Vikash Kumar

kvikash@iisc.ac.in | Mob: 9911614887
viku12cool@gmail.com | Alt. Mob: 1624750637
https://viku18.github.io | https://github.com/viku18

RESEARCH INTERESTS

I am broadly interested in integrating AI into Real-Time/Cyber-Physical Systems with a prime focus on Worst-Case Execution Time Analysis due to shared resources in multi/many-core processors. My research interests include Networks-on-Chip, Memory controllers, and Cache analysis techniques for time-predictable architectures. Apart from that, I have been working on Timing Analysis using machine learning and deep learning methods for past three years.

EDUCATION

Indian Institute of Science, India,
Ph.D, Computational and Data Sciences, 2024 CGPA: 7.3
Thesis: Data-Driven approach to estimate WCET for Real-Time Systems. video

Deen Dayal Upadhyaya college, Delhi University,
B.Tech, Computer Science and Engineering, June 2017 Percentage: 71.47

Patna Central School, Patna,
Intermediate, June 2013 Percentage: 79.20

PUBLICATIONS

V. Kumar, M. Krishna, SK. Nandy, S. Raha "Worst-Case Execution Time prediction on Massively Parallel Processor REDEFINE using Transformer" (To be submitted in RTCSA 2024)

V. Kumar, B. Ranjbar and A. Kumar, "Utilizing Machine Learning Techniques for Worst-Case Execution Time Estimation on GPU Architectures," in IEEE Access, doi: 10.1109/ACCESS.2024.3379018. github

V. Kumar, B. Ranjbar, A. Kumar "ESOMICS: ML-Based Timing Behavior Analysis for Efficient Mixed-Criticality System Design," in IEEE Access, vol. 12, pp. 67013-67024, 2024, doi: 10.1109/ACCESS.2024.3396225. github

V. Kumar, B. Ranjbar, A. Kumar "Motivating the Use of Machine-Learning for Improving Timing Behaviour of Embedded Mixed-Criticality Systems," 2024 Design, Automation & Test in Europe Conference & Exhibition (DATE).

V. Kumar, "Estimation of an Early WCET Using Different Machine Learning Approaches," 2023 In International Conference on P2P, Parallel, Grid, Cloud and Internet Computing 2023 (pp. 297-307). Springer, Cham.

V. Kumar, "An integrated approach of Genetic Algorithm and Machine Learning for generation of Worst-Case Data for Real-Time Systems," 2022 IEEE/ACM 26th International Symposium on Distributed Simulation and Real Time Applications (DS-RT), 2022, pp. 87-95, doi: 10.1109/DS-RT55542.2022.9932054.

V. Kumar, "Deep Neural Network Approach to Estimate Early Worst-Case Execution Time," 2021 IEEE/AIAA 40th Digital Avionics Systems Conference (DASC), 2021, pp. 1-8, doi: 10.1109/DASC52595.2021.9594326.

EXPERIENCE

Research Intern at Samsung R&D Bangalore April 2024 - Present
As a research intern I have been working with OnDevice AI team on Federated Learning and Large Language Model for Knowledge Graph since April.

Associate Member at Morphing Machine March 2020 - March 2024
As a part of Morphing Machine I have worked on massively many-core parallel processor to make it more reliable and predictable for use.

Visiting Researcher at TU Dresden May 2022 - May 2023
As a guest researcher at TU Dresden, I have worked on the machine learning based approach to estimate WCET for the Mixed Criticality Systems.

Senior Research Fellow August 2020 - March 2024
IISc

Junior Research Fellow August 2018 - July 2020
IISc

TEACHING ASSISTANT

Data Structures and Graph Analytics *(Assisted Prof. Y.N Srikant)* Jan 2022 - May 2022

PROJECTS

Project One: Worst case per flow delay bound analysis for network elements such as routers and buffers using deterministic network calculus. In this project we model the given many-core architecture mathematically. (Apr'2021)

Project Two: Object detection using Deep Neural Networks for Autonomous Vehicles. In this project, we reduce the latency of DNN execution and improve the accuracy while satisfying the real-time constraints. (Oct'2020)

Project Three: Exploring the Multi Application interference in GPUs. When multiple applications are concurrently executed in a GPU, they start interfering at various levels in the memory hierarchy like shared caches, TLB, Main Memory, etc. leading to an under utilization of GPU resources. (Dec'2018)

Project Four: Twitter Data Analysis using Hadoop. In this project we collect data using framework like Hive from social site and after processing of the data we visualize the data. For instance, we extract the data of Narendra Modi to know the popularity of him in the people. (June'2017)

Project Five: Website creation using ASP.NET. In this project we allow a client to login shopping site and then choose the products which he/she wants to buy and then go to the cart (which shows the list of selected item) and then give details of how he/she wants to pay the bill. (May'2016)

COURSES

Computer Systems and Algorithms
Computer Architecture, Real-Time Systems, Distributed Computing Systems, Topics in Embedded Systems, Network and Distributed Systems, Introduction to Scalable Systems and Computer Architecture to AI

Data Sciences
Pattern Recognition and Neural Networks, Deep Learning for Computer Vision, Natural Language Processing and Reinforcement Learning

Numerical Methods and Mathematics
Linear Algebra, Probability and Numerical Solution of Differential Equations

COMPUTER SKILLS

Languages: C, C++, Java, Python, MATLAB, Golang, Bash, OpenCL, OpenMP, CUDA, LaTeX.
Machine Learning Tools: PyTorch, Tensorflow.

Web Development: HTML, CSS, JavaScript, ASP.NET.
Applications: Vi/Vim, Eclipse, Visual Studio, Git.
Operating Systems: Unix, Linux, Mac OSX, Windows.
Database: Relational Algebra, SQL.
Architectural Simulators: Gem5, GPGPUSim, REDEFINE Sim.
Source Control, Documentation and Debugging: Github, Gitlab, gdb.

Invited Talks	DLR Braunschweig "AI integration on Safety-Critical System"	(March'2023)
	CFAED TU Dresden "Estimation of WCET using AI for RTS"	(March'2023)
Service Reviewer	Secondary Reviewer of GLSVLSI 2023 Secondary Reviewer of CASES 2023	
HOBBIES	Cricket, Badminton, Chess, Guitar, and Trekking	
Languages Known	English and Hindi	
REFERENCES	Available upon request.	