Performance of machine learning algorithm for predicting muon multiplicity in the INO-ICAL prototype

We have presented our first results on the performance of a machine learning model to predict muon multiplicity using a machine learning model for a simulated dataset using the INO-ICAL prototype geometry.

In most of the analyses using the cosmic muon data from the INO-ICAL prototype stack, only single muon events are considered. Multi-muon events appear to be noisy events to the algorithm and thus get rejected. To address this issue, we developed a machine-learning algorithm to predict the muon multiplicity of an event.

Machine learning models were developed using the XGBoost classifier algorithm based on different datasets generated. To study the performance of the machine learning models developed, the prediction efficiency was estimated for each multiplicity and each dataset. We report a prediction efficiency of ~ 80% for muon multiplicity of 11 without noise. In the real case, due to the quality of the detectors in terms of the noise and efficiency, we expect tracks very similar to the clean tracks. However, we also notice a degradation in the prediction efficiency when extreme detector conditions are assumed (i.e detector efficiency 80%). The prediction time is very less and therefore the trained model can be implemented in the DAQ code to tag multi-muons directly while writing to disc. We intend to use this model to filter out multi-muon events from real data and carry out further analysis.