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Time delay cosmography with a neural ratio estimator

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The latest measurements of the Hubble constant, H_0, by local probes like supernova and early Universe probes like the Cosmic Microwave Background are still at a ~5σ tension with each other. Time delay cosmography with strong gravitational lensing is one of the alternative independent methods that could shed light on this tension. The upcoming Legacy Survey of Space and Time should observe at least 3000 lensed quasars with well-measured time delays. However, analyzing this many systems with the traditional method is not feasible due to computational costs. Fortunately, machine learning methods provide an opportunity to accelerate this procedure.

Here, we discuss our ongoing work in estimating H_0 in a simulation-based inference framework using neural ratio estimators. This allows implicite marginalization over large sets of nuisance parameters, while providing an efficient way to estimate this low-dimensional variable. We discuss our simulation pipeline, the inference structure, show preliminary results on simulated data, and point to future directions and the challenges of applying the method to real data.

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