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LSST AGN Data Challenge database: clustering and variability analysis of quasar light curves

Here we study the variability of quasar light curves found in the LSST AGN Data Challenge (LSST_AGN_DC), a dataset compiled from various catalogs for testing key aspects of active galactic nuclei (AGN) science with the Rubin Observatory Legacy Survey of Space and Time (LSST). The distributions of quasar parameters in large databases may show bimodality or multimodality, thus as preprocessing step it is necessary to cluster light curves according to their local topology.

For clustering quasar light curves we applied Self-Organizing Map (SOM). These clustered light curves were analysed by standard and modified structure functions. Inferred variability properties were checked on modeled light curves using a conditional neural process.

We detected 36 clusters of quasar light curves, each containing light curves of specific topology. The structure function analysis showed that each cluster has specific variability characteristics. For example, we detected one cluster of 300 quasars with low-variable light curves, which could be consistent with microlensing events on a long temporal time scale. Importantly, modeling light curves with the conditional neural process does not alternate variability characteristics of light curves, and it can be a vital tool for studying large datasets containing a significant population of microlensed quasars.

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