

APPLICATION OF CONDITIONAL NEURAL FLOWS ON RECONSTRUCTION OF PHOTOMETRIC LIGHTCURVES OF ACTIVE GALACTIC NUCLEI

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ABSTRACT

Active galactic nuclei (AGN) exhibit stochastic variability in a wide range of timescales across the entire electromagnetic spectrum. These brightness variations carry information about the physical structure of the accretion flow and the coupling between the central ionizing source and the surrounding disk. Time-domain studies of AGN light curves are therefore an important tool for studying black-hole growth and accretion physics on otherwise unresolved scales. In photometric reverberation mapping, correlated variability between different bands is interpreted as the delayed and smoothed response of disk emission to a common driving signal, making multiband light curves a valuable probe of accretion-disk structure and inter-band time delays. However, the corresponding inverse problem is generally non-unique, since different combinations of latent drivers and response functions may produce similar observed light curves, especially under sparse cadence and noise. This makes uncertainty-aware probabilistic approaches particularly important for the interpretation of multiband quasar variability.

Here we present the application of Conditional Neural Flows (CNFs) to reconstruct missing light curve segments under realistic observational cadences. In contrast to approaches aimed at full simulator based inversion of reverberation mapping parameters, the goal of the present work is not to assume a unique recovery of the latent driving signal, but rather to examine whether CNFs can learn useful conditional distributions and informative latent representations from the incomplete multiband light curves. Our preliminary results show the capability of CNFs to be applied on forthcoming

large-scale surveys such as the Vera C. Rubin Observatory Legacy Survey of Space and

Time (LSST), which will deliver large numbers of irregularly sampled multiband AGN light curves.