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	authors: S. Yagiz Olmez; Amirhossein Taghvaei; Prashant G. Mehta title: Deep FPF: Gain function approximation in high-dimensional setting. publication_date: 2020-10-02 00:00:00 source: SupportedSources.OPENALEX journal: arXiv (Cornell University) volume: doi: None urls: https://openalex.org/W3091018929 id: id8456154421871721734 abstract: versions:	authors: S. Y. Olmez; A. Taghvaei; P. Mehta title: Deep FPF: Gain function approximation in high-dimensional setting publication_date: 2020-10-02 00:00:00 source: SupportedSources.SEMANTIC_SCHOLAR journal: volume: doi: 10.1109/CDC42340.2020.9304260 urls: https://www.semanticscholar.org/paper/feff821dbfeba3e03abb17ae976821bd5a33c373 id: id8901758427847280178 abstract: In this paper, we present a novel approach to approximate the gain function of the feedback particle filter (FPF). The exact gain function is the solution of a Poisson equation involving a probability-weighted Laplacian. The numerical problem is to approximate the exact gain function using only finitely many particles sampled from the probability distribution.Inspired by the recent success of the deep learning methods, we represent the gain function as a gradient of the output of a neural network. Thereupon considering a certain variational formulation of the Poisson equation, an optimization problem is posed for learning the weights of the neural network. A stochastic gradient algorithm is described for this purpose.The proposed approach has two significant properties/advantages: (i) The stochastic optimization algorithm allows one to process, in parallel, only a batch of samples (particles) ensuring good scaling properties with the number of particles; (ii) The remarkable representation power of neural networks means that the algorithm is potentially applicable and useful to solve high-dimensional problems. We numerically establish these two properties and provide extensive comparison to the existing approaches. versions:	DUPLICATES	268