Akash Poptani

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Summary

Fourth Year Student (in Seventh Semester) at Indian Institute of Technology (IIT) Dharwad with a passion for Computer Architecture, Formal Verification, Digital Systems, Embedded Systems, Compilers and Hardware Security, Machine Learning, Deep Learning, VLSI, Robotics, Content Writing and Tutoring

Education

2020 - 2024	B.Tech(Electrical Engineering)	**IIT Dharwad**	CPI: 8.96
2018 - 2020	Class 12th (CBSE)	S.R. Public School	92.4
2004 - 2020	Class 10th (ICSE)	St. Xavier's High School	91.3

Publications

SANNA: Secure Acceleration of Neural Network Applications

Accepted at International Conference on VLSI Design (VLSID'23), Hyderabad, India, 2023.

TFCM: Transformer-Focused Cache Management with Broad Compatibility for Multi-Core AI Accelerators

Submitted at International Symposium on High-Performance Computer Architecture (HPCA), 2024.

CASH: Criticality-Aware Split Hybrid L1 Data Cache

Submitted at International Symposium on High-Performance Computer Architecture (HPCA), 2024.

Projects and Internship

Current Projects

Design and Development of Runtime monitor processors July 2022

– Demonstrated comprehension of Runtime Verification, Monitorability, and the rt-R2U2 framework. Actively engaged in implementing Temporal-Logic Based Runtime Observer Pairs for effective System Health Management (SHM) in real-time systems. Executed FSM model implementations, specifically in Haskell on the CLASH compiler, as part of monitoring processor development.

Extending the Tejas architectural simulator with power (McPAT) and temperature (Hotspot) modeling capabilities Jan 2023

– Effectively familiarized with Tejas and McPat frameworks, successfully integrating them to support accurate power calculations. Expanded proficiency to include temperature computations, enabling ongoing tracking of power and temperature variations during program execution.

Drought Prediction using ML/DL Techniques Dec 2022

– Led research initiative utilizing machine learning to enhance drought prediction accuracy, emphasizing socio-economic and environmental impacts. Investigated diverse ML algorithms, including Support Vector Regressor, KNN, and LSTM. Developed and improved ML prototypes through innovative simulations and expanded datasets. Evaluated practicality in real-world drought prediction, addressing economic, environmental, and societal aspects. Pioneering work poised to revolutionize water resource management by advancing drought prediction accuracy.

Criticality aware Cache Design Dec 2022

– Assisted in implementing a Criticality Aware Tiered Cache Hierarchy to optimize system performance. Explored various Memory Technologies and seamlessly integrated them into the cache architecture. Conducted experiments on Branch predictors to fine-tune criticality utilization across different cache sizes, achieving enhanced efficiency.

Research Internships

Hong Kong University of Science and Technology (HKUST) Jun 2023 - Aug 2023

– **Hardware implementation of prefetcher architecture for multi-AI core architecture** using Verilog. Proficiently utilized SMAUG and gem5-aladdin tools to optimize performance through the integration of a prefetcher and dead-block predictor.

– Under the guidance of Prof. Wei Zhang.

Arizona State University Jun 2023 - Aug 2023

– **Machine Learning (ML) Applications in Electronic Design Automation (EDA)**: Prediction of static IR drop using Machine Learning based on distributions of all voltage sources, distribution of current sources, topology of the PDN and resistance values of each resistor.

– Under the guidance of Prof. Vidya A. Chhabria.

Tata Consultancy services (TCS) Banglore May 2023 - Jun 2023

– Enhanced operator support from TensorFlow to TensorFlow Lite to bolster compatibility with TinyML-based applications. Developed an understanding of **TinyMl** and its applications.

IIT Dharwad Apr 2022 - Jul 2022

– Designed and evaluated Task Scheduling Algorithms for Heterogeneous Secure Systems **Task Scheduling Algorithms for Heterogeneous Secure Systems (HSS)** with a focus on securing neural network applications against Hardware Trojans through assisted parallelism. Innovatively developed Heuristic Layer Scheduling algorithms, skillfully implementing them in C++ to optimize processing time. Acquired proficiency in Python scripting and refined document writing skills using LaTeX. Under the guidance of Prof. Rajshekar K.

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IIT Ropar April 2022 - July 2022

– Explored the latest **Advancements in Replacement Policies**, including LRU, BIP, DIP, RRIP, SRRIP, and DRRIP, along with **Cache Partitioning** techniques like UCP. Actively implemented UCP and Hawkeye Predictor on the ChampSim simulator, gaining hands-on experience in cache optimization strategies.

– Under the guidance of Prof. Shirshendu Das.

Other Projects

Breadboard implementation of Calculator Design

Digital Design was created using different gates. (Executed the real-world implementation of a Calculator Design on a breadboard. Developed a Digital Design utilizing RTL (Register-Transfer Level) Model, crafting diverse gate configurations, initially conceived with CMOS logic.)

Understanding modern aspects of processors using simulators

Conducted comparative study of passive cooling techniques(Heat sink, Heat spreader, Fans, fluids in pipes using cooling mechanisms) to prevent over heating of systems. Effectively familiarized Sniper(changing existing system models), HotSpot(monitoring on-chip temperature for different parameters) and 3D-ICE(3D-Interlayer Cooling Emulator with inter-tier Microchannel Liquid Cooling) simulators.

