amplitude transient noise and at picking S waves, a task that is often difficult even for experienced analysts, and they require very few parameters to tune (often only the probability threshold) so an in-depth knowledge of neural networks is not required. (This research has been funded by Spanish Ministry of Science and Innovation MICINN/AEI/10.13039/501100011033 grants CGL2017-88864-R and PRE2018-084986).