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Search for astrophysical tau neutrinos using Deep Learning with IceCube

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The IceCube Neutrino Observatory detects neutrinos by collecting the Cherenkov light created by their inter-action products within one cubic km of ice. Neutrinos of a particular flavor produce corresponding charged leptons in charged current (CC) interactions. Each type of lepton can create a distinct light emission pattern in the detector. The hardest to observe is the pattern of the tau neutrino CC interaction. It strongly resembles electron and neutral current neutrino interactions, except at the highest energies (>10PeV). This work aims to improve collaboration's previous attempts to distinguish the two signatures at lower energy (0.1 to 10 PeV) using deep learning. We represent each neutrino interaction as a set of three 2D images and train a convolutional neural network to separate the ones belonging to tau neutrinos. If successful, the work can improve the measurement of astrophysical tau neutrino flux and astrophysical neutrino flavor composition on Earth.

Collaboration name

IceCube

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