Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY17

Project ID: FNAL-LDRD-2017-010
Project title: Training Deep Neural Networks for Neutrino Identification in the Cloud
Principal investigator: Evan Niner

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

Deep learning has great potential for the neutrino physics and HEP community at large. We propose to build on the work already done for NOvA, developing and optimizing new deep networks to identify substructure in the events, i.e. individual particles, rather than classifying the overall neutrino interaction. We will also pioneer a new way to access the required GPU resources: using off-site commercial resources via HEPCloud. Training networks is a great example of high "peak" demand and low average demand, making it well suited to the HEPCloud approach.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Looking past NOvA, the challenges and opportunities are all the greater with the fine-grained resolution of liquid argon detectors. In the short term protoDUNE 4 will provide an ideal dataset for testing the performance of single-particle identification techniques on events with tagged charged particles from the tertiary beam at CERN. If this technique shows promise in protoDUNE it can be carried forward to the DUNE far detector, a top priority of the high energy physics community in the coming decade.

Previous year's accomplishments: (as applicable)

A new GPU-based machine has been installed leveraging upon singularity containers that were introduced by the Scientific Computing Division. A first test deployment of a network was performed. Work was done to develop networks for physics applications.

Work proposed for current fiscal year and anticipated / desired results:

Larger scale deployments of a network will be done. Studies will be made between GPU and CPU evaluation times. Investigations into features of training images translate to classification tasks. Apply what's learned to the NOvA task of cosmic rejection and particle ID.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY17	FY18	FY19	Total
N/A	45,645	100,000	153,009	298,744

Project Start Data: 3/01/2017 Total Approved Project funds: $ 451,889