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Identifying Neutrino Final States and Energies in MicroBooNE with New Deep-Learning Based LArTPC Reconstruction Frameworks

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MicroBooNE, a Liquid Argon Time Projection Chamber (LArTPC) located in the ν_μ-dominated Booster Neutrino Beam at Fermilab, has been studying ν_e charged-current (CC) interaction rates to shed light on the MiniBooNE low energy excess. The LArTPC technology employed by MicroBooNE provides the capability to image neutrino interactions with mm-scale precision. Computer vision and other machine learning techniques are promising tools for image processing that could boost efficiencies for selecting ν_e-CC and other rare signals, reduce cosmic and beam-induced backgrounds, and improve the reconstruction of neutrino energies. The MicroBooNE experiment has been at the forefront of developing and testing such techniques for use in physics analyses. In this poster we overview deep-learning based reconstruction methods. We will showcase the use of a recurrent neural network to estimate neutrino energies and present a new reconstruction framework that uses convolutional neural networks to locate neutrino interaction vertices, tag pixels with track and shower labels, and perform particle identification on reconstructed clusters. We will present studies characterizing the performance of these new tools and demonstrate their effectiveness through their use in an inclusive ν_e-CC event selection.

Poster prize

No

Given name

Matthew

Surname

Rosenberg

First affiliation

Tufts University

Second affiliation

Institutional email

Matthew.Rosenberg@tufts.edu

Gender

Male

Collaboration (if any)

MicroBooNE

Autore principale: ROSENBERG, Matthew (Tufts University)

Relatore: ROSENBERG, Matthew (Tufts University)

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