

# XIAOWEI HU

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## ACADEMIC QUALIFICATIONS

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<b>Ph.D. in Computer Science and Engineering</b> The Chinese University of Hong Kong (CUHK) Advisors: Prof. Pheng-Ann Heng & Prof. Chi-Wing Fu ★ Awardee of the Hong Kong Ph.D. Fellowship Scheme (HKPFS)	08/2016 - 07/2020
<b>B.Eng. in Computer Science and Technology</b> South China University of Technology (SCUT) GPA: 3.95/4.0 ( <b>rank 1<sup>st</sup></b> in All-English-Teaching Union Class) ★ Selected by SCUT for a special class for the most promising students	09/2012 - 07/2016

## EMPLOYMENT

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<b>Research Scientist</b> , Shanghai Artificial Intelligence Laboratory	03/2022 - present
<b>Postdoctoral Fellow</b> , The Chinese University of Hong Kong	08/2020 - 02/2022

## RESEARCH RECORDS

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Dr. Hu's research interests span **computer vision, low-level vision, vision perception, medical AI, and deep learning**. Specifically, his research focuses on: (a) Designing learning algorithms tailored for image and video restoration under challenging weather and lighting conditions. (b) Specializing in the development of intelligent perception methods capable of continuous operation, with the adaptability to varying environments and diverse lighting scenarios. (c) Advancing the development of next-generation computer vision models, efficiently handling multiple tasks, and contributing to a deeper understanding of and an enhanced ability to create the visual world. Dr. Hu boasts an extensive publication record, with **more than 40 academic papers** published in prestigious journals and conferences, including IEEE TPAMI, CVPR, and ICCV. His work has garnered significant attention, as evidenced by his **Google Scholar citation over 4300** and an **h-index of 29**.

## HONORS & AWARDS

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Outstanding Young Talents Program (Overseas) of China	2023
World's Top 2% Scientists by Stanford University	2023
Achieved Excellence in the Hong Kong Young Scientist Award (two winners in Engineering Science in <b>Hong Kong</b> )	2021
CVPR Doctoral Consortium Award (31 awardees <b>globally</b> )	2020
Best Oral Presentation Award of Hong Kong Computer Vision Workshop (the <b>only</b> winner)	2019
Hong Kong Ph.D. Fellowship (the <b>highest</b> scholarship for students studying in Hong Kong)	2016
Top 10 Outstanding Students at SCUT ( <b>rank 1<sup>st</sup></b> , the <b>highest</b> award for students at SCUT)	2016
Google Excellence Scholarship (one of 58 winners in <b>China</b> )	2015
Tencent Outstanding Scholarship (the <b>only</b> undergraduate winner at SCUT)	2015
National Scholarship (the <b>highest</b> national wide scholarship for undergraduate students in China)	2013

## PUBLICATIONS

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**Summary: CVPR/ICCV/ECCV (13), TPAMI (2), IEEE Transactions (17)**

†: joint first authors; \*: corresponding author;

### 2024

- [1] G. Yu, J. Zou, **X. Hu**, A. I. Aviles-Rivero, J. Qin, and S. Wang, "Revitalizing Multivariate Time Series Forecasting: Learnable Decomposition with Inter-Series Dependencies and Intra-Series Variations Modeling," *Arxiv Tech Report*, 2024.
- [2] S. Deng, Y. Feng, H. Lin, Y. Fan, A. P.-W. Lee, **X. Hu**, and J. Qin, "Semi-supervised TEE Segmentation via Interacting with SAM Equipped with Noise-resilient Prompting," *AAAI Conference on Artificial Intelligence (AAAI)*, pp. 11757-11765, 2024.

- [3] B. Chen, Z. Chen, **X. Hu**, J. Xu, H. Xie, J. Qin, and M. Wei, “Dynamic Message Propagation Network for RGB-D and Video Salient Object Detection,” *ACM Transactions on Multimedia Computing Communications and Applications (ACM TOMM)*, vol. 21, no. 1, pp. 1-21, 2024.

