Syed Muhammad Kazim

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Education

• University of Siegen, Germany PhD in Engineering Department of Electrical Engineering and Computer Science Supervisor: Prof. Ivo Ihrke	Jul. 2023 – Present
 Kyung Hee University, Korea Master of Engineering Department of Electronic Engineering 	Sep. 2019 – Feb. 2022
Supervisor: Prof. Hyundong Shin GPA: 4.21/4.30	
 National University of Sciences and Technology, Pakistan Bachelor of Engineering Department of Electrical Engineering GPA: 3.51/4.00 	Sep. 2014 – Jul. 2018

Projects

- Coded wavefront sensing: Modeling, optimization, and prototyping (ongoing).
 - 1. Modeled scalar wave propagation through thin scatterers to analyze speckle field variations and establish relationships with structure size and arrangement of the scatterers.
 - 2. Devoloping a differentiable optimization framework for tuning microstructured phase elements and identifying effective design parameters.
 - 3. Conducting experiments with phase structures of varying refractive indices and sizes to characterize speckle behavior and validate physical simulation models.
- Refractive index tomography using coded wavefront sensing.
 - 1. Recorded speckle fields of a rotating HEK cell at 30 fps, with a single system reference for phase retrieval using coded wavefront sensing.
 - 2. Estimated the scattering potential of the HEK cell to assess the feasibility of the Fourier diffraction theorem for refractive index tomography.
 - 3. Applied spatial filtering techniques to mitigate specimen jitter and pose uncertainty, enabling tomographic reconstruction using standard algorithms.
- Experimental performance validation of coded wavefront sensor.
 - 1. Simulated a 10 µm spherical silica bead immersed in PBS to create a ground truth for measurements using the beam propagation method.
 - 2. Mapped the retrieved wavefields to the object space and propagated them to the same focus plane, enabling comparison of digital holographic microscopy, coded wavefront sensing, and simulation.
 - 3. Performed comparitive analysis by accurately overlaying wavefields retrieved by different methods and quantifying pixel-wise distances in their optical path differences.

Publications

- 1. S. M. Kazim, F. Strasser, M. Løvmo, A. Nehrych, S. Moser, M. Ziemczonok, W. Heidrich, I. Ihrke, and M. Ritsch-Marte, "Coded wavefront sensing for video-rate quantitative phase imaging and tomography: validation with digital holographic microscopy," *Submitted to Opt. Express*, Apr. 2025.
- 2. S. M. Kazim, F. Strasser, M. Løvmo, A. Nehrych, S. Moser, M. Ziemczonok, W. Heidrich, I. Ihrke, and M. Ritsch-Marte, "Performance validation of coded wavefront sensing for quantitative phase imaging of static and dynamic Specimens using digital holographic microscopy," *International Symposium on Computational Sensing (ISCS)*, Mar. 2025.
- 3. N. Agarwal, J. Schneider, K. Gandikota, S. M. Kazim, J. Meshreki, I. Ihrke, and M. Moeller, "Direct image classification from Fourier ptychographic microscopy measurements without reconstruction," *International Symposium on Computational Sensing (ISCS)*, Mar. 2025.
- 4. J. Meshreki, S. M. Kazim, and I. Ihrke, "Optical system characterization in Fourier ptychographic microscopy," *Opt. Continuum*, Dec. 2024.
- 5. K. Bäuerle, P. Müller, S. M. Kazim, I. Ihrke, and M. Keuper, "Learning the essential in less than 2k additional weights a simple approach to improve image classification stability under corruptions," *Transactions on Machine Learning Research*, Jun. 2024.
- 6. S. M. Kazim, A. Farooq, J. ur Rehman, and H. Shin, "Adaptive quantum state tomography with iterative particle filtering," *Quantum Inf. Process.*, Sep. 2021.
- 7. S. M. Kazim, A. Farooq, J. ur Rehman, and H. Shin, "Applied Bayesian Qubit State Tomography," *Proc. Korea Information and Communications Society (KICS) Summer Conference*, pp. 190-192 Korea, Aug. 2020.

Talks and Oral Presentations

1. (3rd **Prize**) S. M. Kazim, "Refractive index tomography of biological cells with coded phase camera," *ZESS PhD. Forum*, Siegen, May 2025.

Poster Presentations

- 1. S. M. Kazim, "Exposition: Wavefront sensing for quantitative phase imaging," 88th Heidelberg Image Processing Forum ZESS Open Day, Siegen, Nov. 2024.
- 2. (Best Poster Award) S. M. Kazim, J. Meshreki, and I. Ihrke, "Roadmap: Super-resolution of phase objects," ZESS PhD. Forum, Siegen, May 2024.

Co-supervised Projects

1. S. L. Bussu, S. M. Kazim, and I. Ihrke, "Python-based GUI for real-time digital holography system optimization," *Studienarbeit Project*, University of Siegen, Nov. 2024.

Work Experience

- University of Siegen, Siegen, Germany Jul. 2023 Present *Graduate Research Assistant* Chair of Computational Sensorics/Communication Engineering Experimental and algorithmic design, and optimization of quantitative phase imaging methods with special focus on *coded wavefront sensing*.
- Endress+Hauser, Maulburg, Germany
 Oct. 2021 Jun. 2023
 External AI Consultant
 Vision-based automation to preclude human intervention in quality control tasks in industry

• Kyung Hee University, Yongin-si, Korea Graduate Research Assistant Communications and Coding Theory Laboratory

• National University of Sciences and Technology, Karachi, Pakistan Aug. 2018 – Aug. 2019 Research Engineer

Theses

- 1. S. M. Kazim, "Adaptive Learning of Quantum Digits," Master's thesis, Department of Electrical and Information Convergence Engineering, Kyung Hee University, Yongin-si, Korea, Feb. 2022, Thesis Advisor: Professor Hyundong Shin.
- 2. S. M. Kazim, "Frequency Reconfigurable Patch Antenna using Liquid Crystals," Bachelor's thesis, Department of Electrical Engineering, National University of Sciences and Technology, Islamabad, Pakistan, Jul. 2018, Thesis Advisor: Professor Zubair Ahmed.

References

1. Prof. Ivo Ihrke

Designation:Chair of Computational Sensing/Communication EngineeringAffiliation:University of SiegenEmail:ivo.ihrke@uni-siegen.de

2. Prof. Monika Ritsch-Marte

Designation:Director of the Institute of Biomedical PhysicsAffiliation:Medical University of InnsbruckEmail:monika.ritsch-marte@i-med.ac.at

3. Prof. Margret Keuper

Designation:Chair of Computer Vision and Machine Learning GroupAffiliation:University of MannheimEmail:margret.keuper@uni-mannheim.de