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# Towards a Likelihood-Free Inference Analysis of KiDS-1000 Cosmic Shear

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Cosmological weak lensing in the era of modern high-precision cosmology has proven itself to be an excellent probe of key parameters of the standard ΛCDM Model (Lambda Cold Dark Matter). However, the cosmological inference task of working with weak lensing data involves a complex statistical problem to solve within the likelihood function (Jeffrey et al. 2021). Likelihood-free inference (LFI) allows us to overcome the likelihood problem contained within the non-trivial stochastic modelling processes. For cosmic shear analysis however, it is a challenge to procure forward simulations that are both accurate and computationally optimised.

In this work, we propose to make use of a simulation pipeline that produce Pseudo-Cl cosmic shear observables as they contain a similar level of information as other probes (Loureiro et al. 2021) whilst being more efficient to calculate. We demonstrate the power of using a machine learning-based likelihood-free inference methodology in the form of the PyDELFI package by Alsing et al. (2019) combined with score compression to recover cosmological parameter posteriors that are as good as those inferred through traditional methods, but with a near 10 times reduction in necessary evaluations. We find that the performance of our chosen likelihood-free inference methodology is robust to both a poor choice of fiducial cosmology used in the score compression as well as poor compression through an inaccurate data covariance matrix.

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