## 2023

- [4] L. Liu, Y. Cheng, Z. Deng, S. Wang, D. Chen, **X. Hu**, P. Liò, C.-B. Schönlieb, and A. I. Aviles-Rivero, “TrafficMOT: A Challenging Dataset for Multi-Object Tracking in Complex Traffic Scenarios,” *Arxiv Tech Report*, 2023.
- [5] T. Wang, **X. Hu\***, P.-A. Heng, and C.-W. Fu, “Instance Shadow Detection with A Single-Stage Detector,” *IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI)*, vol. 45, no. 3, pp. 3259-3273, 2023.
- [6] Z. Jin, **X. Hu**, L. Zhu, L. Song, L. Yuan, and L. Yu, “IDRNet: Intervention-Driven Relation Network for Semantic Segmentation,” *Neural Information Processing Systems (NeurIPS)*, to appear, 2023.
- [7] H. Yang<sup>†</sup>, T. Wang<sup>†</sup>, **X. Hu\***, and C.-W. Fu, “SILT: Shadow-Aware Iterative Label Tuning for Learning to Detect Shadows from Noisy Labels,” *IEEE International Conference on Computer Vision (ICCV)*, pp. 12687-12698, 2023.
- [8] Y. Zhu<sup>†</sup>, T. Wang<sup>†</sup>, X. Fu\*, X. Yang, X. Guo, J. Dai, Y. Qiao, and **X. Hu\***, “Learning Weather-General and Weather-Specific Features for Image Restoration Under Multiple Adverse Weather Conditions,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 21747-21758, 2023.
- [9] J. Xu, **X. Hu\***, L. Zhu\*, Q. Dou, J. Dai, Y. Qiao, and P.-A. Heng, “Video Dehazing via a Multi-Range Temporal Alignment Network with Physical Prior,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 18053-18062, 2023.
- [10] M. Shi, Z. Huang, X. Ma, **X. Hu**, and Z. Cao, “Matching Is Not Enough: A Two-Stage Framework for Category-Agnostic Pose Estimation,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 7308-7317, 2023. (**Highlight**)
- [11] W. Wang, J. Dai, Z. Chen, Z. Huang, Z. Li, X. Zhu, **X. Hu**, T. Lu, L. Lu, H. Li, X. Wang, and Y. Qiao, “InternImage: Exploring Large-Scale Vision Foundation Models with Deformable Convolutions,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 14408-14419, 2023. (**Highlight**)
- [12] J. Ren<sup>†</sup>, **X. Hu<sup>†</sup>**, L. Zhu, X. Xu, Y. Xu, W. Wang, Z. Deng, and P.-A. Heng, “Deep Texture-Aware Features for Camouflaged Object Detection,” *IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)*, vol. 33, no. 3, pp. 1157-1167, 2023.
- [13] S. Xu, H. Zhang, X. Xu\*, **X. Hu\***, Y. Xu, L. Dai, K.-S. Choi, and P.-A. Heng, “Representative Feature Alignment for Adaptive Object Detection,” *IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)*, vol. 33, no. 2, pp. 689-700, 2023.

## 2022

- [14] Z. Xing<sup>†</sup>, T. Wang<sup>†</sup>, **X. Hu\***, H. Wu, C.-W. Fu, and P.-A. Heng, “Video Instance Shadow Detection,” *Arxiv Tech Report*, 2022.
- [15] **X. Hu<sup>†</sup>**, M. Shi<sup>†</sup>, W. Wang<sup>†</sup>, S. Wu<sup>†</sup>, L. Xing, W. Wang, X. Zhu, L. Lu, J. Zhou, X. Wang, Y. Qiao, and J. Dai\*, “Demystify Transformers & Convolutions in Modern Image Deep Networks,” *Arxiv Tech Report*, 2022.
- [16] T. Wang, **X. Hu\***, Z. Liu, and C.-W. Fu, “Sparse2Dense: Learning to Densify 3D Features for 3D Object Detection,” *Neural Information Processing Systems (NeurIPS)*, 2022.
- [17] X. Ding, J. Yang, **X. Hu**, and X. Li, “Learning Shadow Correspondence for Video Shadow Detection,” *European Conference on Computer Vision (ECCV)*, pp. 705-722, 2022.
- [18] Y. Zhu, X. Wang, X. Fu\*, and **X. Hu\***, “Enhanced Coarse-to-Fine Network for Image Restoration,” *The first Mobile Intelligent Photography & Imaging Workshop @ ECCV 2022*, pp. 130-146, 2022.
- [19] H. Yao, **X. Hu**, and X. Li, “Enhancing Pseudo Label Quality for Semi-Supervised Domain-Generalized Medical Image Segmentation,” *AAAI Conference on Artificial Intelligence (AAAI)*, pp. 3099-3107, 2022.
- [20] Z. Wang, S. Gui, X. Ding, **X. Hu\***, X. Xu\*, and X. Li, “Spectrum and Style Transformation Framework for Omni-Domain COVID-19 Diagnosis,” *IEEE Transactions on Emerging Topics in Computational Intelligence (IEEE TETCI)*, accepted, 2022.

