

How diffusion models for AI can be optimized by path probability of random dynamics?

Taha Bekbachi, Manuel Clergue, Alexandre Q Wang

ESIEA lab, SCIQ and LDR,

ESIEA, 74 bis Avenue Maurice Thorez, Ivry sur Seine

bekbachi@et.esiea.fr, manuel.clergue@esiea.fr, alexandre.wang@esiea.fr

Abstract *This work explores the possibility of optimizing the process of generative diffusion models using a path probability which is the real expression of the complex quantum propagator of Dirac-Feynman in an imaginary spacetime. The first part of this work is a study of the quantum propagator in its real version as a path probability. We show how to obtain it using a mechanics action calculated in an imaginary spacetime. Then we perform numerical experiments of random motion of Hamiltonian systems in order to verify the exponential dependence of the path probability on action. In the second part, we define an action function for diffusion process and propose an action-based generative model in order to apply the least action principle (or maximum path probability) to the denoising diffusion models. The quality of the obtained samples is compared to the samples generated by the different usual models.*

Keywords. AI, generative diffusion models, random dynamics, path probability, path information, quantum propagator

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