ABSTRACT

The increasing volume and variety of astronomical data, particularly spectral data, have made spectrum analysis for calculating single-star stellar parameters less efficient. To address this issue, a Convolutional Neural Network (CNN) architecture named StarNet was developed. This research focuses on optimizing StarNet's hyperparameter combinations using the Komodo Mlipir Algorithm (KMA) to enhance model performance.

Hyperparameter optimization was performed using three different KMA population configurations (n=5, n=10, and n=15) over 10 iterations. Spectral data from APOGEE DR17 was divided into training and testing datasets. KMA was implemented to search for optimal hyperparameter combinations represented as real number vectors within a 0-1 range. The best hyperparameter combinations were evaluated using Mean Square Error (MSE), Root Mean Square Error (RMSE), and residual plots.

The results show that KMA with n=15 achieved the best performance for predicting surface gravity (log g) and metallicity ([M/H]) with accuracies of ±8.4% and ±4.48% respectively. For equatorial rotational velocity (v sin i), KMA n=10 achieved the best accuracy of ±3.74%. Although the standard model still outperformed in effective temperature (Teff) prediction, KMA n=15 showed significant improvement with an accuracy of ±6.01% compared to other KMA configurations. However, systematic bias in extreme ranges remains a challenge for all KMA variants.

Keywords: *hyperparameter, CNN, starnet, KMA, optimization, stellar parameters*