

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: 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 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] “Context-Enriched Voxel Queries for Camera-based 3D Occupancy Prediction”, **NeurIPS**, 2024 (submitted).
- [C13] “CARING-AI: Context-aware Augmented Reality INstruction through Generative Artificial Intelligence”, **CHI**, 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

- [J8] “Enhanced fringe-to-phase framework using deep learning”, *Image and Vision Computing* (under review).
- [J7] “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”, **IEEE 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 3D Deep Neural Network using Visualization in 3D Data Classification”, *Journal of Mechanical Science and Technology*, 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), **BMVC**(2020-2023), **ACCV**(2024), **IROS**(2024).
- Journals: **IEEE TPAMI**, **IEEE TIP**, **CVIU**, **IEEE R-AL**, **ACM 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 Languages	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.