

# Hyung-gun Chi

PHD CANDIDATE

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## Research Interests

I am passionate about the intersection of Computer Vision and Machine Learning, emphasizing representation learning for human actions and 3D Computer vision. I aim to harness large language models to enhance action recognition, 3D Computer Vision, and object detection, particularly in VR/AR, and Autonomous Vehicles.

## Education

### Purdue University

West Lafayette, IN, USA

PHD IN ELECTRICAL AND COMPUTER ENGINEERING

Dec. 2023 (Expected)

- Thesis: Advancements in Human Action Recognition by Learning Human Skeleton Representations (Advisor: Prof. Karthik Ramani).

### Purdue University

West Lafayette, IN, USA

MS IN ELECTRICAL AND COMPUTER ENGINEERING

Dec. 2022

### Yonsei University

Seoul, South Korea

BS IN MECHANICAL ENGINEERING

Feb. 2017

## Professional Experience

### Toyota Research Institute

Los Altos, CA, USA

RESEARCH INTERN

May. 2023 - Aug. 2023

- Carried out research on multi-modal representation learning for robotics, focusing on aligning representations of language, vision, and sensor data [C9]. (Host: Dr. Thomas Kollar)

### Honda Research Institute US

San Jose, CA, USA

RESEARCH INTERN

Jan. 2023 - May. 2023

- Led research initiatives on creating human motion from language descriptions using LLMs [C13]. (Host: Dr. Kwonjoon Lee).

### Honda Research Institute US

San Jose, CA, USA

RESEARCH INTERN

May. 2022 - Aug. 2022

- Conducted research into future action forecasting [C6, P5] and trajectory prediction [C5, P4] for autonomous vehicles (Host: Dr. Chiho Choi).

### Convergence Design Lab, Purdue University

West Lafayette, IN, USA

GRADUATE RESEARCH ASSISTANT

Aug. 2018 - Present

- Conducted research on human action perception [C1, C3, J7], human pose estimation [C4, P3], and 3D computer vision [J2-4, C2]. (Advisor: Prof. Karthik Ramani).

### HeumLabs Corporation

Seoul, South Korea

SOFTWARE ENGINEER & CEO

Sep. 2016 - Dec. 2017

- Founded and led a start-up company that develops an office automation system for office works [P1].

### Knowledge-based Design Lab, Yonsie University

Seoul, South Korea

UNDERGRADUATE RESEARCH ASSISTANT

Jan. 2016 - Aug. 2016

- Contributed to research on explainable AI, specifically targeting advancements in 3D computer vision [J1] (Advisor: Prof. Soo-hong Lee).

## Publications and Patents

\* denotes equal contribution

### Conference Proceedings

- [C13] H. Chi, S. Chi, H. Ma, N. Agarwal, F. Siddiqui, K. Ramani, K. Lee. Long-Term Human Motion Generation from the Action Text, *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024. (submitted)
- [C12] S. Kim, H. Baek, S. Lee, H. Chi, H. Lim, J. Kim, S. Kim. Enhanced Motion Forecasting with Visual Relation Reasoning, *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024. (submitted)
- [C11] S. Moon, H. Woo, H. Park, H. Jung, H. Chi, H. Lim, S. Kim, J. Kim. Improving Trajectory Prediction through Text-Guided High-Level Vision Data Extraction, *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024. (submitted)
- [C10] S. Kim, S. Seo, H. Chi, K. Ramani, J. Kim, and S. Kim. Higher-order Relation Reasoning for Trajectory Prediction, *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024. (submitted)
- [C9] H. Chi, J. Mercat, J. Barreiros, K. Ramani, and T. Kollar. Multi-Modal Representation Learning with Tactile Modality, In proceedings of *International Conference on Robotics and Automation (ICRA)*, 2024. (submitted)
- [C8] S. Chi, R. Jain, J. Shi, H. Doh, H. Chi, A. Quinn, and K. Ramani. CARING-AI: Context-aware Augmented Reality INstruction through Generative Artificial Intelligence, *In Conference on Human Factors in Computing Systems (CHI)*, 2024. (submitted)
- [C7] W. Roh, S. Lee, W. Ryoo, G. Oh, J. Lee, S. Hwang, H. Chi, and S. Kim. Functional Hand Type Prior for 3D Hand Pose Estimation & Action Recognition from Egocentric View Monocular Videos, *British Machine Vision Conference (BMVC Oral)*, 2023.
- [C6] H. Chi, K. Lee, N. Agarwal, Y. Xu, K. Ramani, and C. Choi. AdamsFormer for Spatial Action Localization in the Future, In proceedings of *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2023.
- [C5] Y. Xu, A. Bazarjani, H. Chi, C. Choi, and Y. Fu. Uncovering the Missing Pattern: Unified Framework Towards Trajectory Imputation and Prediction, In proceedings of *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2023.

- [C4] **H. Chi\***, S. Chi\*, S. Chan, and K. Ramani. Pose Relation Transformer: Refine Occlusions for Human Pose Estimation, In proceedings of *International Conference on Robotics and Automation (ICRA)*, 2023.
- [C3] **H. Chi\***, M. Ha\*, S. Chi, S. Lee, Q. Huang, and K. Ramani. InfoGCN: Representation Learning for Human Skeleton-based Action Recognition, In proceedings of *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022.
- [C2] **H. Chi\***, S. Kim\*, X. Hu, Q. Huang, and K. Ramani. A Large-scale Annotated Mechanical Components Benchmark for Classification and Retrieval Tasks with Deep Neural Networks, In proceedings of *European Conference on Computer Vision (ECCV)*, 2020.
- [C1] S. Kim, **H. Chi**, X. Hu, A. Vegesana, and K. Ramani. First-Person View Hand Segmentation of Multi-Modal Hand Activity Video Dataset, In proceedings of *British Machine Vision Conference (BMVC)*, 2020.

