DEEP LEARNING FOR CLASSIFICATION OF LONG-PERIOD VARIABLE STARS IN THE LOCAL GROUP

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The rapid growth of photometric data for variable sources in the past few years has solidified the need for their automated classification. In this paper, we apply different neural network architectures (1D-convolutional NNs, one- and bidirectional recurrent NNs using GRUs and LSTM cells) and architecture augmentation techniques (residual networks – He et al., 2016, Inception blocks – Szegedy et al., 2015 and self-attention – Vaswani et al., 2017) to data obtained by the synoptic survey of M33 (Pellerin & Macri, 2011). In addition, we use the WISE, OGLE-III and Gaia catalogs as controls to validate the research methods.

We take raw multi-band light curves as input and produce classification probabilities as output. We focus on long-period variable stars – Cepheids, RR Lyrae, Miras and eclipsing variables. We compare the performance of the deep learning models to traditional classifiers – linear models and random forests in terms of classification performance and computational complexity.

The analysis shows that neural networks have comparable or better performance to standard machine learning techniques. In addition, they need minimal to no data preprocessing which enables their application to very large datasets with little scientist intervention.

References

Carrasco-Davis, R. et al.: 2019, *Publications of the Astronomical Society of the Pacific*, **131**, 1004, pp. 108006.
Osborn, H. P. et al.: 2020, *A&A* 633 (2020): A53.
Pasquet, J. et al.: 2019, *A&A* 627, id.A21, p. 15.
Pellerin A, Macri, LM. 2011. ApJS 193.2 (2011): 26.
Szegedy, C. et al.: 2015, *2015 CVPR*, pp. 1-9.
He, K. et al.: 2016, *2016 CVPR*, pp. 770-778.
Vaswani, A. et al.:2017. CoRR abs/1706.03762.