Yuwei Zheng

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Education

ShanghaiTech University, Shanghai, China 2022 – 2025

Master student in **Electronic Engineering**, GPA: 3.47/4
Supervisor: Prof. Fei Gao and Prof. Xiran Cai

- Research Focus: Photoacoustic Imaging
- Relevant Coursework: Digital Signal Processing, Digital Image Processing, Digital Integrated Circuit, Analog Integrated Circuit, Electromagnetic Sensing and Detection

Harbin University of Science and Technology, Harbin, China 2018 – 2022

B.S. in **Electronic Information Science and Technology**, GPA: 3.73/4, Rank: 1/94

- Relevant Coursework: Circuits and Systems, Signals and Systems, Digital Logic Design, Principles of Communication, Electromagnetic Fields and Electromagnetic Waves

Publications

- **Yuwei Zheng** , *Zijian Gao, Yuting Shen, Jiadong Zhang, Daohuai Jiang, Fengyu Liu, Feng Gao*, and Fei Gao*,* "Hardware Acceleration of s-Wave Based PA Image Reconstruction," ***IEEE International Ultrasonics Symposium (IUS)***, 2023. [Link]
- **Yuwei Zheng** , *Ruixi Sun, Yuting Shen, Daohuai Jiang, Fengyu Liu, Feng Gao*, and Fei Gao*,* "SmartDAQ: Intelligent Data Acquisition System Enables Low-Latency Photoacoustic Imaging System," ***IEEE Ultrasonics, Ferroelectrics, and Frequency Control Joint Symposium***, 2024. [Link]
- **Yuwei Zheng** , *Zijian Gao, Yuting Shen, Jiadong Zhang, Ruixi Sun, Daohuai Jiang, Fengyu Liu, Xiran Cai, Feng Gao*, Yuan Gao*, Fei Gao*,* "Hardware Architecture Design for Iterative Reconstruction Algorithms Towards Palm-size Photoacoustic Tomography", ***IEEE Transactions on Circuits and Systems I: Regular Papers***, 2025. [Link]
- *Yunhui Jiang, Fan Zhang,* **Yuwei Zheng** , *Ruixi Sun, Xiran Cai*, Fei Gao*,* "Disposable Opto-Acoustic Window Enabled Plug-and-Play Photoacoustic-Ultrasound Dual-modal Imaging," ***Optics Letters***, 2025. [Link]
- *Sheng Liao, Fan Zhang,* **Yuwei Zheng,** *Shangqing Tong, Yuting Shen, Feng Gao, Hulin Zhao, and Fei Gao*,* "Photoacoustic Digital Eye and Image Reconstruction in 3D," ***IEEE Ultrasonics, Ferroelectrics, and Frequency Control Joint Symposium***, 2024. [Link]

Research Experience

Intelligent sensing Lab, Harbin University of Science and Technology, Harbin, China 2019 – 2022

Research Intern

- Designed an autonomous wheeled combat robot controlled by an ARM microcontroller, and won the Second Prize at the China Intelligent Robot Combat Competition
- Participated in the design of an intelligent vision robot, responsible for vision image acquisition, CNN training, and won the First Prize at the China Robot Competition.

Hybrid Imaging System Lab, ShanghaiTech University, Shanghai, China 2022 – 2025

(http://www.hislab.cn/)

Hardware acceleration for photoacoustic image reconstruction algorithms*:* Implemented desgined photoacoustic image reconstruction algorithms on FPGA to accelerate the reconstruction process while ensuring high-quality images, aiming to develop a portable, low-cost, and real-time photoacoustic imaging system.

Outcome: *2023 IEEE IUS, IEEE Transactions on Circuits and Systems I: Regular Papers*

- Proposed a data reuse method, significantly saving on-chip memory resources, making it possible to implement complex photoacoustic reconstruction algorithms on FPGA.

