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Are classification metrics good proxies for science output?

Population-level transient studies dependent on light curve classifiers often use classification performance as a proxy for metrics of the physical parameters of interest. This strategy allows a complete separation between the relatively straightforward classification stage and the more computationally intensive science analysis, meaning that design decisions for each are made independently of one another. Nevertheless, to many scientific questions, these stages are not independent. We illustrate this effect using photometric classifications of type Ia supernovae in a cosmological application as a case study. We show the non-linear relation between proxy metrics (i.e. classification performance) and physically motivated metrics (i.e. discrepancies between posterior samples of the inferred dark energy equation of state parameter). Our experimental design uses the PLAsTiCC data set and archetypical mock classifiers to build light curve samples for a SN Ia cosmology analysis and evaluates multiple metrics of classification quality and cosmological parameter constraining power. We find that classification metrics are insensitive to nonuniform contamination by diverse transient populations, whereas the science metrics respond to the identity of the contaminants in addition to the rate of contamination. We thus urge caution when using classification metrics in place of metrics of the physical parameters of interest for any downstream study conditioned on classification results.

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