Contributed Talk

Splinter E-Science

Probabilistic photometric redshift derivation from multi-band imaging data

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The need to analyze the available large synoptic multi-band surveys drives the development of new data-analysis methods. Photometric redshift estimation is one field of application where such new methods improved the results, substantially. Up to now, the vast majority of applied redshift estimation methods utilize photometric features. We propose a method to derive probabilistic photometric redshift directly from multi-band imaging data, rendering pre-classification of objects and feature extraction obsolete. A modified version of a deep convolutional network is combined with a mixture density network. The estimates are expressed as Gaussian mixture models representing the probability density functions (PDFs) in the redshift space. In addition to the traditional scores, the continuous ranked probability score (CRPS) and the probability integral transform (PIT) are applied as performance criteria. We adopt a feature based random forest and a plain mixture density network to compare performances on experiments with data from SDSS(DR9). It is shown that the proposed method is able to predict redshift PDFs independently from the type of source, e.g. galaxies, quasars or stars. Thereby the prediction performance is better than both presented reference methods and is comparable to results from the literature. The presented method is extremely general and allows the solving of any kind of probabilistic regression problems based on imaging data, e.g. estimating metallicity or star formation rate of galaxies. This kind of methodology is tremendously important for the next generation of surveys.