A dual proximal-gradient approach for variational mean field games

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In this talk, we provide a new algorithm to approximate equilibria of variational mean field game systems (MFG) with local couplings. Under suitable conditions on the coupling function, the dual of the variational formulation of the MFG reduces to the minimization of the sum of a proper convex lower semicontinuous function and a differentiable convex function whose gradient satisfies a locally Lipschitz-type condition. In this context, we provide a generalization of the proximal-gradient (or forward-backward) splitting algorithm for tackling the dual problem. We prove the convergence of our method and derive a linear convergence rate when the differentiable function is locally strongly convex. We recover classical results in the case when the gradient of the differentiable function is globally Lipschitz continuous and an already known linear convergence rate when the function is globally strongly convex. Compared with some benchmark algorithms to solve these problems, our numerical tests show similar performances in terms of the number of iterations but an important gain in the required computational time.

We refer the reader to [BASY23] for more details.

[BASY23] Luis M. Briceno-Arias, Francisco José Silva, and Xianjin Yang. Forward-backward algorithm for functions with locally lipschitz gradient: applications to mean field games, 2023. https://arxiv.org/abs/2306.16047.