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Predicting the redshift of gamma-ray loud AGNs using supervised machine learning

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AGNs are very powerful galaxies characterized by extremely bright emissions coming out from their central massive black holes. Knowing the redshifts of AGNs provides us an opportunity to determine their distance to investigate important astrophysical problems such as the evolution of the early stars, their formation along with the structure of early galaxies. The redshift determination is challenging, because it requires detailed follow-up of multiwavelength observations, often involving various astronomical facilities. Here, we employ machine learning algorithms to estimate redshifts from the observed γ-ray properties and photometric data of gamma-ray loud AGN from the Fourth Fermi-LAT Catalog. The prediction is obtained with the Superlearner algorithm, using LASSO selected set of predictors.
We obtain a tight correlation, with a Pearson Correlation Coefficient of 71.3% between the inferred and the observed redshifts, an average Delta_z_norm = 11.6*10^{-4}, where Delta z_norm : (z_{spetroscopic} - z_{predicted})/(1+z_{spectroscopic}) and sigma_{NMAD} = 0.192, where sigma_{NMAD} : 1.48*median|Delta z_{norm}|. We stress that notwithstanding the small sample of γ-ray loud AGNs, we obtain a reliable predictive model using Superlearner, which is an ensemble of several machine learning models.

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