CosmoPower: deep learning emulation of cosmological power spectra for accelerated Bayesian inference from next-generation surveys

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Abstract

Analysis of the two-point statistics of cosmological fields is one of the cornerstones of modern observational cosmology. For parameter inference pipelines involving power spectra (or their derived real-space counterparts, correlation functions) the computational bottleneck is given by running Boltzmann solvers like Camb or Class to compute theoretical power spectra for a given cosmology. In this talk I will present CosmoPower, a suite of neural cosmological power spectrum emulators that replace the computation of power spectra from Boltzmann codes, thus providing orders-of-magnitude acceleration for parameter estimation from two-point statistics analyses of Large-Scale Structure (LSS) and Cosmic Microwave Background (CMB) surveys. CosmoPower is showcased on a joint cosmic shear and galaxy clustering analysis from the Kilo-Degree Survey, as well as on a Stage IV Euclid-like simulated cosmic shear analysis. For the CMB case, CosmoPower is tested on a Planck 2018 CMB temperature and polarisation analysis. The emulators always recover the fiducial cosmological constraints with differences in the posteriors smaller than sampling noise, while providing a speed-up factor up to O(10^4) to the complete inference pipeline. This acceleration allows posterior distributions to be recovered in just a few seconds, as shown for the Planck likelihood case.
Slides: in PDF
Video: https://youtu.be/ADJIvU9MysI

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