Haoming Cai

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https://haomingcai.com

Research Interest

My research centers on the convergence of computational photography and low-level vision. I aim to synergize computational imaging techniques with advanced back-end processing algorithms to enhance the perceptual quality of human experiences on mobile and edge devices.

Education

2022-2027 **The University of Maryland, College Park.**
Ph.D. in *Computer Science*
Advisor : Prof. Christopher Metzler

- 2D Image Restoration Through Severe Condition
- 3D Reconstruction Through Non-Ideal Condition
- End2End Optimization in Image Signal Processing Pipeline

2017-2022 **The Chinese University of Hong Kong, Shenzhen.**
B.A. in *Computer Science and Engineering*.

Research Experience

2020-2022 **Shenzhen Institutes of Advanced Technology** @ Shenzhen, Guangdong, CHN
Research Assistant supervised by Prof. Dong Chao

- Efficient and Controllable Image Restoration.
- Image Quality or Aesthetic Assessment
- Image Processing on Portable or Mobile Edge Device
- Image-Quality-Guided Loss Function for Image Restoration

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Honors and Awards

2024 **Finalist of Qualcomm Innovation Fellowship**
Acceptance Ratio - 18%

2022-2024 **Ph.D. Dean Fellowship Award**
Graduate School, University of Maryland-College Park

2022 **Winner of Efficient Image SR Challenge, Model Complexity Track**
NTIRE Workshop @ CVPR 2022

2021 **SenseTime Scholarship Finalist** (Top 50 undergrad selected from across China)
Sensetime Group

Publications and Manuscripts

Google Scholar Citations : 520+ (up to March. 2024). * indicates co-first author.

Year 23-24 **Session A: 3D Reconstruction in Computational Imaging**

Under Review **Flash-Splat: 3D Reflection Removal with Flash Cues and Gaussian Splats**

Haoming Cai*, Mingyang Xie*, Sachin Shah, Yiran Xu, Brandon Y. Feng, Jia-bin Huang, Christopher Metzler

Year 23-24 **Session A: Seeing & Tracking Through Adverse Weather Condition**

Under Review 2023 **ConVRT: Consistent Video Restoration Through Turbulence with Test-time Optimization of Neural Video Representations.** [Homepage]

Haoming Cai, Jingxi Chen, Brandon Y. Feng, Weiyun Jiang, Mingyang Xie, Kevin Zhang, Ashok Veeraraghavan, Christopher Metzler

CVPR2024 **CodedEvents: Optimal Point-Spread-Function Engineering for 3D-Tracking with Event Cameras**

Sachin Shah, Matthew Albert Chan, Haoming Cai, Jingxi Chen, Sakshum Kulshrestha, Chahat Deep Singh, Yiannis Aloimonos, Christopher Metzler

ICCV 2023 **Snow Removal in Video: A New Dataset and A Novel Method.** [Homepage]

Haoyu Chen, Jingjing Ren, Jinjin Gu, Hongtao Wu, Xuequan Lu, Haoming Cai, Lei Zhu

Year 20-22 **Session B : Controllable & Efficient Image Processing**

ECCV 2022 **Super-Resolution by Predicting Offsets: An Ultra-Efficient Super-Resolution Network for Rasterized Images**

Jinjin Gu, Haoming Cai, Chenyu Dong, Ruofan Zhang, Yulun Zhang, Wenming Yang, Chun Yuan

CVPRW 2021 **Toward Interactive Modulation for Photo-Realistic Image Restoration**

Haoming Cai, Jingwen He, Yu Qiao, Chao Dong

ECCVW 2022 **Efficient image super-resolution using vast-receptive-field attention**

Haoming Cai*, Lin Zhou*, Jinjin Gu, Zheyuan Li, Yingqi Liu, Xiangyu Chen, Yu Qiao, Chao

CVPRW 2022 **Blueprint separable residual network for efficient image super-resolution**

Zheyuan Li, Yingqi Liu, Xiangyu Chen, Haoming Cai, Jinjin Gu, Yu Qiao, Chao Dong

Year 19-23 **Session C : Image Quality Assessment**

ECCV 2020 **Pipal: a large-scale image quality assessment dataset for perceptual image restoration.** [Homepage]

Jinjin Gu, Haoming Cai, Haoyu Chen, Xiaoxing Ye, Jimmy S. Ren, Chao Dong

ArXiv 2021 **Image Quality Assessment for Perceptual Image Restoration: A New Dataset, Benchmark and Metric**

Jinjin Gu, Haoming Cai, Haoyu Chen, Xiaoxing Ye, Jimmy S. Ren, Chao Dong

NeurIPS 2023 **Assessor360: Multi-sequence Network for Blind Omnidirectional Image Quality Assessment**

Tianhe Wu, Shuwei Shi, Haoming Cai, Mingdeng Cao, Jing Xiao, Yinqiang Zheng, Yujiu Yang

Challenge Publications

800+ Global Participants [NTIRE 2021] [NTIRE 2022]

CVPRW 2021 **NTIRE 2021 Challenge on Perceptual Image Quality Assessment**
Jinjin Gu, Haoming Cai, Chao Dong, Jimmy S. Ren, Yu Qiao, Shuhang Gu, Radu Timofte

CVPRW 2022 **NTIRE 2022 Challenge on Perceptual Image Quality Assessment**
Jinjin Gu, Haoming Cai, Chao Dong, Jimmy S. Ren, Yu Qiao, Shuhang Gu, Radu Timofte

Professional Activities

Co-organizer New Trends in Image Restoration and Enhancement workshop (NTIRE) @ CVPR'21
New Trends in Image Restoration and Enhancement workshop (NTIRE) @ CVPR'22

Reviewer Conference on Computer Vision and Pattern Recognition (**CVPR**), 2022, 2023, 2024
Association for the Advancement of Artificial Intelligence (**AAAI**), 2023, 2024
European Conference on Computer Vision (**ECCV**), 2022, 2024
Winter Conference on Applications of Computer Vision (**WACV**), 2023
Knowledge Discovery and Data Mining (**KDD**), 2023
Rimag, Journal of Information Systems and Telecommunication (**JIST**)
Springer, The Visual Computer (**TVCJ**)
IEEE, Signal Processing Letters (**SPL**)
IEEE, Transactions on Pattern Analysis and Machine Intelligence (**TPAMI**) (external reviewer)
ACM, Transactions on Multimedia Computing, Communications, and Applications (**TOMM**) (external reviewer)

Univ Services Grad Reviewer, University of Maryland CS Graduate Program Application. 2022, 2023

Invited Talk Snow Removal in Video: A New Dataset and A Novel Method. Invited by Computer Vision Seminar by UMD-CS

Teaching Assistant or Lecturer

2023 Spring CMSC351 - Algorithms @ University of Maryland, College Park

2022 Fall CMSC320 - Introduction to Data Science @ University of Maryland, College Park.

2022 Magic in Image Processing. Introduction Lecture for Students in Junior High School.

Research Mentors

2019 - 2022 **Jinjin Gu** Now PhD @ University of Sydney. Research Scientist @ Shanghai AI Lab.

2020 - 2021 **Jingwen He** Now Research Scientist @ Shanghai AI Lab.

Software Development

2020 AI-Based Anime Image Toolbox iOS Application (Swift-based): An AI-based image toolbox named ReyeR, providing reverse image search, image tag recognition, photo cartoonization, and a human face to anime face.