- Implemented the Delay-and-Sum beamforming algorithm, superposed Wave (s-Wave) algorithm, and iterative image reconstruction algorithm on FPGA, mapping them into hardware circuits.
- Achieved over a 270× acceleration in image reconstruction speed compared to CPU implementations, along with an approximately 2700× enhancement in energy efficiency.

SmartDAQ: Data acquisition system for photoacoustic imaging: Our Lab independently developed a partially reconfigurable, low-latency, portable data acquisition system capable of performing real-time photoacoustic imaging internally and supporting dynamic switching of image reconstruction algorithms, tailored for photoacoustic imaging research and clinical applications.

Outcome: *2024 IEEE Ultrasonics, Ferroelectrics, and Frequency Control Joint Symposium (2024 IEEE IUS)*

- Designed the overall hardware architecture for the data acquisition system, implementing the entire data acquisition control through FPGA, and enabled Ethernet communication between the DAQ and the PC.
- Integrated the hardware-accelerated photoacoustic image reconstruction algorithm into the data acquisition front-end for the first time, enabling real-time imaging at 20 fps while simultaneously reducing the overall power consumption of the photoacoustic imaging system.

Opto-acoustic window enabled plug-and-play real-time photoacoustic-ultrasound dual-modal imaging: enables simultaneous real-time PA and US imaging at 20 FPS with a single laser pulse by using a disposable optoacoustic window (partial mask), achieving high resolution (PA: 215 μm, US: 91 μm) and high SNR (up to 37.48 dB).

Outcome: *Optics Letters*

- Analyzed and evaluated the influence of various factors on the performance of the dual-modal imaging system, demonstrating that the size and shape of the optical absorber directly affect the amplitude and frequency of the laser-induced ultrasound signals, as well as the amplitude and spatial coverage of the photoacoustic signals excited by the laser.
- Designed and implemented the data acquisition control flow and parallel processing of photoacoustic and ultrasound signals, and was responsible for the transmission and display of both signal and image data.
- Achieved the hardware acceleration of the dual-modal image reconstruction algorithms and enabled their parallel execution on FPGA, achieving real-time photoacoustic and ultrasound imaging (20 frame per second).

FPGA-Accelerated Adaptive Subtraction for Real-Time Electromagnetic Interference Suppression in Photoacoustic Imaging in Vivo: A signal denoising method tailored for PA imaging to effectively suppress EMI induced by the laser system, significantly mitigated noise contamination in the raw PA signals and led to substantial improvements in image quality. Furthermore, the algorithm was accelerated by FPGA, enabling real-time signal denoising and image reconstruction.

- Proposed an electromagnetic interference denoising method based on signal sorting and mean filtering, effectively reduced the severe interference of electromagnetic noise in PA signals (SNR: 31.141 dB and PSNR: 17.628 dB increased respectively) and in PA images (SSIM: 0.172, PSNR: 1.429dB improved respectively).
- Designed and implemented a hardware-accelerated architecture for the proposed denoising algorithm, employing a 16-channel parallel processing strategy and pipelining techniques to optimize data throughput.
- Successfully deployed the architecture on an FPGA platform, achieving real-time signal denoising and imaging with a latency of approximately 24 ms.

Honors and Awards

- Graduate Academic Scholarship in 2022-2025
- National Scholarship in 2020 and National Encouragement Scholarship in 2019 and 2021
- Merit student in 2019-2022 and Outstanding Graduate in 2022
- First Prize, China Robot Competition in 2020
- Second Prize, China Intelligent Robot Combat Competition in 2019
- Third Prize, China College Innovative Robotics Competition in 2021

Skills

- **Programming Language:** Verilog, MATLAB, Python, C
- **Tools:** FPGA, Vivado, Quartus, ModelSim, Verdi, VCS, Design Compiler, SpyGlass, Cadence, PSpice, MultiSim, Altium Designer, k-Wave, Blender

- **Language:** Mandarin (*Native*), English (*Fluent*)