Mingdian Liu

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Education

Iowa State University — *Iowa, USA*

Ph.D. in Electrical Engineering — *Sept 2017 - Dec. 2023*

Iowa State University — *Iowa, USA*

Master in Computer Science — *Jan 2021 - May 2023*

Shandong University — *Jinan, China*

Bachelor of Science in Physics — *Sept 2012 - June 2016*

Skills

Research Skills	Generative Model, AI for Science, Multimodal Learning, Human Pose Estimation, Hand Gesture Recognition, NeRF
Deep Learning	GPT, VQ-VAE, ResNet, RNN/LSTM, GAN, Transformer, PINN
Programming Language	Python, Java, C/C++, R, Matlab
Platform and Tools	Pytorch, TensorFlow/Keras, AWS, CUDA, Linux

Work Experience

Text-guided music to dance generation [demo] — *Sunnyvale, California*

Applied Scientist Intern, Amazon Alexa AI — *May 2022 - Aug 2022*

- Utilized Transformer as 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 shows our model beats SOTA model in both motion quality and motion diversity. One patent and one paper are also underway.

Smart watch-based hand gesture recognition model for AR glasses [demo] — *Palo Alto, California*

Research Intern, OPPO US Research Center, XR Interaction Lab — *June 2021 - Dec. 2021*

- Modified MobileNetV2 as a hand gesture recognition model for AR glass using 0.4 million data of IMU and PPG sensors.
- 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

Interpretation of Physics-Based System With Unspuervised Learning — *Feb. 2022 - current*

- Combining VAE and WaveNet to develop an unsupervised learning model to extract interpretable hidden physical parameters of Gaussian pulse.
- Modified Transformer model to extract interpretable physical parameters from spatiotemporal systems.
- Trying to extend the model to solve the Maxwells' equation and apply it for EM wave simulation.

Indoor Activities Recognition with Radar Sensor [homepage] [demo] [oral] [code] — *Oct. 2020 - Feb. 2022*

- 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 5 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%.
- Built up a sensor fusion system by mmWave sensor and depth camera to monitor indoor human activities.

Intelligent Antenna Design using Generative Adversarial Network [code] — *Aug. 2020 - May 2021*

- Developed a pipeline to automate model build-up and data collection on Ansys HFSS simulation software.
- Modified an InfoGAN 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.

Publications

"*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 Propagatio*

"*Novel Finger Swipe-based Smart Watch User Interface Control.*" X. Li, M. Liu, Z. Yang, *et al.* *US Patent App. (Submitted)*

"*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*

"*Paper based isothermal DNA amplification and real-time analysis.*" M. Liu, H. Monshat, *et al.* *2019 IEEE SENSORS*