HAOYU HAN

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EDUCATION

University of Science and Technology of China (USTC) *09 / 2020 - 07 / 2024(expected)*
B.S., Major in Information and Computational Science(Computational Math)
Overall GPA: 4.02/4.30

Relevant core courses: Mathematical Analysis(A+), Data Structures and Database(A+), Differential Equations(A+), Linear Algebra, Numerical analysis(A+), Numerical algebra(A+), Finite Element Method, Computer Graphics(A+), Deep Learning

Harvard University *07 / 2023 - 12 / 2023*
Visiting intern in Computational Robotics Lab, advised by Professor Heng Yang.

PUBLICATIONS

[1] **Haoyu Han**, Heng Yang. **On the Geometry of the Optimal Value Function of Infinite-Horizon Pendulum Swing-up**. In preparation.

[2] Hugo Buurmeijer, **Haoyu Han**, Christian Chan, Robert Wood, Heng Yang. **High-Gain Observer Design for State Estimation of Flapping-Wing Robot using Learned Dynamics**. In preparation.

RESAERCH EXPERIENCE

Computation and Analysis on Optimal Control of Pendulum[1] Harvard University
Individual Contributor Advisor: Prof. Heng Yang *August 2023 - Present*

- The first Successfully calculated the cost-to-go function of the pendulum with an HJB error under 1e-4, both with and without control constraints, employing a novel contour line methodology and Pontryagin's maximum principle (PMP).
- Discovered a non-smooth spiral line in the cost-to-go function, meticulously calculated its geometry, and rigorously proved its existence using symmetry and ODE theory.
- Revealing a 'quasi-discontinuous' line in certain regions, with a unilateral inverse proportional growth rate and analysed its properties using viscosity solution theory.
- Compared with other optimal cost-to-go functions, achieved superior results, and further guided the neural network to attain enhanced performance.

Residual Dynamics and Observer Design for Robot Bee[2] Harvard University
Co-Contributor Advisor: Prof. Heng Yang *July 2023 - August 2023*

- Transformed the dynamics of various systems including cartpole, arcbot, and 3D rigid-body into high-gain standard form, and successfully implemented the high-gain observer in MATLAB.
- Established a tighter bound for the high-gain observer using AM-GM inequality and demonstrated its superior performance.
- Proved an error bound and convergence for residual dynamics through network.
- Conducted experiments on real robots and demonstrated that the observer error lower than the established bound.

Cloth Shadow Art USTC
Indivisual Contributor Advisor: Prof. Ligang Liu *March 2023 - July 2023*

- Aimed at using differential simulation to design a square fabric with a arbitrary hole in it. Optimized the hole such that, under certain given inputs (e.g., control or wind), the dynamic shape of the hole matches a cartoon character.
- Implemented the Finite Element Method (FEM) for cloth simulation in C++ using libigl, including StVK, ARAP, and bending energy models. The first computed the full Hessian, including the differentiation of 3D-2D projection.

- Implemented various simulation methods including Implicit Euler, Explicit Euler, Projective Dynamics (PD), PBD in C++. Conducted a comparative analysis among them, concluded that FEM is the most authenticity.
- Optimized a simple example of a waving wing and rendered a video.

PROJECTS

Reproduce Several projects in computer graphics USTC

- Reproduce several papers using C++ such as possion image edit, ARAP/ASAP, fast simulation,path-tracing,shader,etc.

Reproduce Several projects in computer vision USTC

- Reproduce several papers using C++ and MATLAB such as Nerf, camera calibration , video stabilization , image stitching etc.
- Did a survey on image generation through GAN.

Kaggle competition: Natural Language Processing with Disaster Tweets USTC

- Successfully fine-tuned the BERT model for disaster verification tasks using Pytorch with kaggle rank 134/1289.
- Applied parameter freezing in conjunction with Ensemble Learning for enhanced model performance.

SKILLS

English	TOEFL 101(R27/L26/S23/W25)
GRE math subject	910(94%)
Computer Languages	C , C++ , C# , Java
Tools	LaTeX, Matlab , Mathematica , pytorch, Unity , QT , OpenCV , MarkDown

AWARDS

China National Scholarship(highest Scholarship from Ministry of Education of China)	*09/2022*
The China Optics Valley Scholarship	*09/2023*
Outstanding Student Scholarship Grade 2(Top 10%)	*09/2021*
Endeavor Scholarship	*09/2021*
Outstanding Freshman Scholarship	*09/2020*

EXTRACURRICULAR

member of USTC Programming club , USTC paper folding club	*09/2020 - Present*
member of Student Union of School of the Gifted Young	*09/2020 - 09/2021*
DIY an AR glass and a light cube	*09/2020*