Linfang Zheng

PH.D. CANDIDATE · UNIVERSITY OF BIRMINGHAM

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Education

Ph.D. in UoB(University of Birmingham)
SCHOOL OF COMPUTER SCIENCE

Birmingham, UK
Jan. 2020 - Exp. Jul. 2024

- Thesis title: Visual 6D Object Pose Estimation and Tracking
- Supervisors: Prof. Hyung Jin Chang and Prof. Aleš Leonardis

Visiting Student in SUSTech(Southern University of Science and Technology)
DEPARTMENT OF SYSTEM DESIGN AND INTELLIGENT MANUFACTURING

Shenzhen, China
Apr. 2021 - PRESENT

- Visit lab: Control and Learning for Robotics and Autonomy (CLEAR) Lab
- Supervisor: Prof. Wei Zhang

MSc. in HIT(Harbin Institute of Technology)
INTEGRATED CIRCUIT ENGINEERING

Harbin, China
Sep. 2015 - Jul. 2017

- Outstanding Master's Graduate, Outstanding Master Thesis (Silver Award)

BSc. in HIT(Harbin Institute of Technology)
ELECTRONIC INFORMATION SCIENCE AND TECHNOLOGY

Harbin, China
Sep. 2011 - Jul. 2015

- Direct Admission to Post Graduate School

Research Experience

"My research interests cover a wide range of machine learning methods computer, ranging from deep convolution neural network to reinforcement learning, along with computer vision and robotics. I am particularly interested in machine-environment interaction, real-time 6D object pose recognition, hand pose estimation, eye gaze estimation, cloth manipulation, and planer region extraction."

Category-level Articulated Object Pose Estimation
COMPUTER VISION · 6D OBJECT POSE · ARTICULATED OBJECT

UoB, UK
Jan. 2024 - Mar. 2024

- Submitted to European Conference on Computer Vision (**ECCV 2024**) (co-author). Under review.

Hand-Object Pose Estimation
COMPUTER VISION · 6D OBJECT POSE · HAND POSE · GENERALIZABILITY · TRANSFORMER

UoB, UK
Dec. 2023 - PRESENT

- Submitted to the Thirty-eighth Annual Conference on Neural Information Processing Systems (**NeurIPS 2024**) (co-author). Under review.

Optimization-based Multi-Step Cloth Pushing Planning
ROBOTICS · PLANNING · MANIPULATION · CLOTH PUSHING · DEFORMABLE OBJECT

SUSTech, China
Dec. 2023 - Mar. 2024

- Submitted to IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS 2024**) (co-author). Under review.

Category-level 6D Object Pose Refinement
COMPUTER VISION · 6D OBJECT POSE · CATEGORY-LEVEL · REFINEMENT · GRAPH CONVOLUTION

UoB, UK & SUSTech, China
Mar. 2023 - Mar. 2024

- This research addressed the previously unexplored problem of geometric discrepancies among category-level objects for 6D object pose refinement.
- We proposed using 3D graph convolution-based geometric feature extraction, learnable affine transformations, and a unique merging mechanism to enhance the relative pose estimation between objects of different shapes
- Achieved significantly enhanced generalizability (outperforming the baseline method using only 4% of the training data) and performance, *i.e.*, the performance on the $10°2$cm metric improved by **10.5%**.
- Accepted to IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR 2024**) (first author).

Multi-Resolution Planar Region Extraction for Uneven Terrains
ROBOTICS · COMPUTER VISION · SEGMENTATION · PLANE EXTRACTION · LOCOMOTION

SUSTech, China
Nov. 2022 - Sep. 2023

- Collaboratively Introduced a multi-resolution planer region extraction strategy for uneven terrains from point cloud data.
- Contributed to designing deep learning-based plane segmentation.
- Accepted to IEEE International Conference on Robotics and Automation (**ICRA 2024**) (co-author).

Category-level Object Pose Estimation
UoB, UK & SUSTech, China

Computer Vision · 6D Object Pose · Category-level · Graph Convolution · Backbone · Complex-shaped Object
Mar. 2022 - May 2023

- This research focused on effective latent feature extraction from 3D point clouds.
- We proposed a general 3D graph convolution-based hybrid scope feature extraction layer (HS-layer). The HS-layer: 1) can encode translation and scale information, 2) can extract local-global geometric information, and 3) is robust to outliers.
- We use HS-layer to construct a category-level object pose estimation framework. The resulting framework exhibits robustness to outliers, and significant performance improvement (especially for complex-shaped objects), notably enhancing the $5°2cm$ metric by 14.5%.
- Accepted to IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR 2023**) (first author).

3D Joint Gaze Estimation
UoB, UK

Computer Vision · 3D Joint Gaze Estimation
Jan. 2022 - Apr. 2023

- This research addressed the previously unexplored problem of integrating a depth prior and a 3D joint field-of-view probability map to estimate attention targets in a scene.
- I collaboratively introduced the cutting-edge depth-aware joint attention estimation framework, surpassing current benchmarks.
- Accepted to IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshop (**CVPR Workshop 2023**) (co-author).

Instance-level 6D Object Pose Tracking
UoB, UK & SUSTech, China

Computer Vision · 6D Object Pose · Tracking · Severe Occlusion · Textureless Object · GRU · Auto-encoder
Feb. 2020 - Mar. 2022

- This research focused on addressing the challenge of robustness under complex scenarios, particularly for textureless and symmetric objects that are partially occluded.
- Introduced the first neural network-based prior pose generation scheme, leveraging object pose history to effectively forecast future poses.
- Developed a real-time temporally-primed pose estimation architecture that leverages prior pose information and high-quality object recovery for accurate pose error estimation.
- The proposed method outperforms state-of-the-art methods on two benchmark datasets, showing improved robustness in challenging scenarios while maintaining real-time performance.
- Accepted to IEEE International Conference on Robotics and Automation (**ICRA 2022**) (first author).

