

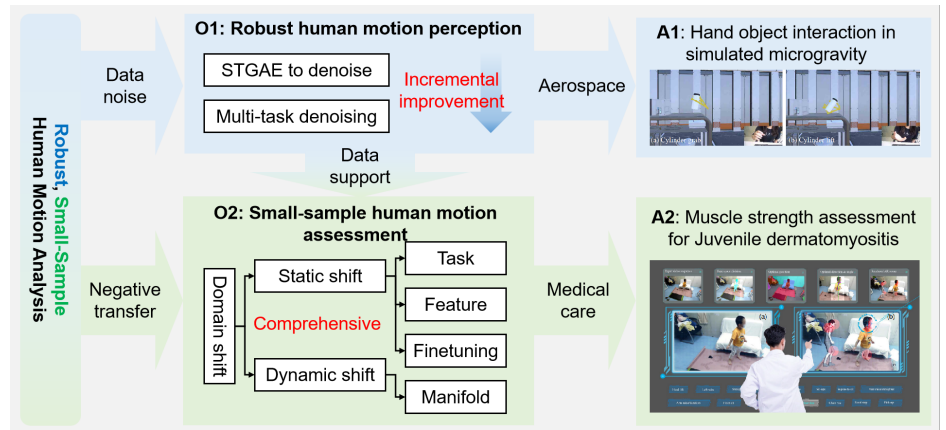
Kanglei Zhou

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RESEARCH SUMMARY

My research leverages Computer Vision (CV) algorithms and Augmented Reality (AR) techniques to integrate human-structured knowledge into robust, small-sample human motion analysis from both semantic and geometric perspectives. Specifically, I focus on hand/body pose estimation and action quality assessment in medical care, addressing real-world challenges such as limited labeled data, domain shift, and stringent privacy requirements. My key contributions include developing continual learning frameworks to enhance adaptability and robustness in dynamic environments, employing human-in-the-loop verification to improve trustworthiness and applicability, and designing deep causality learning methods to ensure model interpretability.

During the past five years of my PhD study, I have achieved two primary research outcomes. *O1: Robust Human Motion Perception*: I developed spatial-temporal graph convolutional networks to address **motion noises** caused by physiological or pathological factors. These methods have been successfully applied to human-object interaction in microgravity, providing exercise tools for astronauts and promoting public understanding of space exploration. *O2: Small-Sample Human Motion Assessment*: Building on the data support from the previous research outcome, I proposed novel method to address **domain shift issues** (from task, feature, fine-tuning, and manifold perspectives) arising from negative transfer between pre-trained domains and action quality assessment. These methods have been applied to muscle strength assessment for Juvenile Dermatomyositis patients, demonstrating significant improvements in precision and generalization.



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I am expected to graduate in June 2025 and am seeking a Postdoctoral Research position starting later that year. I will continue put my research in a forward step and I am also open to other directions.

EDUCATION



PhD Candidate, Beihang University, Beijing, China

Computer Science, State Key Lab of VR Technology and Systems

Supervised by Prof. Xiaohui Liang

2020 – 2025 (Expected)



Visiting Student (Onsite), Durham University, Durham, U.K.

Worked with Prof. Hubert P. H. Shum and Dr. Frederick W. B. Li

Feb – Aug, 2024



Bachelor's Degree, Henan Normal University, Henan, China

Major in Computer Science, College of Computer Science and Engineering

Minor in English, Faculty of International Studies

2016 – 2020

2017 – 2020



Exchange Student (Onsite), Frankfurt University of Applied Sciences, Germany

Worked with Prof. Jürgen Jung

Summer 2019

HIGHLIGHTS

➡ I have played a key role as a primary contributor and principal executor in the NSFC proposal (62272019).

- ➡ I organized the reception during Dr. Fred W. B. Li's visit to Beihang University in June 2023.
- ➡ I have delivered presentations of several top-tier conference papers in person, including:

Conferences	ECCV 2024	VR 2023	ISMAR 2023	ISMAR 2021
Presentation	 - Llyiw-CpOew	 - cZbc1ScexMg	 - D7DL85wP12w	 - DYrh6KpDKC

- ➡ I have co-supervised several master's and PhD students from diverse countries, including:

Name (year)	Degree	University	Co-supervised with	Research Area
Ruisheng Han (24-28)	PhD	Durham	Prof. Hubert P. H. Shum	Action Quality Assessment
Ruizhi Cai (22-25)	Master	Beihang	Prof. Xiaohui Liang	AQA, Co-publish TVCG, IJCAI
Zikai Hao (22-25)	Master	Beihang	Prof. Xiaohui Liang	Hand Pose Estimation
Chen Chen (21-24)	Master	Beihang	Prof. Xiaohui Liang	HPE, Co-publish ISMAR'23
Zhiyuan Cheng (20-22)	Master	Beihang	Prof. Xiaohui Liang	HPE, Co-publish ISMAR'21
Yulei Zhong (20-22)	Master	Beihang	Prof. Xiaohui Liang	Action Recognition

RESEARCH PUBLICATIONS (†=EQUAL CONTRIBUTION)

- ➡ 2020–Present Outcome 1: Robust human motion perception.

