Weiheng Tang

Personal website: https://weihengtang.github.io/

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EDUCATION

School of Physics, Peking University, Beijing, China 09/2020 - present

- Overall GPA: 3.80 / 4.00.
- Research interest: computational optics, bio-medical imaging, computer vision and machine learning.

PREPRINTS AND PUBLICATION

- (In Review) L. Kreiss*, **W.-H. Tang***, R. Balla, X. Yang, A. Chaware, K. Kim, C. Cook, A. Begue, C. Dugo, M. Harfouche, K. C. Zhou and R. Horstmeyer *Recording dynamic facial micro-expressions with a multi-focus camera array*. arXiv: 2410.01973 . * These authors contributed equally.
- (In Review) W.-M. Bai, **W.-H. Tang**, E.-Z. Ye, S.-Y. Chen, W.-Z. Chen and H. Sun *Learning Diffusion Model from Noisy Measurement using Principled Expectation-Maximization Method*. arXiv: 2410.11241.

SELECTED AWARDS AND FELLOWSHIP

- Gold Medal in the 36th China Physics Olympics Final (National Level) 09/2019
- Peking University Qin Wanshun Jin Yunhui Fellowship for Fundamental Disciplines | Top 5% 09/2020
- Peking University Award for Merit Student | Top 10% 09/2021
- Peking University Award for Excellent Academic Performance | Top 10% 09/2021

RESEARCH EXPERIENCES

High-throughput dynamic facial micro-expressions imaging with a multi-focus camera array

Advisor: Prof. Roarke Horstmeyer, Duke University 11/2023 – 09/2024

- Developed a multi-focus imaging system comprising a 54-camera array by adjusting focal plane distribution to capture dynamic facial expressions with high resolution, large field-of-view, and extended depth-of-field (DOF).
- Calibrated each camera's focal plane based on a reference facial model to match the curved facial profile, ensuring optimal focus. Composite images were generated by stitching outputs from all cameras, resulting in an all-in-focus video stream.
- Achieved an over 50-fold increase in resolved pixels per frame compared to existing databases, capturing dynamic facial expressions at 12 fps over an ~85 cm^2 area, with a resolution of ~26 μm and a DOF of ~43 mm.

Generative microscopy imaging and uncertainty quantification using score-based image priors

Advisor: Prof. He Sun, Peking University 03/2024 - present

- Utilized Diffusion Posterior Sampling (DPS) algorithm for microscopic image restoration and uncertainty quantification by modeling the posterior distribution with generative priors and physics-informed likelihood.
- Constructed forward models for 2D and 3D structured illumination microscopy (SIM) to simulate raw data from samples generated by diffusion models, used in the likelihood update step to enforce data consistency.
- Our method surpassed other super-resolution methods (e.g., Sparse-SIM, ZS-DeconvNet, UniFMIR) by more than 5% in both PSNR and SSIM, and achieved reliable uncertainty quantification through Monte Carlo sampling method.

Learning diffusion model from corrupted measurement using principled expectation-maximization (EM) method

Advisor: Prof. He Sun, Peking University 07/2024 - 09/2024

- Proposed a principled EM framework that iteratively learns diffusion models from noisy data with arbitrary corruption types.
- Enhanced the E-step (estimating clean images) by upgrading the DPS algorithm to a plug-and-play Monte Carlo method, and implemented the M-step (refining the model using these images), ensuring accurate sampling and provable convergence.
- Our principled expectation-maximization method outperformed all baselines, such as Ambient Diffusion and SURE-Score, by more than 7% in PSNR and 20% in LPIPS for both image denoising and deblurring tasks, while achieving over a 13% decrease in Fréchet Inception Distance, which assesses the quality of image generation (lower is better).

SERVICE AND VOLUNTEER WORK

- **Volunteer** promoting physics outreach through live experiments at the school's physics festival. 2021
- **Leader** of the teaching group for the Chinese Physics Olympiad at Shenzhen Experimental High School. 2022