**Large scale deep neural network optimization for neutrino physics**
Gabriel Perdue, Steven Young, Alexander Himmel, Aristeidis Tsaris, Jon Miller,
Anushree Ghosh, Barbara Yaeggy, Robert Patton, Evan Niner

Oak Ridge National Laboratory

youngsr@ornl.gov

**Abstract**

We are combining deep neural networks and evolutionary algorithms to extend the scientific reach and impact of accelerator-based neutrino experiments. MINERvA and NOvA are experiments at Fermi National Accelerator Laboratory with a rich and complementary set of physics goals designed to answer questions about the fundamental structure of matter at the subatomic scale. Both detectors can function as imaging devices, making new and exciting techniques from computer vision and machine learning, especially from the subfield of deep learning, highly applicable. This project is using evolutionary algorithms to study deep neural network topology and hyper-parameter optimization by conducting an efficient search through the vast space of possible configurations. We are learning more about neutrino physics in this project but also developing a richer understanding of how artificial intelligence techniques function in the natural sciences.