# Testing Different Machine Learning Algorithms for Identifying Gravitational Waves

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**Abstract**

The direct detection of gravitational waves (GW) by Laser Interferometer Gravitational-wave Observatory (LIGO) and Virgo interferometers in 2015 renewed interest in gravitational-wave astronomy. The observation of binary blackhole has opened up a new window in observational astronomy observation. Since then, there has been a significant improvement in the sensitivities of the new generation of interferometers, e.g., the advanced LIGO-Virgo interferometers, Laser Interferometer Space Antenna (LISA), and GEO600, which can even detect weaker waves from merging neutron stars, leading to unprecedented rates of data collection. The data collected from the GW observatories has challenged traditional techniques used in searching for GW signals in the detectors, e.g., human inspection and some hard-coded computer algorithms. We have developed a machine learning Python code that uses the Long-short Term Memory (LSTM) algorithm to identify signals from the GW observations. The training and testing of the algorithm were conducted using synthetic data generated by the European Gravitational Observatory (EGO) via an algorithm that mimics simultaneous observation of the waves by LIGO Hanford, LIGO Livingston, and Virgo. Approximately 50% of the data contains signals immersed in added noise with the other 50% containing the typical noise of the observatories. We tested five algorithms; Convolutional neural network for 1D (Conv1D), simple neural network (NN), recurrent neural network (RNN), Long Short-Term Memory (LSTM) and RNN-LSTM, and found that LSTM is the most effective in identifying the data containing signals of gravitational waves. The training and test accuracies of the algorithms range from 50% - 96% and 48% - 86% respectively. The LSTM model has the highest training and test accuracy at 96% and 86% respectively. It can therefore be used as a first step in real-time identification of signals from gravitational wave events.

**Keywords:** gravitational waves, machine learning, time-series, LSTM, identification