Adding Kepler Data to a TESS Exoplanet Classification Model: A Novel Approach in Exoplanet Classification Utilizing Deep Learning

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In automated exoplanet classification utilizing transit photometry data and deep learning, there is a disparity in the performance and training data of TESS models compared to Kepler models. A novel approach of adding Kepler data to a TESS model is evaluated to improve the performance and accuracy of TESS exoplanet classification. Kepler and TESS light curves were sourced from the NASA Exoplanet Archive and Mikulski Archive for Space telescopes and then preprocessed. A convolutional neural network was chosen as the classification model. The models with the addition are identical to those without, except for the addition of Kepler data to the training set. Models were trained and then evaluated using machine learning performance metrics. Compared to the models without the addition (average accuracy of 0.973, recall 0.161, precision 0.600, AP 0.388, PR AUC 0.383, ROC AUC 0.949), the models with the addition had an improved performance (accuracy 0.975, recall 0.183, precision 0.739, AP 0.420, PR AUC 0.415, ROC AUC 0.941). When applied to recent TESS Sector 55, the models with the addition had more accurate predictions with much greater confidence and less standard deviation than those without. This study showed that adding Kepler data to a TESS exoplanet classification model increases performance. The approach also produces higher-quality predictions when applied to new sectors. Further experimentation will introduce further transit photometry data as model parameters and apply independent hyperparameter optimization.

Awards Won:
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