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Exploration of Deep Convolutional and Domain Adversarial Neural Networks in MINERvA.

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While Machine Learning algorithms have been used for decades, recent advances in Deep Convolutional Neural Networks have revolutionised the fields of computer vision and image recognition and Artificial Intelligence. Modern particle physics experiments and detectors produce data which is analogous to modern high resolution images, and we anticipate a similar revolution in particle physics. Three central challenges have been faced in using these ML algorithms: feature extraction, (hyper-)parameter tuning and the validity of applying an algorithm on data which was trained and tested on simulation. We present our exploration of using DCNNs and Domain Adversarial Neural Networks to address, respectively, the first and last of these challenges in the task of vertex reconstruction in the passive targets of the MINERvA detector in the medium energy NuMI neutrino beam.

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