

# Mingdian Liu

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## Education

### Iowa State University

Ph.D. in Electrical Engineering

Iowa, USA

Sep. 2020 - Dec. 2023

### Iowa State University

Master in Computer Science

Iowa, USA

Jan. 2021 - May 2023

## Skills

### Computer Vision (CV)

Generative Model, Multimodal Learning, Human Pose Estimation

### Natural Language Processing (NLP)

LLM Finetuning, Retrieval Augmented Generation, AutoGPT

### Deep Learning Model

Diffusion Model, GPT, VQ-VAE, ResNet, RNN/LSTM, GAN, Transformer

### Programming Language

Python, Java, C/C++, R, Matlab

### Platform and Tools

Pytorch, TensorFlow/Keras, AWS, GCP, CUDA, Linux

## Work Experience

### [CV][NLP] Conditional diffusion model for text to motion generation and retargeting

New York City, New York

Research Intern, Snap Research

May 2023 - Dec 2023

- Developed a conditional VAE model to unify motion data of different body shape.
- Modified GLIGEN model for share-aware text to motion generation.
- The generated motion can be retargeted to the body shape of any skeleton length.

### [CV][NLP] Branching GPT model for text to body motion, hand motion, and face motion generation

New York City, New York

Research Intern, Snap Research

May 2023 - Dec 2023

- Built a pipeline for extracting the motion of human body, hand, and face from the wide videos. Constructed a private Text-to-Motion-X dataset by Vision-Language model and GPT-4.
- Firstly proposed a novel multimodal model based on the GPT model for text to Motion-X generation. Used joint space mapping to improve the consistency of the generative motion across human body, hand, and face. The paper was submitted to CVPR 2024.
- The model is under refinement for deployment in the 3D Bitmoji of Snapchat.

### [CV] Multimodal GPT model for Text-guided music to dance generation [demo]

Sunnyvale, California

Applied Scientist Intern, Amazon Alexa AI

May 2022 - Aug 2022

- Utilized Transformer as the backbone to design a Multimodal Learning baseline for music-to-dance generation. Extracted music features by Librosa. Presented dance motions by 6-dim rotation matrix in SMPL. Employed a dataset of 1.2 million frames for training model.
- Proposed a novel model based on VQ-VAE model (generate dance embedding), MotionCLIP (align dance embedding space to text embedding space), and GPT model (predict the future dance) to make dance motion editable by text guidance.
- The experiments showed our model was comparable to the SOTA model in both motion quality and motion diversity. One patent was submitted.

### [CV] MobileNet model for smart watch-based hand gesture recognition system on AR glasses [demo]

Palo Alto, California

Research Intern, OPPO US Research Center, XR Interaction Lab

June 2021 - Dec. 2021

- Prototyped a hand gesture recognition model for AR glass using a modified MobileNetV2 trained with 0.4 million data of IMU and PPG sensors. Involved in the complete development processes including prototype, data collection, and Beta version release.
- Further improved model robustness (averaged 96% recall and 94% precision) and reduced 35% power consumption over existing methods by fusing handcrafted signal features into the model. Also submitted two patents on it.
- Composed 3-DoF hand tracking code for VR controller grip.

## Research Projects

### [NLP] Belief retrieval augmented generation for LLM agent collaboration

current

- Finetuned LLaMA model by agent collaboration dataset.
- Implemented belief (the estimated next action of opposite agent) retrieval augmented generation for LLM agent collaborations. The experiments are run on finetuned-LLaMA 7B, 14B, ChatGPT, and GPT4
- The experiments show that the agent collaboration performance can be improved by 23.5%.

### [CV] Intelligent Antenna Design using Conditional Generative Adversarial Network [code]

Aug. 2021 - May 2023

- Developed a pipeline to automate model build-up and data collection on Ansys HFSS simulation software.
- Modified a conditional GAN model for generating novel antenna designs to match the requested antenna properties.
- Proposed an Active Learning framework to automatically to reduce 29% dataset while reaching the same accuracy of the old system.

- Deployed TI mmWave sensor for real-time point cloud generation of human poses.
- Integrated range-FFT and Doppler-FFT for moving people tracking and reduced averaged position error to 0.11 m.
- Utilized BiLSTM for user identification with the accuracy of 90.2% for 3 people.
- Voxelized point cloud in bounding box and extracted spatial feature by CNN. Proposed a Transformer model for human pose estimation and reached a high classification accuracy of 92.3%.
- Deployed a sensor fusion system by mmWave sensor and depth camera on NVIDIA Jetson to monitor indoor human activities.

## Publications

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**“T2M-X: Learning Expressive Text-to-Motion Generation from Partially Annotated Data.”** M. Liu, et al. *Under Review*

**“Generative Adversarial Network-Based Design of Dielectric Resonator Antenna for mmWave 5G Applications.”** M. Liu, H. Zhang, et al.  
2021 IEEE International Symposium on Antennas and Propagation

**“Novel Finger Swipe-based Smart Watch User Interface Control.”** X. Li, M. Liu. *WO Patent 2022,221,781*

**“An IoT-enabled paper sensor platform for real-time analysis of isothermal nucleic acid amplification tests.”** M. Liu, Y. Zhao, et al.  
*Biosensors and Bioelectronics*