Portfolio Website

Actively acquiring proficiency in HTML, CSS, and JavaScript, with a strong focus on web development technologies. Applied acquired skills to design and construct a static website, demonstrating practical implementation of HTML, CSS, and JavaScript in a real-world context.

Implementation of MIPS using Verilog

Demonstrated proficiency in digital circuit understanding, translating this knowledge into practical application by skillfully implementing both combinational and sequential circuits using Xilinx tools. This experience extends to writing assembly code and seamlessly integrating the entire system, showcasing my ability to contribute effectively to complex hardware projects.

Treasure Hunt, Snakes and Ladders Computer Programming Lab Course

My practical expertise in C Language programming is highlighted by my utilization of binary files and multiple library functions to develop engaging and interactive games. I have successfully engineered both Minesweeper and Snakes and Ladders games, demonstrating my ability to apply complex programming concepts to create enjoyable user experiences.

Implementation of Digital Modulation Schemes Communications Lab

Developed Modulator, Demodulator, and Symbols to Bits functions for various Modulation Schemes including BPSK, QPSK, and 16QAM, utilizing MATLAB. Successfully implemented Repetition and Interleaver Techniques to enhance the efficiency of the modulation processes.

Implementation of Object Detection on Raspberry Pi Hands On Engineering Lab

Installed Raspian OS and proficiently configured the system for optimal performance. Leveraged a pretrained TensorFlow Lite model to execute object detection and face mask recognition tasks with precision, showcasing my expertise in AI and embedded systems integration.

Skills

Programming	VHDL, Verilog, Haskell, CLASH C,C++,Python, Java, MATLAB
Technical	Computer Architecture, Formal Verification, Hardware Security, Digital Design, Arduino, Linux Basics, Data Analysis, Version Controlling
Documentation	LaTeX
Management	Good communication and efficient planning
Tools	Tejas, McPat, Hotspot, SMAUG, gem5-aladdin, ChampSim

Teaching

Teaching Assistant (TA) for CS103: Introduction to Programming Course

Conducted assessments to evaluate students' coding proficiency and progress, ensuring they were on track to meet their programming goals. Facilitated collaborative learning through group discussions, promoting knowledge-sharing and problem-solving among students. Conducted code reviews to enhance students' programming skills, providing constructive feedback and guidance to improve their coding abilities.

Freelance Tutor at Nerdy Academy, Raipur

Developed educational materials and customized lesson plans to cater to individual needs and learning styles. Regularly assessed academic progress and maintained open communication with parents to address concerns and enhance the learning experience.

Subject Matter Expert (SME) at Embibe

Actively engaged in content development and optimization, ensuring the accuracy, clarity, and alignment of educational materials with learning objectives and standards. Thoughtfully categorized questions for efficient learning and revision, contributing to a more enriching educational experience for students.

Experience

Public Relations (PR - CDC) Coordinated outreach efforts between multiple companies and our institute. Served as the coordinator for the HR conclave, preparing thought-provoking questions for speakers.

Eunoia - Literary Club of IITDh Held the position of Council Member, actively shaping club decisions. Crafted engaging content and organized observation-based competitions.

Department Academic Mentorship Programme (DAMP) Guided junior peers, helping them balance academics and extracurricular activities. Conducted mentorship sessions to foster personal and academic growth.

Rational Eloquence Unit (REU- CDC) Coordinated with speakers and organized competitions to develop soft skills. Conducted batch-specific soft skills events, enhancing communication and management skills.

Student Mentorship Programme (SMP) Exposed mentees to diverse academic paths for informed educational decisions. Provided one-on-one mentoring to address their challenges and concerns.

Event Management Team (Career Development Cell) Organized and hosted talks, webinars, and sessions. Served as an anchor for multiple sessions, ensuring high-quality events.

Club Membership

Active participation in Robotics Club, Hardly Human (AI Club), Code Geass (Coding Club), Fierce Gallants (Chess Club), Udghosh (Dramatics Club), and Sapphire (Dance Club).
Hosted and managed various club events, contests, and sessions. Participated in **IIT Tech Meet 2023 (Student's Academic Conclave) and 2022 Bosch Age and Gender Detection event.**

Additional Courses

Digital Design and Computer Architecture By Prof. Onur Mutlu

Computer Organisation and Architecture By Prof. Smruti R. Sarangi

Introduction to Machine Learning
Deep Learning and Neural Networks Prof. Andrew NG (Stanford University)

Relevant Institute Courses

Computer Architecture

Language of bits, Processor design, Pipelining and Hazards, Memory Systems

Microprocessors and Microcontrollers

8085 microprocessor architecture and programming, Serial data communication, Timers and counters, 8051 Microcontroller programming

Digital System

Designing gates from Transistor, Boolean Functions, Multiplexer, Demultiplexer, Registers, Counters, Shift Register, RAM, ROM

Computer Programming

Introduction to C programming, Variables, Data types, Function, Recursion, Pointers, Struct