## 2021

- [21] **X. Hu**, T. Wang, C.-W. Fu, Y. Jiang, Q. Wang, and P.-A. Heng, “Revisiting Shadow Detection: A New Benchmark Dataset for Complex World,” *IEEE Transactions on Image Processing (IEEE TIP)*, vol. 30, pp. 1925-1934, 2021.
- [22] **X. Hu**, L. Zhu, T. Wang, C.-W. Fu, and P.-A. Heng, “Single-Image Real-Time Rain Removal Based on Depth-Guided Non-Local Features,” *IEEE Transactions on Image Processing (IEEE TIP)*, vol. 30, pp. 1759-1770, 2021.
- [23] T. Wang<sup>†</sup>, **X. Hu<sup>†</sup>\***, C.-W. Fu, and P.-A. Heng, “Single-Stage Instance Shadow Detection with Bidirectional Relation Learning,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 1-11, 2021. (**Oral**)

- [24] **X. Hu**, C.-W. Fu, L. Zhu, T. Wang, and P.-A. Heng, "SAC-Net: Spatial Attenuation Context for Salient Object Detection," *IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)*, vol. 31, no. 3, pp. 1079-1090, 2021.
- [25] X. Li, **X. Hu**, X. Qi, L. Yu, W. Zhao, P.-A. Heng, and L. Xing, "Rotation-oriented Collaborative Self-supervised Learning for Retinal Disease Diagnosis," *IEEE Transactions on Medical Imaging (IEEE TMI)*, vol. 40, no. 9, pp. 2284-2294, 2021. (**TMI Popular Paper**)
- [26] X. Xu, T. Yu, **X. Hu\***, W. W. Y. Ng\*, and P.-A. Heng, "SALMNet: A Structure-Aware Lane Marking Detection Network," *IEEE Transactions on Intelligent Transportation Systems (IEEE TITS)*, vol. 22, no. 8, pp. 4986-4997, 2021.
- [27] L. Zhu, Z. Deng, **X. Hu\***, H. Xie, X. Xu\*, J. Qin, and P.-A. Heng, "Learning Gated Non-Local Residual for Single-Image Rain Streak Removal," *IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)*, vol. 31, no. 6, pp. 2147-2159, 2021.
- [28] X. Yan, H. Zhang, X. Xu, **X. Hu**, and P.-A. Heng, "Learning Semantic Context from Normal Samples for Unsupervised Anomaly Detection," *AAAI Conference on Artificial Intelligence (AAAI)*, vol. 35, no. 4, pp. 3110-3118, 2021.
- [29] C. Xue, L. Zhu, H. Fu, **X. Hu**, X. Li, H. Zhang, and P.-A. Heng, "Global Guidance Network for Breast Lesion Segmentation in Ultrasound Images," *Medical Image Analysis (MedIA)*, vol. 70, article no. 101989, 2021.

## 2020

- [30] **X. Hu**, C.-W. Fu, L. Zhu, J. Qin, and P.-A. Heng, "Direction-Aware Spatial Context Features for Shadow Detection and Removal," *IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI)*, vol. 42, no. 11, pp. 2795-2808, 2020.
- [31] T. Wang<sup>†</sup>, **X. Hu<sup>†</sup>**, Q. Wang, P.-A. Heng, and C.-W. Fu, "Instance Shadow Detection," *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 1880-1889, 2020.
- [32] L. Zhu<sup>†</sup>, **X. Hu<sup>†</sup>**, C.-W. Fu, J. Qin, and P.-A. Heng, "Saliency-Aware Texture Smoothing," *IEEE Transactions on Visualization and Computer Graphics (IEEE TVCG)*, vol. 26, no. 7, pp. 2471-2484, 2020.
- [33] L. Liu,<sup>†</sup> **X. Hu<sup>†</sup>**, L. Zhu, C.-W. Fu, J. Qin, and P.-A. Heng, "Psi-Net: Stacking Densely Convolutional LSTMs for Sub-cortical Brain Structure Segmentation," *IEEE Transactions on Medical Imaging (IEEE TMI)*, vol. 39, no. 9, pp. 2806-2817, 2020.
- [34] X. Li\*, **X. Hu\***, L. Yu, L. Zhu, C.-W. Fu, and P.-A. Heng, "CANet: Cross-disease Attention Network for Joint Diabetic Retinopathy and Diabetic Macular Edema Grading," *IEEE Transactions on Medical Imaging (IEEE TMI)*, vol. 39, no. 5, pp. 1483-1493, 2020. (**ESI Highly Cited Paper**)
- [35] X. Tang, **X. Hu**, C.-W. Fu, and D. Cohen-Or, "GrabAR: Occlusion-aware Grabbing Virtual Objects in AR," *ACM Symposium on User Interface Software and Technology (UIST)*, pp. 697-708, 2020.
- [36] L. Zhu, J. Chen, **X. Hu**, C.-W. Fu, X. Xu, J. Qin, and P.-A. Heng, "Aggregating Attentional Dilated Features for Salient Object Detection," *IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT)*, vol. 30, no. 10, pp. 3358-3371, 2020.

