# Hyung-gun **Chi**

PHD CANDIDATE

*585 Purdue Mall ME3171, West Lafayette, IN 47907*

hgchi@purdue.edu | hyung-gun.me | stnoah1 | hyung-gun | Hyung-gun Chi

## Research Interests

I am deeply invested in the interdisciplinary sphere where Computer Vision intersects with Machine Learning, with a distinct focus on representation learning applied to human actions and 3D Computer Vision. Moreover, my ambition is to pioneer advancements in integrating large-scale language models to fortify the fields of human action recognition, 3D scene interpretation, and object detection. My intent is to apply these developments specifically to emerging technologies such as Virtual Reality (VR), Augmented Reality (AR), and Autonomous Vehicles, aiming to enhance their functional capacities and applications.

## Education

**Purdue University** — *West Lafayette, IN, USA*

PhD in Electrical and Computer Engineering — *Aug. 2018 - 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 — *Aug. 2018 - Dec. 2022*

- Advisor: Prof. Karthik Ramani

**Yonsei University** — *Seoul, South Korea*

BS in Mechanical Engineering — *Mar. 2010 - Feb. 2017*

- Advisor: Prof. Soo-hong Lee
- 2-year military service (2011-2013)

## Professional Experience

**Toyota Research Institute** — *Los Altos, CA, USA*

Research Intern — *May. 2023 - Aug. 2023*

- Conducted research on multi-modal representation learning for the robotics which aligning the representations of language, vision, and sensor data (Host : Dr. Thomas Kollar).

**Honda Research Institute US** — *San Jose, CA, USA*

Research Intern — *Jan. 2023 - May. 2023*

- Conducted research on generating human motion from the language description (Host: Dr. Kwonjoon Lee).

**Honda Research Institute US** — *San Jose, CA, USA*

Research Intern — *May. 2022 - Aug. 2022*

- Conducted research on future action forecasting task for autonomous vehicles (Host: Dr. Chiho Choi).

**Convergence Design Lab, Purdue University** — *West Lafayette, IN, USA*

Graduate Research Assistant — *Aug. 2018 - Present*

- Conducted skeleton-based human action recognition and pose estimation research (Advisor: Prof. Karthik Ramani).

**HeumLabs Corporation** — *Seoul, South Korea*

Software Engineer & CEO — *Sep. 2016 - Dec. 2017*

- Founded and managed a start-up company as a CEO.
- Developed an office automation system specifically for automating office work.

**Knowledge-based Design Lab, Yonsie University** — *Seoul, South Korea*

Undergraduate Research Assistant — *Jan. 2016 - Aug. 2016*

- Participated on the 3D computuer vision research (Advisor: Prof. Soo-Hong Lee).

## Publications and Patents

### Conference Proceedings

- [**C8**] S. Kim, S. Seo, **H. Chi**, K. Ramani, J. Kim, and S. Kim. Higher-order Relation Reasoning for Trajectory Prediction, *Annual AAAI Conference on Artificial Intelligence (**AAAI**)*, 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**)*, 2023. submitted.
- [**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 *IEEE 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, G. Oh, **H. Chi**, W. Byeon, S. Yoon, J. Kim, and S. Kim. Robust Sound-Guided Image Manipulation. In *Neural Network*, 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*, submitted.
- [**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

### Conference Reviewers

- Conference on Neural Information Processing Systems (NeurIPS) 2023
- The IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 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

### Journal Reviewers

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

## Invited Talks

**Sungkyunkwan University** — *Seoul, South Korea*

*Guest Lecturer*: Advancements in Human Action Recognition by Learning Skeleton Representations — *May. 2023*

**Keimyung University** — *Deagu, South Korea*

*Guest Lecturer*: Representations Learning for Recognizing Human Activity — *Apr. 2023*

**Yonsei University** — *Seoul, South Korea*

*Guest Lecturer*: Representation for Human Activities — *Apr. 2023*

**Hongik University** — *Seoul, South Korea*

*Guest Lecturer*: Learning Representation for Human Action Recognition — *Dec. 2022*

## Awards and Honors

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

## Skills

### Research and Development Stacks

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

### Other Tools and Skills

| | |
|---|---|
| **Text Editors** | **Neovim & Vim** |
| **Other Langauges** | Shell Scripts(bszh, zsh), Matlab(Octave), R |
| **Operating Systems** | macOS, Linux Debian/Ubuntu, Windows |
| **IDE** | VSCode, Eclipse, IDEA |
| **Softwares** | SolidWorks, Catia, AutoCAD |
| **VCS** | **Git** |

## References

| | | |
|---|---|---|
| **Karthik Ramani** | Professor, Purdue University | ramani@purdue.edu |
| **Soo-Hong Lee** | Professor, Yonsei University | shlee@yonsei.ac.kr |