DEEP BACKWARD AND GALERKIN METHODS FOR LEARNING FINITE STATE MASTER EQUATIONS

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Abstract. We study two methods designed to efficiently solve high-dimensional PDEs in the setting of mean field master equations. Such master equations are independently interesting because they fully characterize the value of a game with a large number of players and have a myriad of applications in economics, finance, epidemiology, and more. The first method we explore is the deep backward dynamic programming (DBDP) method-we derive BSDEs for the master equation along some exploratory process and use this structure to train neural networks to approximate the master equation solution. Then we revisit the deep Galerkin method (DGM) as applied to the master equation and compare the efficacy of the two methods. This is joint work with Asaf Cohen and Ethan Zell (University of Michigan, Ann Arbor).

Keywords: mean field games, master equation, deep learning, backward dynamic programming, deep Galerkin method

Mathematics Subject Classifications (2010): 49N70, 91A13, 91A15, 65N12, 62M45

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