### Journal Papers

- [J7] **H. Chi**, S. Chi, Q. Huang, and K. Ramani. InfoGCN++: Learning Representation by Predicting the Future for Online Skeleton-based Action Recognition, *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*. (submitted)
- [J6] S. Lee\*, **H. Chi\***, G. Oh, W. Byeon, S. Yoon, J. Kim, and S. Kim. Robust Sound-Guided Image Manipulation. In *Neural Networks (NN)*. (under revision)
- [J5] A. Unmesh, R. Jain, J. Shi, VK Chaitanya, **H. Chi**, S. Chidambaram, A. Quinn, and K. Ramani. Interacting Objects: A dataset of object-object interactions for richer dynamic scene representations. In *IEEE Robotics and Automation Letters (RA-L)*. To appear
- [J4] H. Lee, J. Lee, S. Kwon, K. Ramani, **H. Chi**, and D. Mun. 3D CAD Model Simplification for Mechanical Parts Using Generative Adversarial Networks. In *Computer-Aided Design (2023)*: 103577.
- [J3] S. Kim, **H. Chi** and K. Ramani. Object synthesis by learning part geometry with surface and volumetric representations. In *Computer-Aided Design (2021)*: 102932.
- [J2] S. Kim, N. Winovich, **H. Chi**, G. Lin, and K. Ramani. Latent transformations neural network for object view synthesis. In *The Visual Computer (2019)*: 1-15.
- [J1] H. Hwang, S. Lee, **H. Chi**, N. Kang, H. Kong, J. Lu, and H. Ohk. An Evaluation Methodology for 3D Deep Neural Network using Visualization in 3D Data Classification. In *Journal of Mechanical Science and Technology* 33, no. 3 (2019): 1333-1339.

### Preprinted papers

- S. Kim, J. Bae, **H. Chi**, S. Hong, B.S. Koh, and K. Ramani. Egocentric View Hand Action Recognition by Leveraging Hand Surface and Hand Grasp Type. *arXiv preprint arXiv:2109.03783*, 2021.

### Patents

- [P5] **H. Chi**, K. Lee, Y. Xu, and C. Choi. System and Method for Providing Spatio-Temporal Action Localization in the Future. US Patent Application.
- [P4] Y. Xu, A. Bazarjani, **H. Chi**, and C. Choi. Trajectory Imputation and Prediction, US Patent Application.
- [P3] K. Ramani, **H. Chi**, and S. Chi. Pose Relation Transformer Refine Occlusions for Human Pose Estimation. US Patent Application.
- [P2] K. Ramani, S. Kim, and **H. Chi**. Pixel-wise Hand Segmentation of Multi-modal Hand Activity Video Dataset. US Patent 11,562,489 B2.
- [P1] **H. Chi**. Computer Input System for Office/Factory Automation. WO Patent 2018/074729 A1.

## Academic Services

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### Conference Reviewers

- International Conference on Learning Representations (ICLR) 2024
- The IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2023 - 2024
- Conference on Neural Information Processing Systems (NeurIPS) 2023
- The IEEE/CVF International Conference on Computer Vision (ICCV) 2023
- The British Machine Vision Conference (BMVC) 2020 - 2023
- The IEEE Conference on Artificial Intelligence (CAI) 2023
- International Conference on Computer Science and Application Engineering (CSAE), 2023

### Journal Reviewers

- IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- IEEE Robotics and Automation Letters (RAL)
- Computer Vision and Image Understanding (CVIU)
- Journal of Visual Communication and Image Representation (JVCI)
- Journal of Computing and Information Science in Engineering (JCISE)

## Skills

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### Research and Development Stacks

<b>Major Languages</b>	Python, C/C++
<b>Machine Learning</b>	PyTorch, TensorFlow
<b>Web Frameworks</b>	Django, Flask, Node.js
<b>Computer Vision</b>	OpenCV, OpenGL
<b>Web Languages</b>	React, HTML5, PHP, JavaScript, CSS
<b>Database</b>	MySQL, PostgreSQL, SQLite, MongoDB

### Other Tools and Skills

<b>Text Editors</b>	Neovim & Vim
<b>Other Languages</b>	Shell Scripts(bszh, zsh), MATLAB, R
<b>Operating Systems</b>	Linux Debian/Ubuntu, MacOS, Windows
<b>IDE</b>	VSCode, Eclipse, IDEA
<b>Cloud Platforms</b>	AWS
<b>VCS</b>	Git

## Awards and Honors

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2023	<b>Conference Travel Funds</b> , Purdue Engineering Graduate Program	West Lafayette, IN, USA
2023	<b>Travel Grants</b> , Purdue Graduate Student Government	West Lafayette, IN, USA
2016	<b>Korea Institute of Science and Technology Information (KISTI) President's Award</b> , Edison Challenge – Computer Aided Design Section	Seoul, South Korea
2016	<b>Korea Society for Computational Design and Engineering (CDE) President's Award</b> , CDE Challenge – Computational Design and Engineering Tools Section	Daejeon, South Korea

## References

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Available upon request.