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Deep Learning Classifier for Low-Energy Events in IceCube

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Tau appearance from neutrino oscillations of atmospheric muon neutrinos is studied by the DeepCore sub-array, the densely-instrumented region of IceCube, an ice-Cherenkov neutrino detector 1.5 kilometers below the surface of the South Pole. These studies probe the unitarity of the PMNS matrix. Distinguishable event signatures in this region include track-like and shower-like events. Because the contribution of tau neutrinos manifests as a statistically significant excess of shower-like events, accurate event classification is crucial. However, at the low energies relevant to the oscillation maximum, separation of tracks and showers is challenging. This talk will show an ongoing study of a deep learning event classifier that currently achieves an accuracy comparable to that of the currently used method, with still large room for improvement. We show that DNNs can learn complex features in DeepCore data at hit level (i.e., not relying on reconstructed quantities) that differentiate the signal types.

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