

## **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  $\pm 8.4\%$  and  $\pm 4.48\%$  respectively. For equatorial rotational velocity ( $v \sin i$ ), KMA  $n=10$  achieved the best accuracy of  $\pm 3.74\%$ . Although the standard model still outperformed in effective temperature ( $T_{\text{eff}}$ ) prediction, KMA  $n=15$  showed significant improvement with an accuracy of  $\pm 6.01\%$  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*