Haoxuan Sun

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RESEARCH INTERESTS

World models, with a particular interest in their intersection with procedural content generation (PCG) for games — studying how dynamic world modeling can inform the authoring of interactive environments. Broadly interested in generative models, reinforcement learning, and AI for games.

EDUCATION

Vanderbilt University, Nashville, TN — Aug 2025 – Present
M.S. in Computer Science · GPA: 3.766/4.0

Shanghai Jiao Tong University, Shanghai, China — Sep 2019 – Jun 2023
B.S. in Artificial Intelligence · GPA: 3.335/4.0

EXPERIENCE

Research Assistant — Apr 2021 – Aug 2025
BCMI Lab (Center for Brain-Like Computing and Machine Intelligence), Shanghai Jiao Tong University
Advisors: Prof. Jianfu Zhang, Prof. Liqing Zhang

PUBLICATIONS

[1] **Haoxuan Sun**, Yan Hong, Jiahui Zhan, Haoxing Chen, Jun Lan, Huijia Zhu, Weiqiang Wang, Liqing Zhang, Jianfu Zhang. *"Robustness in AI-Generated Detection: Enhancing Resistance to Adversarial Attacks."* Under review at PRCV2026 arXiv:2505.03435.

[2] Lingxiao Lu, Shengyi Wu, **Haoxuan Sun**, Junhong Gou, Jianlou Si, Chen Qian, Jianfu Zhang, Liqing Zhang. *"Self-Supervised Vision Transformer for Enhanced Virtual Clothes Try-On."* arXiv:2406.10539.

RESEARCH EXPERIENCE

ScrollWeaver: Online Sequential Authoring of Game Worlds from Player Trajectories — Jan 2026 – Present
Independent research project

- Framing game world generation as online sequential authoring conditioned on player behavioral trajectories and designer constraints. Unlike static one-shot generation approaches, Scrollweaver models the dynamic co-evolution of game worlds and player interactions over time, enabling game worlds that adapt to how each player actually plays.
- Reproducing PCGRL and DIAMOND (ICLR 2025) as technical foundations; building an online authoring system in a Pygame roguelike environment; preparing a technical report and targeting submission to IEEE Conference on Games.

PPG-to-ECG Cross-Modal Generation — Dec 2025 – Present
Vanderbilt University

- Developing generative models that translate photoplethysmography (PPG) signals into electrocardiogram (ECG) waveforms beat-by-beat, modeling the translation as a causal temporal process rather than a static window-to-window mapping.

- Each cardiac cycle is treated as a discrete time step: a state-space model propagates hidden states across cycles so that each generated beat is conditioned on the history of prior beats, with RR intervals encoding irregular beat durations. Within each cycle, a flow matching generator produces the full ECG waveform in a continuous signal space.

AIGC Detector Robustness Jan 2024 – Present

BCMI Lab, Shanghai Jiao Tong University · Advisors: Jianfu Zhang, Liqing Zhang

- Investigated the adversarial robustness of AI-generated face detection systems, including ResNet/ViT classifiers and diffusion reconstruction residual-based detectors (DIRE).
- Proposed an adversarially trained variant of DIRE as a defense, effective under offline threat models where the attacker is unaware of the reconstruction step. Submitted to PRCV2026 as first author.
- Ongoing work extends the analysis to online white-box attacks, where the attacker has full knowledge of the reconstruction-and-classification pipeline and can compute end-to-end gradients, and develops new defenses robust under this stronger threat model.

Virtual Try-on Model and Algorithm Design based on DreamBooth Dec 2022 – May 2023

Undergraduate thesis project, BCMI Lab, SJTU · Advisors: Jianfu Zhang, Liqing Zhang

- Based on DreamBooth, use control-net method to expand the model network structure, and realized the process of generating the picture of the wearer wearing the target clothes after inputting the picture of the wearer and the picture of the clothes.

SKILLS

Programming: Python (proficient)

Frameworks & Tools: PyTorch

Research Areas: Generative models, procedural content generation, adversarial robustness