Deep Learning Engines for LSST AGN photometric reverberation mapping

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Exploring the transient optical sky (ETOS) is one of the four main science themes which drive the Rubin Observatory Legacy Survey of Space and Time (LSST) design (Ivezić et al. 2019). Our contribution is motivated by the ETOS LSST science opportunity #14 (see section 4, Ivezić et al. 2019), which enables the harnessing of LSST light curves of AGN for photometric reverberation mapping (Chelouche & Daniel 2012). Our goal is twofold: development of deep learning engines (DLEs) for non-parametric modeling of AGN light curves (DLE1) and implementation of photometric reverberation mapping procedure (DLE2), preparing them for the LSST usage. Here we present our progress report on the DLEs development. DLE1 is an artificial neural network already trained with several dozens of AGN ASAS-SN light curves of the Swift-BAT 9-month sample, and applied on synthetic photometric AGN data set (i.e., light curves simulated using a damped random walk process, Kovačević et al. 2021) and non-AGN datasets (e.g., light curves from LSST Data Preview 0), with possibility to be used for datasets from LSST AGN Data Challenge. Learned light curves will enable us to improve time-lag determination as a goal of photometric reverberation mapping. DLE2 is a Python code for extraction of time-lags from photometric AGN light curves based on pure photometric reverberation mapping principles. DLE1 and DLE2 are implemented in the Jupyter environment and will be available to the LSST community. Both DLEs are part of the SER-SAG LSST Directable In-kind software pre-operations activities.