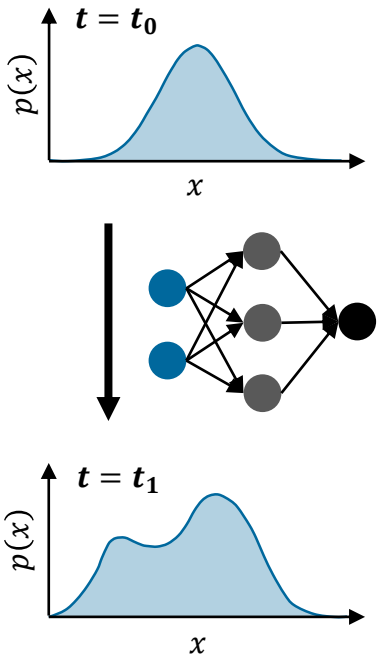
Neural Network-based Solution of the Fokker-Planck Equation

TECHNISCHE UNIVERSITÄT DARMSTADT

Project Seminar Topic (2 – 4 Persons)

A Gaussian process (GP) defines a Gaussian probability distribution over a function space and can be used to probabilistically model unknown system dynamics. As GPs output probability distributions, recursive model evaluations mean to repeatedly propagate a probability distribution through the (in general) nonlinear model. The resulting distributions are analytically intractable. Usually, the distribution is then approximated by a Gaussian, whereat no guarantees on the approximation quality can be provided.

Alternatively, a GP can be formulated as a stochastic differential equation. The exact temporal evolution of the distribution is then described by the associated Fokker-Planck equation, a partial differential equation, which needs to be solved efficiently. In recent years, neural network-based solvers have shown to be suited for this task. Thus, within the scope of this work, such a neural network-based solver is to be implemented for the Fokker-Planck equation and to be compared with other approaches. This work involves the design of neural networks, the generation of training data by solving the Fokker-Planck equation numerically, the training of the neural network on the PDE‘s solution and the implementaiton of other PDE solution strategies for comparison.



The following prerequisites will be useful for the project:

Experience with:	Partial differential equations, neural networks
Programming skills:	Python
Language:	German or English

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