



Contribution ID: 79

Type: **not specified**

Machine Learning Algorithms for Multi-Messenger Astroparticle Physics

Wednesday, 20 December 2023 10:40 (10 minutes)

Machine Learning algorithms bring a new opportunity of investigation and analysis of phenomena in the context of Astroparticle Physics and multi-messenger Astrophysics. We focus here on Water Cherenkov detectors, such as Super-Kamiokande and Hyper-Kamiokande, which offer a low noise environment ideal for the study of neutrinos from astrophysical sources, but also for the detection of rare events, like proton decay, for which an accurate knowledge of neutrino interaction events is critical since they play the part of an unavoidable background.

On the Super-Kamiokande side we want to introduce Machine Learning based reconstruction algorithms, along with the existing reconstruction algorithm based on Likelihood Maximization (`fitQun`), to improve reconstruction performance, such as particle counting and particle identification, with focus on proton decay analysis as a benchmark. On the Hyper-Kamiokande side we want to study the improvement of reconstruction processing time, motivated by the increase of the number of photosensors.

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Session Classification: Lightning Talks