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Cherenkov and Scintillation Light Classification for Neutrino Interactions Using Machine Learning Techniques

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Separating Cherenkov from Scintillation light precisely and efficiently would allow a broad range of physics, especially in the neutrino field. The classification of Cherenkov and Scintillation photons in neutrino interactions is essential for better energy reconstruction, particle identification, and background separation. This classification can be carried out using traditional methods, and the implementation with techniques such as machine learning is also of great significance. Considering this importance, we've been trying several machine learning models and comparing results with the classical methods such as simple kinematic cuts. There are several parameters depending on the detector setup, geometry, etc. but in the scope of our study we focus on two main parameters; the arrival time and the energy of photons produced by neutrino interactions. In this study, we have tried several models including XGBoost, LightGBM, and RandomForest which currently give the top three best accuracies. We have been also doing hyperparameter tuning with these models, especially with XGBoost, in order to find the most optimized parameter list. Here, we present selected parameters, model results, and their comparisons between each model as well as the classical methods.

Poster prize

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