[1] **K. Zhou**, Z. Cheng, H. P. Shum, F. W. Li, and X. Liang, “Stgae: Spatial-temporal graph auto-encoder for hand motion denoising,” in *ISMAR*, 2021, pp. 41–49. DOI: [10.1109/ISMAR52148.2021.00018](#). ()

[2] **K. Zhou**[†], C. Chen[†], Y. Ma, Z. Leng, H. P. H. Shum, F. W. B. Li, and X. Liang, “A mixed reality training system for hand-object interaction in simulated microgravity environments,” in *ISMAR*, 2023, pp. 167–176. DOI: [10.1109/ISMAR59233.2023.00031](#). ( | )

[3] **K. Zhou**, H. P. Shum, F. W. Li, and X. Liang, “Multi-task spatial-temporal graph auto-encoder for hand motion denoising,” *IEEE TVCG*, vol. 30, no. 1, pp. 6754–6769, 2024. DOI: [10.1109/TVCG.2023.3337868](#). ( | )

- ➡ 2020–Present Outcome 2: Small-sample human motion assessment.

[4] **K. Zhou**, Z. Hao, L. Wang, and X. Liang, “Adaptive score alignment learning for continual perceptual quality assessment of 360-degree videos in virtual reality,” in *IEEE TVCG*, 2025. ( | **Presented at VR 2025**)

[5] **K. Zhou**, R. Cai, Y. Ma, Q. Tan, X. Zhang, J. Li, S. Jin, and X. Liang, “A video-based augmented reality system for human-in-the-loop muscle strength assessment of juvenile dermatomyositis,” *IEEE TVCG*, vol. 29, pp. 2456–2466, 5 2023. DOI: [10.1109/TVCG.2023.3247092](#). ( |  | **Presented at VR 2023, Top 10%**)

[6] **K. Zhou**, Y. Ma, H. P. H. Shum, and X. Liang, “Hierarchical graph convolutional networks for action quality assessment,” *IEEE TCSVT*, vol. 33, no. 12, pp. 7749–7763, 2023. DOI: [10.1109/TCSVT.2023.3281413](#). ()

[7] **K. Zhou**, J. Li, R. Cai, L. Wang, X. Zhang, and X. Liang, “Cofinal: Enhancing action quality assessment with coarse-to-fine instruction alignment,” in *IJCAI*, 2024, pp. 1771–1779. DOI: [10.24963/ijcai.2024/196](#). ()

[8] **K. Zhou**, L. Wang, X. Zhang, H. P. Shum, F. W. Li, J. Li, and X. Liang, “Magr: Manifold-aligned graph regularization for continual action quality assessment,” in *ECCV*, vol. 15069, 2024, pp. 375–392. DOI: [10.48550/arXiv.2403.04398](#). ( |  | **Oral Presentation, Top 2.3%**)

- ➡ Three papers of Outcome 2 are **Under Review**.

[9] **K. Zhou**, H. P. Shum, F. W. Li, X. Zhang, and X. Liang, “Phi: Bridging domain shift in long-term action quality assessment via progressive hierarchical instruction,” *IEEE TIP*, 2024. (**Major Revision**)

- [10] **K. Zhou**, R. Cai, L. Wang, H. P. H. Shum, and X. Liang, “A comprehensive survey of action quality assessment: Method and benchmark,” *arXiv preprint arXiv:2412.11149*, 2024. DOI: [10.48550/arXiv.2412.11149](https://doi.org/10.48550/arXiv.2412.11149). ( | Submitted to IJCV)
- [11] **K. Zhou[†]**, R. Cai[†], X. Wang[†], J. Li, and X. Liang, “Two-stage multi-modal fusion with adaptive alignment for muscle strength assessment of juvenile dermatomyositis,” *IEEE TPAMI*, 2025.

SELECTED AWARDS

- 2018 The First Prize in the Contemporary Undergraduate Mathematical Contest in Modeling (CUMCM)
- 2019 Henan Normal University Youth May Fourth Medal
- 2019 National Scholarship (Top 1% undergraduate students)
- 2020 Excellent Dissertation (Graduation Design) in Henan Province
- 2020 The Second Prize in “Huawei Cup” – the 18th China Postgraduate Mathematical Modeling Competition
- 2023 First Prize, PhD Academic Scholarship (Top 5%)
- 2024 National Scholarship (Top 1% PhD students)

TECHNICAL SKILLS

Programming Languages: C/C++, Python, MATLAB

Softwares/Platforms/Libraries: Unity, Microsoft HoloLens 2, `pytorch`, `tensorflow`, `matplotlib`

Research Tools: $\text{\LaTeX}$, Visio

PROFESSIONAL ACTIVITIES

Reviewer for ISMAR 2022-2024, VR 2024, ACM MM 2024, BMVC 2024

Reviewer for TCSVT, TCYB, PR