Accuracy correlation in neutron resonance reclassification

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The acquisition of accurate neutron resonances is essential for application in practical nuclear systems and understanding astrophysical processes. From these neutron resonances we can determine a description of the neutron interaction cross sections for related nuclei. However, current methods for determining the resonance quantum numbers associated with angular momenta and spin are difficult, time consuming, and may not be fully reproducible, often leading to incorrect spin assignments. To solve this problem, we have employed a machine learning (ML) based method to train an algorithm for identifying and reclassifying incorrect neutron spin assignments. Currently, the algorithm operates with varied successes depending on the isotope, set of features, and training set. For this project, we are examining the properties of the algorithm on polarized Indium-115, in this way, we can accept the given resonance assignments as accurate. We build synthetic data that mimics the statistical properties of real resonances to train the algorithm. Once we have obtained a training accuracy for the synthetic data, we validate the trained algorithm with a set of real In-115 data and observe the correlation between the two sets. However, for unpolarized data, we cannot guarantee the given resonances as accurate, so we also test the trained algorithm on an In-115 set with purposely misclassified resonance assignments. We can then attempt to improve the validation accuracy by adjusting the ML classifier's hyperparameters. We also explored an iterative method in which, under certain conditions, successive reclassifications could incrementally improve the quality of any misclassified resonance sequence.