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Event reconstruction and tau neutrino appearance using CNNs for KM3NeT/ORCA

The KM3NeT research infrastructure is under construction at two locations in the Mediterranean Sea. The KM3NeT/ORCA water-Cherenkov neutrino detector off the French coast consists of a three-dimensional array of photosensors. Its main purpose is the determination of the neutrino mass ordering by investigating the flavour oscillations of few-GeV atmospheric neutrinos. In this contribution, we will demonstrate the application of deep convolutional neural networks to simulated sets of KM3NeT/ORCA photosensor data. A complete analysis pipeline for the reconstruction and classification of events in the KM3NeT/ORCA detector is presented and performance comparisons to previously developed machine-learning classification and maximum-likelihood reconstruction algorithms are provided. The presented deep convolutional neural networks yield competitive reconstruction results and performance improvements with respect to classical approaches. Furthermore, the sensitivity of KM3NeT/ORCA to the appearance of tau neutrinos is presented, achieved with the described deep-learning event analysis pipeline.

Mini-abstract

Application of CNNs to KM3NeT/ORCA improves sensitivity to tau neutrinos and detector resolutions.

Experiment/Collaboration

for the KM3NeT Collaboration

Primary author: EBERL, Thomas (Erlangen Centre for Astroparticle Physics, University Erlangen-Nuremberg)

Co-author: MOSER, Michael (Erlangen Centre for Astroparticle Physics, University Erlangen-Nuremberg)

Presenter: EBERL, Thomas (Erlangen Centre for Astroparticle Physics, University Erlangen-Nuremberg)

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