Minkyu Choi

Ann Arbor, MI 48109 | (301) 265-6425 | cminkyu@umich.edu | in/cminkyu | minkyu-choi04

AI/Computational Neuroscience Ph.D. candidate specializing in brain encoding and neural network modeling, with extensive experience in developing deep learning solutions for understanding and simulating human cognitive processes. Holds expertise in both brain encoding/decoding and aligning AI models with human cognition.

Education

University of Michigan	Ann Arbor, MI
Ph.D. Candidate in Electrical & Computer Engineering, GPA: 4.0	Jan. 2020 - Aug. 2024

Thesis: *Aligning Machine and Human Vision: A Deep Learning Journey from Retina to Cortical Interpretation*

Korea Advanced Institute of Science and Technology	Daejeon, Korea
M.S. in Electrical Engineering, GPA: 3.8	Sept. 2015 - Aug. 2017
Yonsei University	Seoul, Korea
B.S. in Electrical Engineering, GPA: 3.7	Mar. 2009 - Feb. 2015

Research Experience

University of Michigan — Ann Arbor, MI
Ph.D. Candidate Researcher in AI / Computational Neuroscience — Jan. 2020 - Present

- **Developed a Deep Learning Architecture for Enhanced Brain Encoding (published at NeurIPS).**
  - Engineered an advanced deep learning framework to simulate human brain visual processing, achieving a 7% improvement in neural response prediction accuracy and enhancing model interpretability.
  - Improved visual attention prediction accuracy by 8% in a computer vision model through the incorporation of retinal structure analysis, significantly refining eye-tracking predictions.
- **Aligned Representations of Language-Vision Models with Human Understandings (published at NeurIPS).**
  - Improved the alignment of NLP word representations with human understanding by 14%, refining the model to better reflect language comprehension. This optimization enhances the interpretability and the safety of language models.
  - Boosted cross-modal text/image search accuracy by 15% by grounding language representations to visual data.
- **Built a Vision Foundational Model for Personalized Attribute Prediction.**
  - Enhanced the accuracy of personalized attribute prediction by 22% with a multimodal foundational model designed for analyzing human fMRI/physiological signals. This model successfully predicted personalized attributes, such as emotional states and cognitive abilities, in over 700 patients.
- **Designed a Computer Vision Model for Enhanced Video Contents Understanding.**
  - Developed a self-supervised learning model that utilizes temporal dynamics for improved action recognition and video retrieval, showing significant performance enhancements on UCF101 and HMDB51 datasets.

Samsung Research America — Mountain View, CA
Research Engineer Intern — May 2022 - Aug. 2022

- **Developed AI models for human motion and facial expression synthesis.**
  - Developed a deep generative model for human motion synthesis, achieving a 15% improvement in prediction accuracy, resulting in the production of natural human motions, indistinguishable from real human movements.
  - Reduced computational costs by 10%, for deep generative models, achieving low latency for real-time ML services.

Skills

- **AI/ML Specializations**: Machine learning, Computer vision, Natural language processing, Signal processing
- **Technical Skills**: Python, C++, Pytorch, MATLAB, Linux, Git, Docker

Selected Publications

- **Choi, M**., Zhang, Y., Han, K., Wang, X., & Liu, Z. (2024). Human Eyes Inspired Recurrent Neural Networks are More Robust Against Adversarial Noises. *Neural Computation* (In Press).
- Chen, S., **Choi, M**., Han, K., Qu, Q., & Liu, Z. (2024). Uncovering Latent Dynamics: Self-Supervised Learning of Video Representation Invariant to Temporal Differentiation (Manuscript under review).
- **Choi, M**., Han, K., Wang, X., Zhang, Y., & Liu, Z. (2023). A Dual-Stream Neural Network Explains the Functional Segregation of Dorsal and Ventral Visual Pathways in Human Brains. *Advances in Neural Information Processing Systems (__NeurIPS__)*.
- Zhang, Y., **Choi, M**., Han, K., & Liu, Z. (2021). Explainable Semantic Space by Grounding Language to Vision with Cross-Modal Contrastive Learning. *Advances in Neural Information Processing Systems (__NeurIPS__)*, 34, 18513-18526.
- Kim, J. H., Zhang, Y., Han, K., Wen, Z., **Choi, M**., & Liu, Z. (2021). Representation learning of resting state fMRI with variational autoencoder. *NeuroImage*, 241, 118423.
- **Choi, M**., & Tani, J. (2018). Predictive Coding for Dynamic Visual Processing: Development of Functional Hierarchy in a Multiple Spatiotemporal Scales RNN Model. *Neural computation,* 30(1), 237-270.
- **Choi, M**., & Tani, J. (2017). Predictive coding for dynamic vision: Development of functional hierarchy in a multiple spatio-temporal scales RNN model. In 2017 *International Joint Conference on Neural Networks* (pp. 657-664). IEEE.
- For **full publication** list: Google Scholar

Talks and Presentations

- Han, K., **Choi, M**., Wang, X., Murguia, A., & Liu, Z. (2023). Individualized representation learning of resting-state fMRI. *The International Society for Magnetic Resonance in Medicine*, Toronto.
- **Choi, M**., Han, K., Wang, X., & Liu, Z. (2023). A novel deep neural network models two streams of visual processing from retina to cortex. *Computational and Systems Neuroscience*, Montreal.
- **Choi, M**., Zhang, Y., Han, K., Wang, X., & Liu, Z. (2022). Retinal Transformation and Recurrent Attention Improve Adversarial Robustness. *Collaborative Research in Computational Neuroscience*, Atlanta.
- **Choi, M**., Hwang, J., Tani, J., & Ahmadi, A. (2017). Predictive Coding for Dynamic Visual Processing: Development of Functional Hierarchy in a Multiple Spatio-Temporal Scales RNN Model. *International Conference on Intelligent Robots and Systems (IROS)*, Vancouver.
- **Choi, M**., & Tani, J. (2017). Predictive coding for dynamic vision: Development of functional hierarchy in a multiple spatio-temporal scales RNN model. *International Joint Conference on Neural Networks*, Anchorage.

Relevant Courseworks

Computer Vision, Machine Learning, Reinforcement Learning, Digital Image Processing, Digital Signal Processing, Engineering Random Process, Medical Imaging Systems, Neural Networks, Operating Systems, Random Variables, Statistical Learning Theory, Theory of Brain Function

Additional Activities

Committed donor to the United Nations High Commissioner for Refugees (UNHCR) for over a decade, actively supporting global humanitarian efforts and refugee assistance programs.