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Predicting the Ages of Galaxies with an Artificial Neural Network

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We present a new method of predicting the ages of galaxies using an artificial neural network (ANN) with an evaluation of the methods such that future work can be derived for other properties of galaxies with ANNs. Ideally, we would be able to quickly and accurately determine individual properties of galaxies such as age on a large scale for use in studies. However, we currently rely on time consuming and computationally heavy traditional modelling to estimate many properties at a time. This means smaller studies that only require one or two properties are limited to the galaxies that have already been surveyed and modelled. To circumvent this simple machine learning models such as ANNs could be used to predict one or two properties on large samples of galaxies.

We train our ANN to recognise the patterns between the equivalent widths of spectral indices and the mass-weighted ages of galaxies estimated by the MAGPHYS model in data release 3 (DR3) of the Galaxy and Mass Assembly (GAMA) survey. We provide a discussion of the process of optimising our hyperparameters to increase the accuracy of our predictions with Tensorflow and Keras capabilities to provide an accessible method for future studies to build on.

We quantify the quality of our predictions by calculating the mean squared error as 0.02, mean absolute error as 0.11, R-squared score as 0.53 and presenting prediction uncertainties which show our network performs well. Finally, we describe how the predictions are physically motivated as they follow trends already present in the properties and EWs of the galaxies which shows the network is able to meaningfully derive age from the EWs of galactic spectra.

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