## 2019

- [37] **X. Hu**, Y. Jiang, C.-W. Fu, and P.-A. Heng, "Mask-ShadowGAN: Learning to Remove Shadows from Unpaired Data," *IEEE International Conference on Computer Vision (ICCV)*, pp. 2472-2481, 2019.
- [38] Z. Deng, L. Zhu, **X. Hu**, C.-W. Fu, X. Xu, Q. Zhang, J. Qin, and P.-A. Heng, "Deep Multi-Model Fusion for Single-Image Dehazing," *IEEE International Conference on Computer Vision (ICCV)*, pp. 2453-2462, 2019.
- [39] **X. Hu**, C.-W. Fu, L. Zhu, and P.-A. Heng, "Depth-Attentional Features for Single-Image Rain Removal," *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 8022-8031, 2019.
- [40] **X. Hu**, X. Xu, Y. Xiao, H. Chen, S. He, J. Qin, and P.-A. Heng, "SINet: A Scale-Insensitive Convolutional Neural Network for Fast Vehicle Detection," *IEEE Transactions on Intelligent Transportation Systems (IEEE TITS)*, vol. 20, no. 3, pp. 1010-1019, 2019. (**ESI Highly Cited Paper**)
- [41] L. Liu, **X. Hu**, L. Zhu, and P.-A. Heng, "Probabilistic Multilayer Regularization Network for Unsupervised 3D Brain Image Registration," *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, pp. 346-354, 2019.
- [42] Y. Wang, H. Dou, **X. Hu**, L. Zhu, X. Yang, M. Xu, J. Qin, P.-A. Heng, T. Wang, and D. Ni, "Deep Attentive Features for Prostate Segmentation in 3D Transrectal Ultrasound," *IEEE Transactions on Medical Imaging (IEEE TMI)*, vol. 38, no. 12, pp. 2768-2778, 2019.
- [43] Y. Tian, C.-W. Fu, S. Zhao, R. Li, X. Tang, **X. Hu**, and P.-A. Heng, "Enhancing Augmented VR Interaction via Egocentric Scene Analysis," *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (Ubicomp)*, vol. 3, no. 3, article no. 105, 2019.

- [44] H. Al Hajj, M. Lamard, P.-H. Conze, S. Roychowdhury, **X. Hu**, et al., “CATARACTS: Challenge on Automatic Tool Annotation for cataRACT Surgery,” *Medical Image Analysis (MedIA)*, vol. 52, pp. 24-41, 2019.

## 2018 & Before

- [45] **X. Hu**, L. Zhu, C.-W. Fu, J. Qin, and P.-A. Heng, “Direction-Aware Spatial Context Features for Shadow Detection,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 7454-7462, 2018. (**Oral**)
- [46] **X. Hu**, L. Zhu, J. Qin, C.-W. Fu, and P.-A. Heng, “Recurrently Aggregating Deep Features for Salient Object Detection,” *AAAI Conference on Artificial Intelligence (AAAI)*, pp. 6943-6950, 2018. (**Spotlight**)
- [47] Z. Deng<sup>†</sup>, **X. Hu**<sup>†</sup>, L. Zhu, X. Xu, J. Qin, G. Han, and P.-A. Heng. “R3Net: Recurrent Residual Refinement Network for Saliency Detection,” *International Joint Conference on Artificial Intelligence (IJCAI)*, pp. 684-690, 2018. (**Oral**)
- [48] L. Zhu, Z. Deng, **X. Hu**, C.-W. Fu, X. Xu, J. Qin, and P.-A. Heng, “Bidirectional Feature Pyramid Network with Recurrent Attention Residual Modules for Shadow Detection,” *European Conference on Computer Vision (ECCV)*, pp. 122-137, 2018.
- [49] Y. Wang, Z. Deng, **X. Hu**, L. Zhu, X. Yang, X. Xu, P.-A. Heng, and D. Ni, “Deep Attentional Features for Prostate Segmentation in Ultrasound,” *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, pp. 523-530, 2018.
- [50] **X. Hu**, L. Yu, H. Chen, J. Qin, and P.-A. Heng, “AGNet: Attention-Guided Network for Surgical Tool Presence Detection,” *Deep Learning in Medical Image Analysis and Multimodal Learning for Clinical Decision Support*, pp. 186-194, 2017.

