

Patrick Rim

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Research Interests

Embodied AI with multimodal sensing {vision + language} for 3D tasks {perception + reconstruction}. Robust representations for sensor fusion {camera + lidar/radar} in challenging and dynamic settings {unsupervised + continual}.

Education

Yale University 2024 – Present

Ph.D. in Computer Science

Advisor: Prof. Alex Wong | Yale Vision Lab

Caltech 2020 – 2024

B.S. in Computer Science, Minor in Information and Data Sciences

GPA: 4.3/4.3 (Best Academic Record in Computer Science)

Research Experience

Yale Vision Lab

Advisor: Prof. Alex Wong Aug 2024 – Present

- First-authored: continual learning of unsupervised image+lidar depth completion by learning prototypes as adaptive domain-specific biases.
- Co-authored: language priors for depth estimation with diffusion models; recovering depth of occluded regions; energy-based test-time adaptation.

MSC Lab, UC Berkeley

Advisor: Dr. Wei Zhan Aug 2022 – Jun 2024

- Fused and transferred information between sparse representations of LiDAR and camera inputs to achieve state-of-the-art 3D object detection.
- Created novel representation of 3D scenes using quadric representations to improve accuracy and efficiency of odometry, mapping, and localization.
- Improved point-cloud segmentation using denoising pretraining.

Yue Lab, Caltech

Advisor: Prof. Yisong Yue May 2022 – Jun 2024

- Built and trained diffusion models for conditional trajectory generation.
- Learned animal behaviors in an unsupervised manner by clustering the latent representation space of a classifier predicting interaction type.
- Developed an unsupervised contrastive learning method to learn and disentangle causal features from spurious correlations.

Alvarez Lab, Caltech

Advisors: Prof. Mike Alvarez, Prof. Christina Ramirez

Oct 2021 – Dec 2023

- Developed a novel transformer-based vision architecture to outperform state-of-the-art methods in image sentiment analysis, and used it to identify emotions in political ad videos.
- Explored deep learning approaches for detecting HIV using genetic data.
- Built a mixed-effects fuzzy forest architecture to analyze longitudinal and highly correlated high-dimensional time-series data.

“CaltechFN: Distorted and Partially Occluded Digits” Project

Advisors: Dr. Elijah Cole, Prof. Yisong Yue

Sep 2021 – Dec 2022

- Led project to create the CaltechFN dataset as the new state-of-the-art benchmark for classification, detection, and weakly-supervised detection.
- Provided experimental accuracy and mAP results showing vision models trained on CaltechFN exhibit improved performance and generalize well across datasets.
- First-authored paper published in *ACCV 2022*.

Publications

ProtoDepth: Unsupervised Continual Depth Completion with Prototypes

P. Rim, H. Park, S. Gangopadhyay, Z. Zeng, Y. Chung, A. Wong.

In Submission, 2024.

OcCom’s Razor: Unsupervised Depth Completion by Learning from Occlusions

H. Park, R. Chen, **P. Rim**, C. Moon, A. Wong.

In Submission, 2024.

PriorDiffusion: Leverage Language Prior in Diffusion Models for Monocular Depth Estimation

Z. Zeng, J. Ni, D. Wang, **P. Rim**, Y. Chung, F. Yang, B. Hong, A. Wong.

In Submission, 2024.

ETA: Energy-based Test-time Adaptation for Depth Completion

Y. Chung, H. Park, **P. Rim**, J. He, Z. Zeng, S. Cicek, B. Hong, A. Wong.

In Submission, 2024.

SparseFusion: Fusing Multi-Modal Sparse Representations for Multi-Sensor 3D Object Detection

Y. Xie, C. Xu, M. Rakotosaona, **P. Rim**, F. Tombari, K. Keutzer, M. Tomizuka, W. Zhan.

International Conference on Computer Vision (ICCV), 2023.

Quadric Representations for LiDAR Odometry, Mapping and Localization

C. Xia, C. Xu, **P. Rim**, M. Ding, N. Zheng, K. Keutzer, M. Tomizuka, W. Zhan.

IEEE Robotics and Automation Letters (RA-L), 2023.

CaltechFN: Distorted and Partially Occluded Digits

P. Rim, S. Saha, M. Rim.

Asian Conference on Computer Vision (ACCV), 2022.

Optimizing the C4.5 Decision Tree Algorithm using MSD-Splitting

P. Rim, E. Liu.

International Journal of Advanced Computer Science and Applications, 2020.

