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Machine learning for star parametrization

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An increasing amount of photometric data are made available by multiple large photometric surveys such as GAIA, SDSS, SKYMAPPER, among others. While the large statistical samples available from these catalogs are fundamental for astronomical analyses, parameters estimates (such as temperature, metallicity, or gravity) are difficult to obtain due to the limited reliability of analytical methods applied to photometric data. The Survey of Surveys (Tsantaki et al. 2022) makes a huge contribution in homogenizing high- and intermediate- resolution spectroscopic surveys like APOGEE, GALAH, Gaia-ESO, LAMOST, and RAVE, and provides one of the largest catalogs of radial velocities to date. With similar methods, it also provides a catalog of stellar parameters for a few million stars with uncertainties of about 150 K in temperature, 0.2 dex in surface gravity, and 0.1 dex in metallicity. We made use of this huge dataset of homogenized measurements to train our machine learning algorithms to compute temperature, metallicity, and gravity from photometric data and thus provide spectroscopic-quality estimates for the above quantities on a large sample of stars. At the moment, we in fact obtain performances that are very similar to the uncertainties of the spectroscopic catalog used for the training. We aim to develop a tool that can be applied to the largest possible collection of photometric catalogs in order to map the largest sample of stars in our galaxy.

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