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Machine Learning Applications for Reactor Antineutrino Detection at PROSPECT

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PROSPECT is an antineutrino detector located above ground at the High-Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL). The energy spectrum of antineutrinos emitted from the reactors is measured by using a delayed coincidence technique through the inverse-beta-decay reaction (IBD). The ORNL group is currently exploring several applications of machine learning techniques for the reconstruction and analysis of antineutrino events. In this talk, an overview of these efforts will be presented. Specifically, the use of the individual distribution of the observables of positron and neutron signals in IBD's can be used as input to train a neural network to discriminate between true IBD interactions and accidental correlations. Furthermore, we explore the possibility of using machine learning techniques to optimize the pulse-shape discrimination (PSD) variable used for particle classification. We designed an encoder-decoder architecture for sequence prediction based on recurrent neural networks (RNNs). This method will allow us to match detector pulses to reconstruct the IBD interaction.

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