Unifying large-scale spectroscopy, astrometry, and photometry with Convolutional Neural-Networks.

Guillaume Guiglion*[1]

[1]Leibniz-Institut für Astrophysik Potsdam (AIP) – An der Sternwarte 16, 14482 Potsdam, Germany

Abstract

In the context of large Milky Way spectroscopic surveys such as GALAH, APOGEE or RAVE, machine-learning tools are key in parameterizing precisely millions of spectra in a short time. We show that a Convolutional-Neural-Network-based approach (CNN) offers a unique way of combining spectroscopic, photometric and astrometric data smoothly. We adopted atmospheric parameters and chemical abundances from APOGEE DR16 for the training set labels, and used part of the intermediate-resolution RAVE DR6 spectra set (R_~7500) overlapping with APOGEE DR16 data set. We derived precise atmospheric parameters and chemical abundances for more than 400000 RAVE spectra. Incorporating broad-band WISE and 2MASS photometry and Gaia DR2 photometry and parallaxes as an extra set of constraints allows us to improve the results drastically, compared to RAVE standard spectrocopic pipeline. The developed procedure gives very good insights for the large-scale surveys Gaia RVS, WEAVE, and 4MOST.
Video: https://youtu.be/yTWdC8Ibvvg
Poster: in PDF

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*Speaker