

A neural network for simultaneous classification and redshift estimate of galaxies

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Introduction

Modern galaxy surveys aim to answer open questions in observational cosmology and understand galaxies' formation, evolution, physical and environmental properties.

Neural networks are versatile supervised machine learning tools capable of using input data from different sources (text, tables, images, and videos) for solving regression or classification problems.

We present a neural network that performs simultaneous morphological classification and redshift estimates from broadband photometry [1].

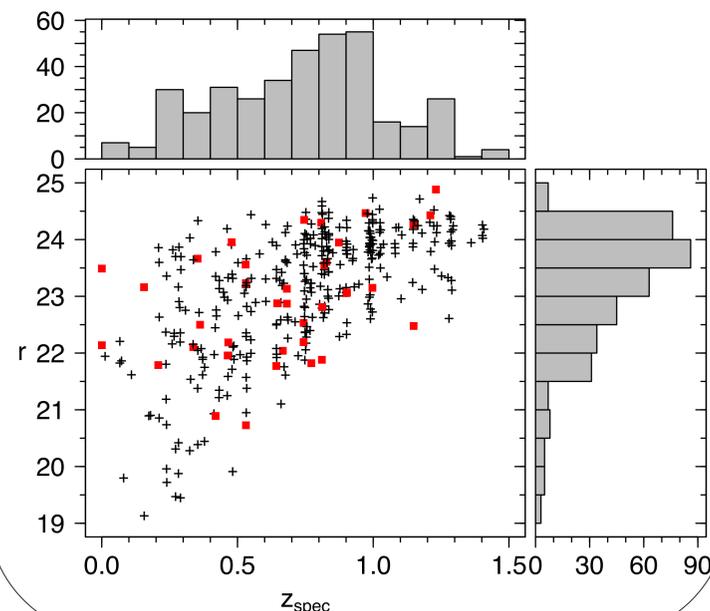
Methodology

- High-level neural networks *Keras* APPI [2] to design the network.
- *Leave-One-Out* cross-validation: each galaxy is used once as a test set while the remaining galaxies form the training set.

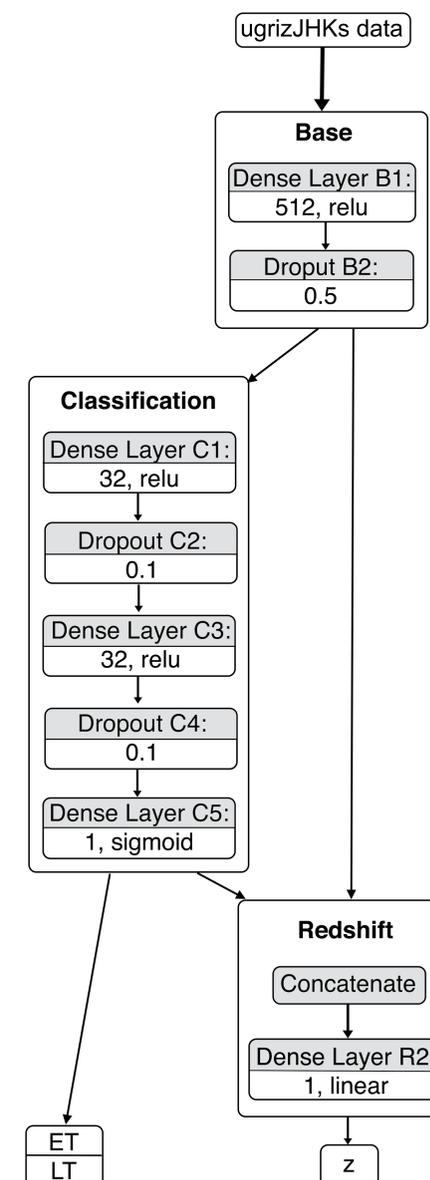
Data

The dep emission-line OTELO Survey was carried out with the OSIRIS Tunable Filters instrument at the 10.4 m Gran Telescopio Canarias (GTC). The OTELO catalog [3] includes ancillary data from Chandra, GALEX, CFHT, WIRDS, and IRAC.

Our sample (see figure below) consists of 370 galaxies with morphological classification [4], and spectroscopic redshifts available at the DEEP2 Galaxy redshift survey [5].



Neural network

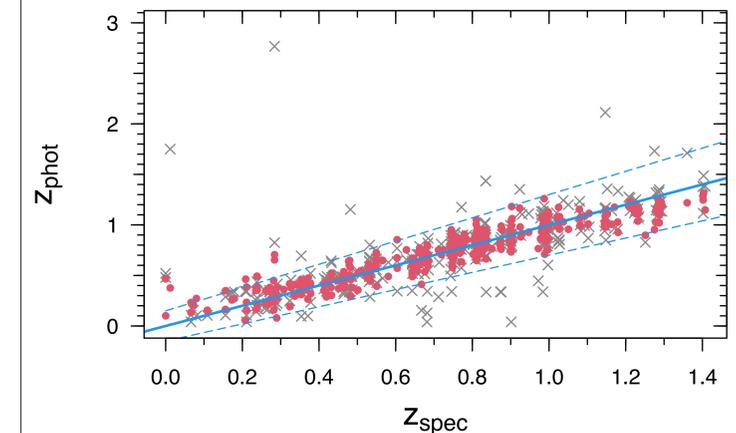


Results

OTELO \ NN	Early Type	Late Type	Sum
Early Type	28	3	31
Late Type	3	336	339
Sum	31	339	370

Classification contingency table

Accuracy 98.4%



Photometric vs spectral redshifts

Gray crosses: SED fitting

Red circles: Neural network fitting

References

1. de Diego et al. 2021, A&A in press
2. Chollet 2021, Manning Publications
3. Bongiovanni et al. 2019, A&A 631, A9
4. Nadolny et al. 2021, A&A 647, A89
5. Newman et al. 2013, ApJSS 208, 5N