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Viscosity solutions of a class of second-order Hamilton-Jacobi-Bellman Equations in the Wasserstein Space

The talk is about solving a class of second-order Hamilton-Jacobi-Bellman (HJB) equations in the Wasserstein space, arising from mean field control problems involving common noise. We provide the well-posedness of viscosity solutions to the HJB equation in the sense of Crandall-Lions' definition, under general assumptions on the coefficients. Our approach adopts the smooth metric developed by Bayraktar, Ekren, and Zhang [Proc. Amer. Math. Soc.(2023)] as our gauge function for the purpose of smooth variational principle used in the proof of comparison theorem. Subsequently, we derive further estimates and regularity of the metric, including a novel second-order derivative estimate with respect to the measure variable, in order to ensure its uniqueness and existence. The talk is based on joint work with Hang Cheung and Ho Man Tai.