SIHAN SHAO

Add.: Servin Maijan tie 10 A, Espoo, Finland
+358 41-475-5156 ◇ sihan.shao@aalto.fi ◇ sihan-shao.github.io

EDUCATION

Aalto University, Finland *Sep 2022 - July 2024*
M.Sc, in Electronics and Nanotechnology (major) and Machine Learning (minor), GPA: 4,73/5
Honors: Finland Government Scholarship

Changchun University of Science and Technology University, China *Sep 2018 - July 2022*
B.Eng. in Opto-Electronics Information Science and Engineering, GPA: 3,74/5 (87/100)
Honors: First-Class Academic Scholarship

Research Skills: MATLAB, Python/Pytorch, Zemax, CST Microwave Studio, AWR Microwave Office

RESEARCH & PROJECTS

Implicit Neural Representations for Ptychographic Electron Tomography Reconstruction (Remote)
Supervisor: Prof. Philipp Pelz
ECLIPSE Lab. *Feb. 2025 - Present*

- Investigated the application of neural radiance fields (NeRF) for 3D phase reconstruction in transmission electron microscopy.
- Integrated NeRF with multiresolution hashing encoding into multislice ptychography simulation code.
- Conducted a hyperparameter study demonstrating a 20% compression ratio and a 2dB PSNR improvement over voxel-based representations in simulated core-shell nanoparticles.

Neural Dispersive Hologram for Computational Submillimeter-wave Imaging (Master's Thesis)
Supervisor: Prof. Zachary Taylor and D.Sc. Aleksi Tamminen
Millimetre Wave and THz Techniques Lab. *September 2023 - June 2024*

- Developed a PyTorch code of the angular spectrum method-based wave propagation model for multi-wavelength parallel simulation.
- Utilized a differentiable framework for co-optimizing hardware design of hologram-based frequency-diverse submillimeter imaging system along with its corresponding neural networks.
- Proposed a surrogate gradient method using the Gumbel-SoftMax trick for optimizing heavily-quantized hologram to reduce the mismatch between the simulation and measurement.
- Constructed an imaging system featuring an optimized hologram element, and validating the performance of the proposed method through real measurements.

Design of Smartwatch Bluetooth Rim Antenna
Instructor: Dr. Holopainen Jari
Antenna Workshop Project *September 2023 - December 2023*

- Conceptualized and optimized a smartwatch rim antenna using CST and AWR software, focusing on integration into the lateral faces of the device.
- Manufactured the optimal rim antenna design, testing it with hand phantom and battery cover considerations. Achieved notable results with a -1.0dB realized gain and a 10m coverage area for received power.
- Preparing findings for submission to EuCAP 2024, with a focus on miniaturized smartwatch antenna design, demonstrating advancements in wearable technology antenna design.

Coded Aperture Design for Infrared Lens-less Imaging System (Bachelor's Thesis)
Supervisor: Prof. Wenjun He
Optoelectronic Measurement and Optical Information Transmission Lab. *June 2021 - June 2022*

- Developed a coded aperture model for amplitude modulation of the wave field, utilizing Fresnel propagation to simulate a point spread function.
- Implemented a convolutional neural network for deconvolution images from simulated measurements based on the LLVIP dataset, focusing on optimizing aperture patterns and network parameters.
- Compared the reconstruction quality to traditional model-based methods such as FISTA.

Feature-Level Denoising Methodology in Synthetic Aperture Radar Ship Detection
Supervisor: Prof. Shifeng Wang
Artificial Intelligent and Photoelectric Perception Lab. *April 2020 - July 2021*

- Studied the imaging mechanism of synthetic aperture radar and the formation of noise in SAR images and analyzed the impact of noise and complex background in SAR images ship detection.
- Transferred soft thresholding function for wavelet domain denoising to feature map domain in deep learning and proposed a feature-level denoising method combining soft thresholding function and attention mechanism.
- Applied soft-thresholding attention (STA) block into typical neural network and conducted experiments on SAR ship detection datasets with various algorithms such as Faster R-CNN, Cascade R-CNN.
- Various detection algorithms with STA have high prediction accuracy for SAR ship detection with around 2% average precision improvement.

Lidar Sensor-based Objects Recognition Using Machine Learning
Supervisor: Prof. Shifeng Wang
Artificial Intelligent and Photoelectric Perception Lab. *April 2019 - October 2020*

- Spearheaded the development of a Lidar sensor-based data collection system, yielding a robust classification dataset of pedestrian and vehicle samples.
- Utilized filtering and data clustering techniques, significantly enhancing point cloud data classification accuracy.
- Successfully implemented PCA and SVM classifier, achieving 93.75% classification accuracy with a 33.25% reduction in training features.

LEADERSHIP EXPERIENCES

President of IEEE Photonics Student Branch of CUST
October 2020 - October 2021

- Joined IEEE R10 SAC Outreach Volunteer and responsible for the information exchange of Harbin Section.
- Reached a cooperation with local primary and middle school to give regular optical class as optical youth education.

PUBLICATIONS

- **S. Shao**, A. Tamminen, S. V. Pälli, S. Gamaethige, & Z. Taylor, Quantized THz Diffractive Optics Design via Automatic Differentiation. 2024 International Conference on Infrared, Millimeter, and Terahertz Waves.
- S.R. Gamaethige, S. V. Pälli, A. Tamminen, **S. Shao**, et al. Harnessing Frequency Diversity for Improved Holographic Imaging Systems. 2024 International Conference on Infrared, Millimeter, and Terahertz Waves.
- **S. Shao**, H. Li., & S. Wang., SAR Ship Detection from Complex Background Based on Dynamic Shrinkage Attention Mechanism, 2021 SAR in Big Data Era (BIGSARDATA), 2021, pp.1-5
- R. Wang, **S. Shao**, M. An, J. Li, S. Wang, &X. Xu. Soft Thresholding Attention Network for Adaptive Feature Denoising in SAR Ship Detection[J]. IEEE Access, 2021, 9: 29090-29105.)