Instance-level Object Pose Estimation and Refinement
UoB, UK

Computer Vision · 6D Object Pose · Estimation · Refinement · Transformer
Aug. 2021 - Mar. 2022

- Collaboratively introduced a Transformer-based network, leveraging global feature correlation to enhance object pose estimation performance.
- Accepted to European Conference on Computer Vision Workshop (**ECCV Workshop 2022**) (co-author).

Optimal Control Inspired Q-Learning for Switched Linear Systems
SUSTech, China

Optimal Control · Reinforcement Learning · Q-Learning · Switched Linear System
May 2019 - Dec. 2019

- Collaboratively proposed an algorithm with a carefully designed parametric approximator that respects the analytical structure of the exact Q-function, paired with an associate parameter training algorithm.
- Accepted to American Control Conference (**ACC 2020**) (co-author).

Work Experience

Employment

SUSTech
Shenzhen, China

Research Assistant
Mar. 2019 - Jan. 2020

- Assisted in project and research work including embedded software and hardware design, algorithm implementation, and project proposal writing.
- Participated in research on reinforcement learning based on optimal control, resulting in publication at ACC 2020.

DJI Co. Ltd.
Shenzhen, China

Embedded Hardware Engineer
Jul. 2017 - Mar. 2019

- Evaluated the rationality of electronic component selection in the company's embedded hardware circuit design, enhancing design efficiency
- Managed arrangements and follow-ups for electronic component performance verification, improving the stability of the electronic component supply chain.
- Achieved cost savings for the company through optimized electronic component selection, receiving recognition and rewards.

Internship

DJI Co. Ltd.
Shenzhen, China

Embedded Hardware Engineer
Jul. 2016 - Sep. 2016

- Supported Robomasters competition field hardware circuit-related tasks and summer camp activities.

Honors & Awards

2023	**Best Paper Award**, CVPR Workshop on GAZE 2023	*Vancouver, Canada*
2017	**Outstanding Master's Graduate**, Harbin Institute of Technology	*Harbin, China*
2017	**Silver Award for Outstanding Master's Thesis**, Harbin Institute of Technology	*Harbin, China*
2017	**First Prize Scholarship**, Harbin Institute of Technology (2011 - 2017)	*Harbin, China*
2014	**Second Prize**, HIT Technology Innovation and Entrepreneurship Training Program	*Harbin, China*
2014	**Second Prize**, HIT First Physics Academic Competition	*Harbin, China*
2014	**Second Prize Scholarship**, People's Daily (People.cn)	*Harbin, China*

Skills

Programming	Python, C, Matlab, Verilog
Deep Learning	PyTorch, TensorFlow
Hardware Design	Embedded Hardware Design, Integrated Circuit Design, FPGA
Software Design	Embedded Software Design
Languages	English, Mandarin (Mother Language)

Peer-Review Activity

Conference

CVPR(2023/2024), ECCV(2023/2024), ICCV(2023,2024), ICRA(2023/2024), IROS(2024), CASE(2024)

Publications

2024   Linfang Zheng, Tze Ho Elden Tse, Chen Wang, Yinghan Sun, Hua Chen, Aleš Leonardis, Wei Zhang,
GeoReF: Geometric Alignment Across Shape Variation for Category-level Object Pose Refinement,
*IEEE Proc. Computer Vision and Pattern Recognition (**CVPR**), June, 2024.*

2024   Yinghan Sun, Linfang Zheng, Hua Chen, Wei Zhang,
Multi-Resolution Planar Region Extraction for Uneven Terrains,
*IEEE International Conference on Robotics and Automation (**ICRA**), May, 2024*

2023   Linfang Zheng, Chen Wang, Yinghan Sun, Esha Dasgupta, Hua Chen, Aleš Leonardis, Wei Zhang, Hyung Jin Chang,
HS-Pose: Hybrid Scope Feature Extraction for Category-level Object Pose Estimation,
*IEEE Proc. Computer Vision and Pattern Recognition (**CVPR**), June, 2023.*

2023   Nora Horanyi, Linfang Zheng, Eunji Chong, Aleš Leonardis, Hyung Jin Chang
Where Are They Looking in the 3D Space?
*IEEE Proc. Computer Vision and Pattern Recognition Workshop (**CVPR Workshop**), June, 2023. [Best Paper Award]*

2022   Linfang Zheng, Aleš Leonardis, Tze Ho Elden Tse, Nora Horanyi, Wei Zhang, Hua Chen, Hyung Jin Chang,
TP-AE: Temporally Primed 6D Object Pose Tracking with Auto-Encoders,
*IEEE International Conference on Robotics and Automation (**ICRA**), May, 2022*

2022   Zhongqun Zhang, Wei Chen, Linfang Zheng, Aleš Leonardis, Hyung Jin Chang,
Trans6D: Transformer-Based 6D Object Pose Estimation and Refinement,
***ECCV Workshop**, 7th International Workshop on Recovering 6D Object Pose, October, 2022*

2020   Hua Chen, Linfang Zheng, Wei Zhang
Optimal Control Inspired Q-Learning for Switched Linear Systems
*American Control Conference (**ACC**), July, 2020*