TECHNISCHE UNIVERSITÄT DARMSTADT

Fachbereich 18
Elektrotechnik und
Informationstechnik

Institut für Nachrichtentechnik

Self-Organizing Systems

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Bachelor/Master thesis
Solving Hamilton-Jacobi-Bellman equations using Physics Informed Neural Networks

This thesis investigates the application of Physics-Informed Neural Networks (PINNs) to solve Hamilton-Jacobi-Bellman (HJB) equations, arising in continuous time Reinforcement Learning (RL) and optimal control problems. HJB equations, derived from dynamic programming, are essential for determining optimal policies but are challenging to solve as they are nonlinear partial differential equations (PDEs). Traditional numerical methods, such as finite element methods, often face scalability and efficiency issues in high-dimensional contexts. PINNs leverage the power of deep learning by embedding the physical laws governing these equations directly into the neural network training process. Recent advancements in deep learning have shown that PINNs can effectively solve complex PDEs. This thesis aims to implement and evaluate PINNs for efficiently solving HJB equations, offering a scalable and accurate framework for optimal decision-making in continuous time RL and control scenarios.

Some of the following may help:

- Good Python skills, preferably in pyTorch
- Deep Learning Expertise

For further information, please contact Yannick Eich.