Separating Stars from Quasars: Machine Learning Investigation Using Photometric Data

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A problem that lends itself to the application of machine learning is classifying matched sources in the Galex (Galaxy Evolution Explorer) and SDSS (Sloan Digital Sky Survey) catalogs into stars and quasars based on color-color plots. The problem is daunting because stars and quasars are still inextricably mixed elsewhere in the color-color plots and no clear linear/non-linear boundary separates the two entities. Diversity and volume of samples add to the complexity of the problem. We explore the efficacy of neural network based classification techniques in discriminating between stars and quasars using GALEX and SDSS photometric data. Both sources have compact optical morphology but are very different in nature and are at very different distances. We have used those objects with associated spectroscopic information as our training-set and built neural network and ensemble classifiers that appropriately classify photometric samples without associated spectroscopic labels. Catalogs comprising of samples labelled using our classifiers can be further used in studies of photometric sources. The design of a novel Generative Adversarial Network (GAN) based classifier is proposed in the paper to tackle the classification problem. To evaluate the correctness of the classifiers, we report the accuracy and other performance metrics and find reasonably satisfactory range of 91-100 %.