DOI: doi.org/10.47363/JAICC/TechFusion2025/2025(4)1

TechFusion 2025 - AI, Cybersecurity, and Emerging Trends in Computer Sciences

Conference Proceedings November 27-28, 2025 - Singapore

On the Convergence of the Euler-Maruyama Scheme for McKean-Vlasov SDEs

Song Xuanye

Research Fellow at Nanyang Technological University - NTU Singapore

Abstract:

On the convergence of the Euler-Maruyama scheme for McKean-Vlasov SDEs: Building on the well-posedness of the backward Kolmogorov partial differential equation in the Wasserstein space, we analyze the strong and weak convergence rates for approximating the unique solution of a class of McKean-Vlasov stochastic differential equations via the Euler-Maruyama time discretization scheme applied to the associated system of interacting particles. We consider two distinct settings. In the first, the coefficients and test function are irregular, but the diffusion coefficient remains non-degenerate. Leveraging the smoothing properties of the underlying heat kernel, we establish the strong and weak convergence rates of the scheme in terms of the number of particles N and the mesh size h. In the second setting, where both the coefficients and the test function are smooth, we demonstrate that the weak error rate at the level of the semigroup is optimal, achieving an error of order $N^{-1} + h$.