Hyung-gun **Chi**

AI Researcher

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Research Interests

Focused on the intersection of Computer Vision and Machine Learning, with a keen interest in representation learning for 3D action recognition and object detection. My work aims to advance VR/AR and autonomous vehicle technologies by improving machine understanding of human actions through innovative algorithms and leveraging large language models for enhanced human-computer interaction.

Education

Purdue University — *West Lafayette, IN, USA*

PhD in Electrical and Computer Engineering — *Aug. 2018 - Dec. 2023*

- Thesis: Towards Improved Representations on Human Activity Understanding (Advisor: Dr. Karthik Ramani).

Purdue University — *West Lafayette, IN, USA*

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

- Advisor: Dr. Karthik Ramani

Yonsei University — *Seoul, South Korea*

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

- Advisor: Dr. Soo-hong Lee
- 2 years of military service 2011-2013

Professional Experience

Apple Inc. — *Cupertino, CA, USA*

AI/ML Resident — *Jul 2024 -*

- Conducted multi-modality research as part of the Vision-Assisted Interaction team.

Hanwha Vision America — *Santa Clara, CA, USA*

AI Researcher — *Jan - June 2024*

- Conducted research in advanced human pose estimation and activity recognition, enhancing surveillance camera capabilities.
- Developed machine learning models to accurately predict human activities, significantly improving detection accuracy and reducing false positives.

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

ML Research Intern — *May - Aug 2023*

- Led a project on multi-modal representation learning for robotics, achieving groundbreaking advancements in aligning language, vision, and sensor data representations.
- Published a comprehensive dataset comprising language descriptions, tactile images, and visual captures of robotic interactions, facilitating enhanced robot sensory perception and interaction studies.

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

CV Research Intern — *Jan - May 2023 & May - Aug 2022*

- Led a research project that transformed language descriptions into human motion using LLMs, establishing a new benchmark in the field.
- Developed a specialized VQ-diffusion model for text-to-human motion generation, focusing on accurately predicting long-term movements.
- Conducted pioneering research in future action forecasting and trajectory prediction for autonomous vehicles, resulting in two patents and significant advancements in vehicle safety and navigation systems.
- Introduced an algorithm capable of predicting future action locations by integrating NeuralODE with the Transformer for enhanced accuracy.

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

Graduate Research Assistant — *Aug 2018 - Dec 2023*

- Advanced research in human action perception, pose estimation, and 3D computer vision, yielding numerous peer-reviewed publications and patents.
- Directed a team to innovate a 3D pose estimation algorithm from video, drastically enhancing both accuracy and processing speed.
- Developed a 3D object generation model utilizing GAN, focusing on the precise definition of geometrical features.
- Proposed an algorithm for skeleton-based action recognition that integrates self-attention mechanisms with graph-convolutional networks to capture human topology effectively.

HeumLabs Corporation — *Seoul, South Korea*

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

- Founded and led a startup developing an office automation system, securing initial funding and overseeing the product development lifecycle from concept to launch.
- Achieved a successful market entry, with the system adopted by over 150 businesses within the first year, demonstrating strong leadership and entrepreneurial skills.

Publications and Patents

Conference Proceedings

- [**C14**] "CARING-AI: Context-aware Augmented Reality INstruction through Generative Artificial Intelligence", **CHI**, 2024 (submitted).
- [**C13**] "Context-Enriched Voxel Queries for Camera-based 3D Occupancy Prediction", **NeurIPS**, 2024 (submitted).
- [**C12**] "M2D2M: Discrete Diffusion Model for the Multi-Motion Generation from the Text", **ECCV**, 2024.
- [**C11**] "Enhanced Motion Forecasting with Visual Relation Reasoning", **ECCV**, 2024.
- [**C10**] "Improving Trajectory Prediction through Text-Guided High-Level Vision Data Extraction", **ECCV**, 2024.
- [**C9**] "Multi-Modal Representation Learning with Tactile Modality", **IROS**, 2024.
- [**C8**] "Higher-order Relation Reasoning for Trajectory Prediction", **CVPR**, 2024.
- [**C7**] "Functional Hand Type Prior for 3D Hand Pose Estimation & Action Recognition from Egocentric View Monocular Videos, **BMVC** (Oral), 2023.
- [**C6**] "AdamsFormer for Spatial Action Localization in the Future", **CVPR**, 2023.
- [**C5**] "Uncovering the Missing Pattern: Unified Framework Towards Trajectory Imputation and Prediction", **CVPR**, 2023.
- [**C4**] "Pose Relation Transformer: Refine Occlusions for Human Pose Estimation", **ICRA**, 2023.
- [**C3**] "InfoGCN: Representation Learning for Human Skeleton-based Action Recognition", **CVPR**, 2022.
- [**C2**] "A Large-scale Annotated Mechanical Components Benchmark for Classification and Retrieval Tasks with Deep Neural Networks", **ECCV**, 2020.
- [**C1**] "First-Person View Hand Segmentation of Multi-Modal Hand Activity Video Dataset", **BMVC**, 2020.

