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Episodic reinforcement learning for 0vbb signal discrimination

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0vbb decay is a Beyond the Standard Model process that, if discovered, could prove the Majorana nature of neutrinos—that they are their own antiparticles. The Majorana Demonstrator (MJD) is one experiment searching for 0vbb decay using semiconductor detectors, however the nature of the waveform data produced by the detectors is such that they are unlabelled, and producing ground-truth labels is an involved process if using traditional methods. Fortunately, machine learning methods like reinforcement learning (RL) are able to perform tasks on unlabelled data. I present an episodic RL algorithm implementing Randomized Return Decomposition for binary classification of detector events from the Majorana Demonstrator Data Release for AI/ML Applications. Under stringent masking of the MJD detector data, the RL-trained classifier slightly outperforms a standard supervised learning model trained under the same conditions, showing potential for further development and even future deployment as a first-stop classifier on other 0vbb decay experiments like LEGEND.

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