## TALKS & PRESENTATIONS

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### Revitalizing Visual Content under Adverse Weather and Complex Illumination

- ◇ Talk at The University of Hong Kong, January 2024.

### Demystifying the Giants: An Introduction to Large Language and Vision Models with Healthcare Applications

- ◇ Tutorial at The Hong Kong Polytechnic University, November 2023.

### Learning for Visions Under the Adverse Weather and Complex Illumination

- ◇ Talk at ShanghaiTech University, November 2023.
- ◇ Talk at Zhejiang Lab, June 2023.
- ◇ Talk at University of Cambridge, May 2023.
- ◇ Talk at South China University of Technology, March 2023.

### Basic Vision Models (Object Detection)

- ◇ Tutorial at The Hong Kong University of Science and Technology, February & September 2022.

### Shadow Detection and Removal with Deep Learning

- ◇ Talk at Shanghai AI Laboratory, October 2021.
- ◇ Talk at TechBeat, August 2021.
- ◇ Talk at Nanjing University, May 2021.
- ◇ Talk at Nanjing University of Science and Technology, May 2021.
- ◇ Talk at Nanjing University of Aeronautics and Astronautics, April 2021.
- ◇ Talk at Peng Cheng Laboratory Overseas Young Scientist Forum, July 2020.
- ◇ Talk at Shantou University, December 2019.

### Instance Segmentation and Instance Shadow Detection

- ◇ Tutorial at Nanjing University of Aeronautics and Astronautics, October 2021.

### Mask-ShadowGAN: Learning to Remove Shadows from Unpaired Data

- ◇ Talk at Hong Kong Computer Vision Workshop, October 2019. (**Best Oral Presentation Award**)

### Direction-Aware Spatial Context Features for Shadow Detection

- ◇ Talk at AI Research Club, July 2018.

## PROFESSIONAL SERVICES

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### Conference Reviews

- ◇ IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2019-2024)
- ◇ IEEE International Conference on Computer Vision (ICCV 2019 [**Outstanding Reviewer**] /2021/2023)
- ◇ European Conference on Computer Vision (ECCV 2020/2022/2024)

- ◇ Neural Information Processing Systems (NeurIPS 2023)
- ◇ International Conference on Learning Representations (ICLR 2023/2024)
- ◇ SIGGRAPH Asia 2022
- ◇ PC of AAAI Conference on Artificial Intelligence (AAAI 2020-2024)
- ◇ ACM International Conference on Multimedia (ACM MM 2021/2022)
- ◇ Pacific Conference on Computer Graphics and Applications (PG 2020/2021)
- ◇ Medical Image Computing and Computer Assisted Intervention (MICCAI 2019-2021)

### **Journal Reviews**

- ◇ IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- ◇ International Journal of Computer Vision (IJCV)
- ◇ IEEE Transactions on Image Processing (TIP)
- ◇ IEEE Transactions on Multimedia (TMM)
- ◇ IEEE Transactions on Intelligent Transportation Systems (TITS)
- ◇ IEEE Transactions on Medical Imaging (TMI)
- ◇ IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- ◇ IEEE Transactions on Circuits and Systems for Video Technology (TCSVT)
- ◇ IEEE Transactions on Vehicular Technology (TVT)
- ◇ Neurocomputing
- ◇ Journal of Biomedical and Health Informatics (JBHI)
- ◇ Computer Vision and Image Understanding
- ◇ Artificial Intelligence Review
- ◇ The Visual Computer
- ◇ Computers & Graphics
- ◇ IEEE Computer Graphics and Applications (CG&A)