J/MNRAS/486/1377 Photometric SFR using machine learning (Delli Veneri+, 2019)

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Star formation rates for photometric samples of galaxies using

machine learning methods.

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ADC_Keywords: Galaxies, photometry ; Redshifts

Keywords: methods: data analysis - techniques: photometric - catalogues -

galaxies: distances and redshifts - galaxies: photometry

Abstract:

Star formation rates (SFRs) are crucial to constrain theories of galaxy formation and evolution. SFRs are usually estimated via spectroscopic observations requiring large amounts of telescope time. We explore an alternative approach based on the photometric estimation of global SFRs for large samples of galaxies, by using methods such as automatic parameter space optimisation, and supervised machine learning models. We demonstrate that, with such approach, accurate multiband photometry allows to estimate reliable SFRs. We also investigate how the use of photometric rather than spectroscopic redshifts, affects the accuracy of derived global SFRs. Finally, we provide a publicly available catalogue of SFRs for more than 27 million galaxies extracted from the Sloan Digital Sky Survey Data Release 7. The catalogue will be made available through the Vizier facility.

Description:

This catalogue contains SFRs for 27,513,324 galaxies of the SDSS-DR7.

To produce the catalogue, we started by querying the Galaxy View4 of

the SDSS-DR7 for all the needed photometric features of galaxies with a "good" photometry (see PhotoFlags) and containing no Missing Values. We then applied the magnitudes cuts of our knowledge base (in order to keep the photometric features within the ranges of our knowledge base) and cross-matched the resulted data set with the photoz catalogue derived by Brescia et al. (2014b), in order to use them as a quality flag. The final catalogue contains the following columns:

Identifiers: dr9objid, objid, ra, dec, i.e. respectively, the object identifier in the SDSS DR9 and DR7 and their ascension and declination coordinates;

Quality flags: photoz and Quality_Flag, i.e. the photometric redshifts measured by Brescia et al. (2014b) and the associated flag. The Quality_Flag can assume three values 1, 2, and 3; 1 stands for the best photo-z accuracy, 2 and 3 for decreasing accuracy;

SFR: It is computed by the MLPQNA model with the 32 best features selected by the PHILAB method (excluding redshifts).

In order to select only SFRs with high-quality (i.e. only select sources inside the training set parameter space constrains), the user should impose photoz=0.33 and Quality_Flag=1. This is due by considering that in our knowledge base there are only objects with spectroscopic redshift less than 0.33, thus we are able to predict SFRs only for objects within such redshift range. These constraints will select ~6.6 million objects. Since we do not have any spectroscopic redshifts for the catalogue objects, we must use photometric redshifts (where available) to perform these cuts. Nevertheless using photometric redshifts instead of spectroscopic ones may introduce some contamination in the catalogue, i.e. a source may

be inside the photoz=0.33 cut when in reality it has a spectroscopic redshift higher than 0.33. To estimate the number of such contaminants, we verify that among the 871 784 objects with photoz=0.33 and a spectroscopic redshift only ~1.33 per cent resulted to have a true redshift higher that 0.33.

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
catalog.dat	80	27513324	SFR Catalogue

See also:

J/A+A/568/A126 : SDSS-DR9 photometric redshifts (Brescia+, 2014)

Byte-by-byte Description of file: catalog.dat

Bytes	Format	Units	Label	Explanations
1- 19	I19	---	dr9objID	SDSS-DR9 objID
21- 38	I18	---	objID	SDSS-DR7 objID
40- 49	E10.6	deg	RAdeg	[] Right Ascension (J2000)
51- 60	E10.6	deg	DEdeg	Declination (J2000)
62- 69	E8.6	---	photoz	Photometric redshift measured by Brescia et al. (2014, Cat. J/A+A/568/A126)
71	I1	---	Qual	[0/3] Quality Flag from Brescia et al. (2014, Cat. J/A+A/568/A126) (1)
73- 80	F8.4	[yr-1]	SSFR	Photometric Star Specific Formation Rates, in -log((Mass/Msun)*(1/yr)) unit

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Note (1): Quality flag as follows:

1 = high accuracy

2 = lower accuracy (medium)

3 = lower accuracy (low)

0 = none

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