Haoyi Gu

CPC Member

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Education

Nanjing University Intelligent Science and Technology *Sept.2022–Present*

- **GPA: 4.40/5** **IELTS: 6.5** **CET-6: 579**
- **Top Honor**: **National 2nd Prize** in Mathematics Competition of Chinese college students 2024.
- **Core Courses**: Programming Training (99)、Deep Learning (98)、Machine Learning (95)、Operating System (95)、Advanced Programming (94.6)、Mathematical Logic (94)、Calculus (93)、Data Thinking (93)、 Linear Algebra (92)、 Multi-Agent System and Reinforcement Learning (92).
- **Professional Skills**: Experienced in Python, C/C++, and MATLAB. Demonstrated ability in algorithm reproduction and engineering implementation. Extensive experience with PyTorch, along with familiarity with Diffusers, Transformers, and other cutting-edge libraries. Proficient in Linux development environments, with hands-on experience in GPU programming.

Publications

[1] **H. Gu**, "Pose-Conditioned Generative Steganography " *2025 Pacific Rim International Conference on Artificial Intelligence (PRICAI)*, Accepted.

[2] **H. Gu**, "Co-Adaptive Neural Radiance Field With Geometry-Feature," *2025 6th International Conference on Computer Vision, Image and Deep Learning (CVIDL)*, Ningbo, China.

Research Experience

Pose-Conditioned Generative Steganography *PRICAI 2025, Accepted*

- **Keywords**: AIGC Security, Generative Steganography | [Project Page]
- **Background**: Existing coverless generative steganography avoids cover modification, it faces two major bottlenecks: (a) **Quality**: Generated images often exhibit visual artifacts with extremely low embedding capacity; (b) **Robustness**: Early pose-based attempts relied on unstable features like facial keypoint distances and required full visibility, leading to severe decoding failures under real-world occlusion, truncation.
- **Methodology**: (a) **Geometry-Aware Mapping**: Discarded unstable facial features and constructed a codebook based on limb geometric proportions; (b) **Pose-Conditioned Generation**: Utilized extracted pose sequences as structural conditions to guide diffusion models in generating steganographic images, achieving disentanglement of information representation and image semantics; (c) **Randomized Linear Expansion**: Proposed a random projection algorithm to map variable-length pose encodings into fixed-length latent vectors, solving decoding challenges under incomplete pose conditions; (d) **Capacity Enhancement**: Embedded multi-person pose within a single image, significantly increasing the effective payload.
- **Outcome**: The paper has been accepted by **PRICAI 2025 (First Author)**.

Path Planning for Bench Dragon *CUMCM | National 2nd Prize (Team Leader)*

- **Keywords**: Mathematical Modeling, Multi-Rigid-Body Kinematics, Path Planning | [Project Page]
- **Background**: The *Bench Dragon* is a multi-joint rigid body system with over 200 sections, prone to collisions and restricted by space during spiral maneuvers. This project aims to solve complex rigid body motion control problems and optimize paths and velocities for spiraling in/out while avoiding collision.
- **Methodology**: (a) **Trajectory Calculation**: Modeled motion using differential equations and applied time discretization strategies to recursively calculate the instantaneous position and velocity; (b) **Geometric Collision Detection**: Designed a collision detection algorithm based on Point-in-Rectangle inclusion relationships, accurately calculating the collision moment during the spiral-in process; (c) **Evolutionary Path Optimization**: Constructed a single-objective optimization model minimizing path length under complex constraints. Utilized **Genetic Algorithm** to search for the optimal S-shaped turn-around curve composed of two tangent arcs; (d) **Velocity Limit Search**: Applied Golden Section Search to determine the maximum permissible velocity for the head node under strict velocity constraints for all sections.
- **Outcome**: Completed full-process numerical simulation and won the National Second Prize in CUMCM.

Co-Adaptive Neural Radiance Field *CVIDL 2025, Published*

- **Keywords**: 3D Reconstruction, Neural Radiance Fields, Neural Rendering | [Project Page]
- **Background**:Although NeRF achieves high-quality reconstruction via implicit neural representations and acceleration frameworks, it suffers from the frequency allocation of high-frequency/low-frequency signals.
- **Methodology**: (a) **Geometric Disentanglement**: Proposed a disentanglement strategy that projects 3D coordinates onto three orthogonal sub-planes, utilizing dedicated MLP pathways to process planar features independently, effectively mitigating gradient conflicts; (b) **Feature-Augmented Positional Encoding**: Designed a frequency regulator based on 2D projective embeddings, using local texture density as a proxy for scene complexity to adaptively adjust the spectral distribution of positional encoding.
- **Outcome**: The related paper has been published in **CVIDL 2025 (First Author)**.

Multi-Track Music Generation *Course Project | Team Leader*

- **Keywords**:Audio Generation, Multi-modal Learning, Style Transfer | [Project Page]
- **Background**: Music generation faces two core challenges: modeling complex harmonic and temporal dependencies among multiple tracks, such as pianos et al., and gradient vanishing in traditional GANs. Furthermore, existing style transfer methods typically require paired data, limiting cross-domain applications.
- **Methodology**: (a) **Multi-Track Tensor Modeling**: Converted musical scores into Pianoroll format and constructed a 3D tensor representing 5 instrument tracks. Utilized 3D Transpose Convolution to jointly capture temporal and pitch features; (b) **WGAN-GP Architecture**: Introduced Wasserstein Distance with Gradient Penalty to address training instability. Designed an asymmetric training strategy, effectively solving gradient vanishing and ensuring smooth convergence; (c) **CycleGAN Style Transfer**: Built a dual-GAN framework incorporating Cycle Consistency Loss and Identity Loss, enabling unpaired music style transfer, such as Pop to Jazz, while preserving the original melodic skeleton.
- **Performance**: The model successfully generated harmonious multi-track music clips with chord structures.

Honors & Awards

People's Scholarship *2023, 2024, 2025*

National 2nd Prize, CUMCM *Nov. 2024*

National 3rd Prize, CSIAM Operations Research Competition *Oct. 2024*

Jiangsu Government Scholarship for Overseas Studies *Jan. 2023*

Outstanding Youth League Member *May 2024*