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Energy Reconstruction in NOvA with Regression Convolutional Neural Networks

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NOvA is a long-baseline accelerator neutrino oscillation experiment. It uses the upgraded NuMI beam from Fermilab and measures electron neutrino appearance and muon neutrino disappearance at its Far Detector in Ash River, Minnesota. NOvA aims to resolve the mass hierarchy, the CP violation and the octant of theta23. We will focus on the development and application of deep learning to the reconstruction tasks at NOvA. NOvA is a pioneer to use convolutional neural networks for event classification and particle identification in the neutrino community. Recently, we developed regression convolutional neural networks to estimate electron neutrino energy with direct raw detector pixel inputs. Compared with kinematics-based energy reconstruction, this method shows a significantly better energy resolution. The regression CNN also shows smaller systematic uncertainties from the simulation of neutrino interactions.

Primary author: Prof. BIAN, Jianming (UC Irvine)

Presenter: Prof. BIAN, Jianming (UC Irvine)

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