Run Wang

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SUMMARY

Master's student at ETH Zurich with a Bachelor's from Fudan University, specializing in algorithm optimization and digital IC architecture, focused on hardware-software co-design.

EDUCATION

ETH Zurich, Switzerland *Sep. 2022 - Present*
Master of Science in Electrical Engineering

Fudan University, China *Sep. 2018 - Jun. 2022*
Bachelor of Engineering in Electrical Engineering (Honours)

PUBLICATION

Run Wang, Ke Xu, Hui Feng and Wei Chen. Hybrid RNN-ANN Based Deep Physiological Network for Pain Recognition, *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*

Run Wang*, Xiaotian Zhou*, Wei Li, Zhongzhi Zhang. Maximizing the Smallest Eigenvalue of Grounded Laplacian Matrix, *arXiv*, 2021/10/25

Run Wang*, Mark Daniel Alea*, Jonah van Assche*, Georges Gielen. Towards a Neuromorphic Tactile Sensing Glove, *Eurohaptics 2024*

RESEARCH EXPERIENCE

1. ETH Integrated Systems Laboratory (IIS) *Feb. 2024 - Present*
Advisor: *Luca Benini, Professor at the Department of ITET of ETH Zurich*
Topic: Transformer Hardware Software Codesign for NeuroSoC

Description: Implemented hardware and software optimizations to enhance the transformer algorithm performance on NeuroSoC, ensuring high efficiency and rapid processing capabilities.

- Implemented hardware and software optimizations to enhance the transformer algorithm performance on NeuroSoC, ensuring high efficiency and rapid processing capabilities.
- Developed and integrated fast, precise floating-point exponential algorithm based on the improved Schraudolph Expf algorithm, integrating the new exponential algorithm into FPU and implementing RISC-V exponential instruction extensions in a Snitch-based SoC architecture.
- Accelerated Softmax, Attention and LLM kernel computations using new exponential instructions, SIMD parallelism and Streaming SIMD Extensions (SSR), significantly boosting the processing speed and throughput of transformer models.
- Utilized GF12 technology and Fusion Compiler for comprehensive synthesis and layout.

Keywords: RTL, Architectural Design, Kernel Programming, RISCV, Transformer, C, Assembly, Sythesis, Backend

2. KUL EAST-MICAS *Jun. 2023 - Sep. 2023*
Advisor: *Prof. Georges Gielen*
Topic: Neuromorphic Electronic Skin System for Prosthetic Sensory Integration

Description: Designed an electronic system for an electronic skin (e-skin), incorporating custom tactile sensors and a neuromorphic SNN processor.

- ► Designed an electronic system for an electronic skin (e-skin), incorporating custom tactile sensors and a neuromorphic SNN processor.
- ► Spearheaded advanced quantization and model compression for the SNN processor, optimizing it for efficient, low-power operation.
- ► Demonstrated real-time touch sensing capabilities through a sophisticated classification task, highlighting the system's advanced functionality and precision.

Keywords: ML Edge Deployment, PCB Design, Embedded System, FPGA

3. Clifford Lab, GeorgiaTech *May.2021 - Oct.2021*
Advisor: *Gari Clifford, Professor at the Biomedical Engineering Department, GeorgiaTech*
Topic: An Interpretable Framework for Pain Evaluation

Description: Quantitative assessment of pain is vital for non-verbal patients. However, previous approaches based on black-box models are too elusive to trust. An interpretable framework that can figure out when and which went wrong is of significance. Besides, provide interpreter scores to human can help them make better decisions.

- ► Proposed an exploratory pipeline for interpretable ML application in pain evaluation scenario: Utilized interpretable ML methods to study scientific principles for physiological signals; Initiated a human-centered computing design with interpreters' score to improve human pain-classification capability
- ► Exhausted extant interpretable ML techniques to investigate what temporal or frequency features of the physiological signal the network learns
- ► Designed a human-centered computing system with video signals' interpreter score; Conducted large-scale experiments at Amazon MTurk to justify its effectiveness

4. Intelligent Complex Systems Lab, Fudan University *Sep. 2020 - May.2021*
Advisor: *Zhongzhi Zhang, Professor at the Computer Science Department, Fudan University*
Topic: Maximizing the Smallest Eigenvalue of Grounded Laplacian Matrix by node removel

- ► Proved that this combinatorial optimization problem is NP-hard and that the optimization function is not submodular, which implied the extreme difficulty
- ► Proposed nearly-linear time heuristic algorithm and proved the approximation via matrix perturbation theory and matrix derivative theory
- ► Evaluated the algorithm's effectiveness and efficiency on diverse large-scale real-world graphs

OPEN SOURCE EXPERIENCE

Apache@Alibaba RocketMQ Open Source Project *Jun. 2022 - Sep. 2022*
Role: *Documentation Manager*
Topic: Open Source Project & Alibaba Intern

Description: Served as the Documentation Manager for the Apache RocketMQ project, established the documentation website, and organized and coordinated contributions from 40 volunteers to enhance and expand the project documentation.

Keywords: Java, Middleware, HTML, CSS, Javascript

SKILLS

C: Advanced (Bare Metal Programming, Cuda, OpenMP, System Programming)
Embedded System Development: Advanced (MCU, FPGA, ML Deployment)
Python: Advanced (Deep learning framework, Pytorch, Tensorflow, OOP)
Digital IC EDA: Advanced (Design Compiler, Innovous, Cadence, Modelsim)
Julia, Matlab: Advanced (Numerical Calculation)
HTML, CSS, Javascript: Intermediate