Mokai Pan

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Education

ShanghaiTech University *Shanghai*

Undergraduates, Major: Computer Science Sep. 2021 - Present

- GPA: 3.64 / 4.0
- Relevant Course:
  Mathematical Analysis I & II : A
  Probability and Statistics I: A+
  Introduction to Machine Learning: B+
  Numerical Optimization: A
  Convex Optimization: A
  Computational Science and Engineering: A
  Fundamentals of Information Theory: A+

Skills

Programming C, C++,Java, Python

Drawing & Typesetting Office, LaTeX

Languages Chinese (Native), English (fluent)

Selected Research & Projects

UniDB: A Unified Diffusion Bridge Framework via Stochastic Optimal Control *Shanghai*

A Unified Diffusion Bridge Model Nov. 2024 - Feb. 2025

- We introduce UniDB, a novel unified diffusion bridge framework based on stochastic optimal control. This framework generalizes existing diffusion bridge models like DDBMs and GOUB, offering a comprehensive understanding and extension of Doob's h-transform by incorporating general forward SDE forms.
- We derive closed-form solutions for the SOC problem, demonstrating that Doob's h-transform is merely a special case within UniDB when the terminal penalty coefficient in the SOC cost function approaches infinity. This insight reveals inherent limitations in the existing diffusion bridge approaches, which UniDB overcomes. Notably, the improvement of UniDB requires minimal code modification, ensuring easy implementation.
- UniDB achieves state-of-the-art results in various image restoration tasks, including super-resolution (DIV2K), inpainting (CelebA-HQ), and deraining (Rain100H), which highlights the framework's superior image quality and adaptability across diverse scenarios.

Course Projects in Convex Optimization *Shanghai*

Reproduction of Deep Declarative Networks May. 2024 - Jun. 2024

- The research reproduces the node of Deep Declarative Networks, discusses their theoretical foundations and tests the performance on the mini-ImageNet and point cloud dataset. By leveraging the implicit function theorem, DDNs enable gradient back-propagation through declaratively defined nodes, facilitating end-to-end learning.
- Reconstruct some equations into unconstrained or constrained optimization problem and solve the optimization problem through the KKT conditions and compute gradients.
- Reproduce the test of the comparisons between DNN's running time and memory consumption and the normal networks.
- Explore the Deep Declarative Networks' application potential: use the node of DDNs to solve the hyperparameter optimization of the Ridge Regression Models which can be rebuild as a bi-level problem and tests the performance of the algorithm on common datasets like Iris and Diabetes dataset.

Extracurricular Activities

Shanghai International Marathon *Shanghai*

Volunteer Nov. 27 2022

Awards and Honors

Nov. 2021 **Contest**: Second Prize in "Chinese Mathematics Competitions" *Shanghai*

Nov. 2022 **Contest**: Second Prize in "Chinese Mathematics Competitions" *Shanghai*

Nov. 2023 **Contest**: Second Prize in "Chinese Mathematics Competitions" *Shanghai*