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Emulation by committee: faster AGN fitting

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Neural network emulators are frequently used to speed up the computation of physical models in physics. However, they generally include only a few input parameters due to the difficulty of generating a dense enough grid of training data pairs in high dimensional parameter spaces. This becomes particularly apparent for cases where they replace physical models that take a long time to compute. We utilize an active learning technique called query by dropout committee to achieve a performance comparable to training data generated on a grid, but with fewer required training examples. We also find that the emulator generalizes better compared to grid-based training: We are able to suppress poor performance which occurs in particular areas of parameter space in grid-based training. Using these methods, we train an emulator on a numerical model of the accretion flow and emission of an accreting disk around a supermassive black hole in order to infer the physical properties of the black hole. Our neural network emulator can approximate the physical simulator to 1% precision or better and achieve 10^4 times speedup over the original model.

Primary author: RICKETTS, Benjamin (SRON)

Co-authors: Dr INGRAM, Adam (Newcastle University); Dr HUPPENKOTHEN, Daniela (SRON); Dr MAS-TROSERIO, Guglielmo (INAF); Dr LUCCHINI, Matteo (University of Amsterdam)

Presenter: RICKETTS, Benjamin (SRON)

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