Journal Papers

- [**J9**] "Enhanced fringe-to-phase framework using deep learning", **Image and Vision Computing** (under review).
- [**J8**] "InfoGCN++: Learning Representation by Predicting the Future for Online Skeleton-based Action Recognition", **TPAMI** (under revision).
- [**J7**] "Deep Learning-Assisted Design of Bilayer Nanowire Gratings for High-Performance MWIR Polarizers, **Advanced Materials Technologies**, 2024.
- [**J6**] "Robust Sound-Guided Image Manipulation", **Neural Networks**, 2024.
- [**J5**] "Interacting Objects: A dataset of object-object interactions for richer dynamic scene representations", **RA-L**, 2024.
- [**J4**] "3D CAD Model Simplification for Mechanical Parts Using Generative Adversarial Networks", **Computer-Aided Design**, 2023.
- [**J3**] "Object synthesis by learning part geometry with surface and volumetric representations", **Computer-Aided Design**, 2021.
- [**J2**] "Latent transformations neural network for object view synthesis", **The Visual Computer**, 2019.
- [**J1**] "An Evaluation Methodology for 4D Deep Neural Network using Visualization in 3D Data Classification", **JMST**, 2019.

Preprinted papers

- [**X1**]"Egocentric View Hand Action Recognition by Leveraging Hand Surface and Hand Grasp Type", *arXiv*, 2021.

Patents

- [**P7**] "Multi-Motion Generation", US Patent App.
- [**P6**] "System and Method for Authoring Context-augmented Reality Instruction through Generative Artificial Intelligence", US Patent App.
- [**P5**] "Pose Relation Transformer Refine Occlusions for Human Pose Estimation", US Patent App.
- [**P4**] "Spatio Action Localization in the Future", US Patent App. 18/300,844.
- [**P3**] "Trajectory Imputation and Prediction", US Patent App. 18/182,195.
- [**P2**] "Pixel-wise Hand Segmentation of Multi-modal Hand Activity Video Dataset", US Patent 11,562,489 B2.
- [**P1**] "Computer Input System for Office/Factory Automation", WO Patent 2018/074729 A1.

Academic Services

Reviewer

- Conferences: **CVPR**(2023-2024), **ECCV**(2024), **ICCV**(2023), **ICML**(2024), **ICLR**(2024), **NeurIPS**(2023), **AAAI25**(22025), **BMVC**(2020-2023), **ACCV**(2024), **IROS**(2024).
- Journals: **TPAMI**, **TIP**, **CVIU**, **R-AL**, **TOMM**, **JVCI**, **JCISE**.

Skills

Research and Development Stacks

Major Languages	**Python**, **C/C++**
Machine Learning	**PyTorch**, **TensorFlow**
Web Frameworks	Django, Flask, Node.js
Computer Vision	**OpenCV**, OpenGL
Web Languages	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, R
Operating Systems	Linux Debian/Ubuntu, MacOS, Windows
IDE	VSCode, Eclipse, IDEA
Cloud Platforms	AWS
VCS	**Git**

Awards and Honors

2024	**Doctoral Consortium,** IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)	*Seattle, WA, USA*
2023	**Conference Travel Funds,** Purdue Engineering Graduate Program	*West Lafayette, IN, USA*
2023	**Travel Grants,** Purdue Graduate Student Government	*West Lafayette, IN, USA*
2016	**Korea Institute of Science and Technology Information (KISTI) President's Award,** Edison Challenge – Computer Aided Design Section	*Seoul, South Korea*
2016	**Korea Society for Computational Design and Engineering (CDE) President's Award,** CDE Challenge – Computational Design and Engineering Tools Section	*Daejeon, South Korea*

References

Available upon request.