Validating Planck SZ2 Clusters with Optical Counterparts

P. Banerjee, E. Pierpoali, N. Mirzatury, K. Maamari, **P. Rim**.

New Astronomy, 2019.

Dimensionality Reduction as Evidence of a New Regime of Galaxies

P. Rim, C. Steinhardt, A. Blank.

Caltech Undergraduate Research Journal (CURJ), 2022.

UnCLe: Unsupervised Continual Learning of Depth Completion

S. Gangopadhyay, X. Chen, M. Chu, **P. Rim**, H. Park, A. Wong.

arXiv Preprint, 2024.

Industry Experience

Squarepoint Capital, Quantitative Research Intern

Summer 2023

- Constructed and analyzed database of price, volatility, volume, and spreads of U.S. natural gas and power futures.
- Performed market structure analysis to find predictive factors using statistical and deep learning methods.

Airstrafe Interactive, Software Engineering Intern

Spring 2023

- Designed and integrated dynamic probability models to build new AI and logic systems using C++ and Unity.
- Created inverse kinematics system using quaternions and 3D math for realistic movement and rotation.

Honors and Awards	Graduate Nathan Hale Fellowship	2024
	Henry Ford II Scholar Award	2023
	Jack E. Froehlich Memorial Award Nominee	2023
	Marcella Bonsall SURF Fellowship	2022
	George W. Housner Fund Recipient	2021, 2022
	William Hassenzahl Family SURF Fellowship	2021
	Hixon Prize for Writing Nominee	2021
	1st Place, AI Hacks Hackathon at UPenn	2020
	Top 5 Overall Hack, YHack at Yale	2020
	“Best Use of Google Cloud” Award	2020
	“Facebook: Building Community” Award	2020
	National Merit Scholarship Recipient	2020

Teaching Experience	Head Instructor (CS 12: Computer Vision for Research)	2022 – 2023
	<ul style="list-style-type: none"> Independently designed and taught a term-long course that provides students with a practical and theoretical foundation in computer vision. Covered fundamental topics and advanced topics such as generative modeling and 3D vision, drawing from my own research. Taught 23 total students, including undergraduate and graduate students.¹ Updated course to cover diffusion models for image generation in 2024. 	
	Head TA (First-Year Success Research Institute)	Summer 2022
	<ul style="list-style-type: none"> Collaboratively designed a research project for FSRI (First-Year Success Research Institute) at Caltech, a DEI (Diversity, Equity, and Inclusion) program. Work included creating mini-projects and providing in-person help to students for 4-6 hours a week. Developed machine learning curriculum and assisted students with incorporating computer vision into their robotics projects. 	
	Head of Online, TA (CS 2, CS 3, CS 24)	2021 – 2023
	<ul style="list-style-type: none"> Worked as TA for CS 2 (Data Structures), CS 3 (Software Design), and CS 24 (Computing Systems) in the fall, winter, and spring terms respectively. Promoted to Head of Online (Ticketing) role in 2022, where I was in charge of managing a 24/7 online help platform, in addition to holding 4-6 hours of Office Hours per week. 	

¹Selected student endorsements:

- “I think you have made excellent video lectures and you are very good at explaining subjects clearly and concisely.”
- “The lectures have been very comprehensive and helpful. Thanks for designing a great course!”

Service and Leadership	NeurIPS 2024 , Reviewer	2024
	NeurIPS 2023 Datasets & Benchmarks Track , Reviewer	2023
	NeurIPS 2022 Datasets & Benchmarks Track , Reviewer	2022
	Deans Office Tutoring Program , Tutor	2022 – Present
	Quantitative Finance Club , Head of ML Research	2022 – Present
	Course Ombuds Program , Ompudsperson	2020 – 2022
	Southern California Science Olympiad , Treasurer	2020 – 2021
Talks and Presentations	Unsupervised Continual Depth Completion with Prototypes The 8th New England Computer Vision Workshop (NECV 2024)	Nov 2024
	Efficient 3D Vision Berkeley Artificial Intelligence Labs	Mar 2023
	CaltechFN: Distorted and Partially Occluded Digits Oral Presentation at ACCV 2022	Dec 2022
	Sentiment Analysis of Political Ad Videos Caltech SFP Fall Seminar Day	Oct 2022
	Identifying the Pre-Main Sequence with t-SNE Poster at 240th Meeting of the American Astronomical Society	Jun 2022
	Dimensionality Reduction to Find a New Galaxy Regime Caltech SFP Fall Seminar Day	Oct 2021
	Rethinking Galaxy Evolution with Unsupervised Learning Technical University of Denmark	Aug 2021