Optimizing Exoplanet Detection: A Comparison of Neural Networks and Traditional Machine Learning Models on Light Curve Data

Field, Warren (School: Chagrin Falls High School)

The growing need for efficient and accurate detection of exoplanets, especially with limited datasets, presents a significant challenge in the field of astronomy. This project analyzes the accuracy of neural networks when compared with traditional machine learning models in detecting exoplanets from light curve data. The purpose of this project is to address a gap in research by identifying the most effective AI model for this task. Each model is optimized, but only using preset parameter options. This ensures fair adjustments across all models. Data is obtained from the NASA Exoplanet Archive, and the results are analyzed using graphs to easily visualize trends. The findings revealed that the Decision Tree classifier (a traditional model) achieved the highest accuracy. Even with an 80/20 to 20/80 data split, it retained an accuracy of over 99%. Whereas the worst performing neural network's accuracy dropped from 74% to 52%. These results support my hypothesis that traditional models perform better with smaller datasets. Due to limitations in the amount of data the can be accessed at one time it is paramount for the data to reflect real world data limitations. These results enhance exoplanet detection while using limited data, saving time and enabling scientists to focus on studying discovered exoplanets rather than identifying them. Improving detection efficiency contributes to the advancement of our understanding of the universe and supports the search for potentially habitable planets.

Awards Won: