Abenezer Wudenhe

awude001@ucr.edu | https://abe157.github.io/ | Google Scholar

RESEARCH INTEREST

- Accelerator hardware including GPGPU, TPU, FPGA, and embedded devices
- Application specific domains including machine learning, data mining, and bioinformatics
- Memory architecture for accelerating data dependent application and near/in data processing

EDUCATION

University of California, Riverside (UCR) PhD (Computer Science)
- SMART Fellow Expected: May 2024
- Chancellor's Distinguished Fellow
- GAANN Fellow

University of Maryland, Baltimore County (UMBC) BS (Computer Engineering)
- Meyerhoff Scholar May 2018 (Cum Laude)
- NSA Scholar

PROFESSIONAL EXPERIENCE

Google Software Engineering Intern **June 2023 – Sep 2023**

Software Engineering Intern under Dr. Jaswanth Sreeram
- Participate in a 13-week internship program for the Google XLA TPU Backend Compiler team.
- Developed Low Level Instruction analysis tool to identify performance gaps in compiler heuristics.
- Create a python static visual analysis tool of compiler generated TPU & CPU instruction execution and Utilization.
- Participated in internal Core Machine Learning (ML) training program, "Core ML University".

Google Software Engineering Intern **June 2022 – Sep 2022**

Software Engineering Intern under Dr. Ayub Gubran
- Participate in a 14-week internship program for the Google gChips Architecture Team.
- Developed System Verilog based tools for architects to utilize in debugging/analysis of SoCs files.
- Participated in Google Intern Mentorship Program during weeks 5 - 12.

Intel OneAPI Graduate Student Software Internship **Oct 2021 – Feb 2022**

Software Engineering Research Intern
- Participate in a 3 month internship to extend existing research project to Intel OneAPI.
- Extend existing compiler infrastructure to produce Data Parallel C++ device code to run on CPU, GPU, and FPGA.
- Present Temporal to Spatial Programming (T2SP) at the 10th International Workshop on OpenCL (IWOCL) and SYCL.

Google Computer Science Research Mentorship Program (CSRMP) **Sep 2021 – Dec 2021**

Research Mentee under Dr. Jan Wassenberg
- Participate in a 12-week virtual workshop to navigate Computer Science Research.
- Discuss and collaborate one on one with research faculty at google.
- Discuss roadblocks and possible solutions to producing novel computing research.

Facebook (**Meta**) **2021 Amplified Program** **June 2021 - Aug 2021**

Above & Beyond Computer Science Program
- Participate in a three-part virtual workshop over the course of six weeks.
- Review technical concepts important to the interviewing process.

ARMY CYBER DWD Internship **May 2019 – Aug 2019**

Software Engineering Intern.
- Assessed new technologies for ARMY Big Data Platform.
- Evaluated the potential and cost of machine learning application.

- Explored Amazon Kinesis tool for data stream processing for reduction of database overhead.

Extreme Storage and Computer Architecture Lab (ESCAL)   **Aug 2018 – Present**
Graduate research assistant to Dr. Hung-Wei Tseng.
Accel-Bench: A Benchmark Suite toward the Future of Accelerator-Intensive Programming
- Designed and developed a benchmark suite optimization for accelerator evaluation for applications outside of their domain
- Integrate over 10 applications in fields including genomics, web mining, image processing.
- Integrate GPU simulator, Accel-Sim, for evaluation of micro architecture.

Optimizing memory hierarchy for mixed precision computing
- Developed an GPGPU-sim extension to enable more accurate simulation of NVIDIA's half-precision computation and evaluation of the overhead.
- Developed a set of Rodinia benchmarks to utilize the half-precision support
- Accelerate the performance of GPU kernels with reasonable accuracy using CUDA.

TPUPoint: Profiler and optimizer for TPU cloud
- Designed and developed an automatic profiling and optimization tool for Google's TPU-based ML Cloud Platform.
- Achieved up to 1.12x speedup for programmer's optimizations using TensorFlow.
- Ported a set of MLPerf applications to Google's TPU Cloud Platform.

University of Michigan Lab 4PROGRESS REU   **May 2017 - Aug 2017**
Undergraduate research assistant to Dr. Chad Jenkins
- Applied cluster computing methods to robotic visualization techniques and object recognition.
- Utilized computer networking and Message Passing Interface (OpenMPI) for applications.
- Developed GPU accelerated image rendering using Nvidia drivers and CUDA programing.

Electroencephalograph (EEG) Study on Image Formation   **May 2016 - Aug 2016**
Undergraduate research assistant to Dr. Fow-Sen Choa
- Examined a new approach to link single measurement with behaviors that can monitor brain functions reproducibly without repeating measurements.
- Organized data management from experiments.
- Programed MATLAB model for 3D graph plotting and analysis.

TECHNICAL SKILLS
- Experience programming in **C, C++, python**, **CUDA**, Bazel, Makefile, CMake, html, MPI, php, Arduino, OpenMP, Open MPI, TensorFlow, Skilearn, Javascript, NodeJS
- Experience writing technical documents using LaTex, BibTex, Word
- Experience with Xilinx Design Tool, MATLAB, Cadence's Allegro Design Entry CIS, Atmel Studio

PUBLICATION
A. Wudenhe, Hung-Wei Tseng. "TPUPoint: Automatically Characterizing Hardware Accelerated Data Center Machine Learning Program Behavior". In IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2021), 2021.

Q. Meng, D. Gupta, **A. Wudenhe**, X. Du, L. Hong, F. Choa. "Three-Dimensional EEG Signal Tracking for Reproducible Monitoring of Self-Contemplating Imagination". In Advances in Science, Technology and Engineering Systems Journal (ASTESJ), 2017.

CONFERENCE PRESENTATIONS
A. Wudenhe. "Accel-Bench: Exploring the Potential of Programming using Hardware-Accelerated Functions". Presentation delivered at 2024 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS2024), Indianapolis, IN, October 29, 2023.

A. Wudenhe. "Accel-Bench: A Benchmark Suite toward the Future of Accelerator-Intensive Programming". Presentation delivered at the Career Workshop for Inclusion and Diversity in Computer

Architecture (CWIDCA23) in conjunction with IEEE/ACM International Symposium on Microarchitecture (MICRO-56), Toronto, CA, October 29, 2023.

A. Wudenhe, Hongbo Rong. "Embedding a DSL in SYCL for Productive and Performant Tensor Computing on Heterogeneous Devices". Poster presentation delivered at the 10th International Workshop on OpenCL (IWOCL) and SYCL, Remotely, May 11, 2022.

A. Wudenhe, Hung-Wei Tseng. "Characterizing Hardware Accelerated Data Center Machine Learning". Poster presentation delivered at the Career Workshop for Women and Minorities in Computer Architecture (CWWMCA20) in conjunction with IEEE/ACM International Symposium on Microarchitecture (MICRO-53), San Diego, CA, October 17, 2020.

A. Wudenhe, Jinyoung Choi, Yu-Ching Hu, Hung-Wei Tseng. "What Can Intelligent SSDs Do for machine Learning" Poster presentation delivered at the Non-Volatile Memory Workshop (NVMW19), San Diego, CA, March 10-12, 2019.
`
A. Wudenhe. "Three-dimensional EEG signal tracking for reproducible brain activity monitoring". Poster presentation delivered at the Institute of Electrical and Electronics Engineers (IEEE) Signal Processing in Medicine and Biology Symposium (SPMB16), Philadelphia, PA., December 3, 2016.

A. Wudenhe, F. Avila-Soto, A. Beri, E.Valenzuela. "Parallelization for Fast Image Reconstruction using the Stochastic Origin Ensemble Method for Proton Beam Therapy". Poster presentation delivered at the UMBC Summer Undergraduate Research Fest (SURF), Baltimore, MD, August 5, 2015.

REFERENCES

Hung-Wei Tseng, PhD
Assistant Professor
Department of Electrical and Computer Engineering
University of California, Riverside
+1 (951) 827-1012
htseng@ucr.ed

Chad Jenkins, PhD
Professor
Department of Computer Science and Engineering
University of Michigan
(734) 763-6985
ocj@umich.edu

Fow-Sen Choa, PhD
Professor
Department of Computer Science and Electrical Engineering
UMBC
(410) 455-3272
choa@umbc.edu

Matthias K. Gobbert, PhD
Professor
Department of Mathematics and Statistics
UMBC
410-455-2404 (Office)

gobbert@umbc.edu

Bonny Tighe
Senior Lecturer
Department of Mathematics and Statistics
UMBC
410-455-2425 (Office)
tighe@umbc.edu

Mudduppa Gowda, PhD
Professor
Department of Mathematics and Statistics
UMBC
410-455-2431 (Office)
gowda@math.umbc.edu