Diksha Moolchandani

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Work Experience

Research Scientist (Full-time) (Jan. 2022 - present)
IMEC, Leuven, Belgium

Education

Ph.D. in Computer Science (Jan. 2016 - 2021)
Indian Institute of Technology Delhi (IIT Delhi)
Advisors: Prof. Smruti Ranjan Sarangi and Prof. Anshul Kumar

B.Tech. in Electronics and Communication Engineering (Aug 2011 - May 2015)
Indian Institute of Information Technology, Design and Manufacturing, Jabalpur (IIITDM Jabalpur)
CGPA: 8.6/10

Research Interests

- Computer Architecture for Computer Vision
- ML Accelerators
- ML applications in Computer Architecture
- Energy-efficient architecture design for UAVs and autonomous driving vehicles

Honors & Awards

- Winner: Technical Blog Competition at IBM Research's flagship event Maitreyee (Sept. 2021)
  IBM Research
- Selected to attend the 8th Heidelberg Laureate Forum (Sept. 2021)
  Heidelberg, Germany
- Fellowship to attend Robotics: Science and Systems (RSS) (Jul. 2021)
  virtual event
- Winner: Technical Blog Competition at IBM Research's flagship event Maitreyee (Oct. 2020)
  IBM Research
- Scholarship with short stay: Ph.D. young researcher (Sept.-Nov. 2019)
  Innopolis University, Russia

Publications

Game Theory-based Parameter Tuning for Energy-efficient Path Planning on Modern UAVs
D. Moolchandani, K. Yadav, G. Prathap, I. Afanasyev, A. Kumar, M. Mazzara, and S.R. Sarangi
ACM Transactions on Cyber-Physical Systems, Oct. 2022

Hardware-Assisted Mechanisms to Enforce Control Flow Integrity: A Comprehensive Survey
S. Kumar, **D. Moolchandani**, and S.R. Sarangi
Elsevier Journal of Systems Architecture (JSA), Sept. 2022, Vol. 130

Performance and Power Prediction for Concurrent Execution on GPUs
D. Moolchandani, A. Kumar, and S.R. Sarangi
ACM Transactions on Architecture and Code Optimization, Sept. 2022, Vol. 19, Issue 3

PredStereo: An Accurate Real-Time Stereo Vision System
D. Moolchandani, N. Shrivastava, A. Kumar, and S.R. Sarangi
Winter Conference on Applications of Computer Vision (WACV) 2022

Game Theory-based Parameter-Tuning for Path Planning of UAVs
D. Moolchandani, G. Prathap, I. Afanasyev, A. Kumar, M. Mazzara, and S.R. Sarangi
International Conference on VLSI Design 2021

Accelerating CNN Inference on ASICs: A Survey
D. Moolchandani, A. Kumar, and S.R. Sarangi
Elsevier Journal of Systems Architecture (JSA), Feb. 2021, Vol. 113

VisSched: An Auction based Scheduler for Vision Workloads on Heterogeneous Processors
D. Moolchandani, A. Kumar, J.F. Martínez,and S.R. Sarangi
Full paper accepted in ESWEEK CASES 2020
Published in IEEE International Transactions on Computer-Aided Design of Integrated Circuits and Systems (IEEE TCAD), Nov. 2020, Vol. 39, Issue 11

Performance Prediction for Multi-Application Concurrency on GPUs
D. Moolchandani, S. Gupta, A. Kumar, and S.R. Sarangi
IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS) 2020

A Machine to Machine framework for the charging of Electric Autonomous Vehicles
Z. Elbanna, I. Afanasyev, L.J.P. Araújo, R. Hussain, M. Khazeev, J. Lamptey, M. Mazzara, S. Megha, **D. Moolchandani**, and D. Strugar
The Workshops of the IEEE International Conference on Advanced Information Networking and Applications (WAINA) 2020

F-LaaS: A Control-Flow-Attack Immune License-as-a-Service Model
S. Kumar, **D. Moolchandani**, T. Ono, and S.R. Sarangi
IEEE International Conference on Services Computing (SCC) 2019

Posters

Scheduling and Characterization of Computer Vision Workloads on Heterogeneous Systems
D. Moolchandani
Ph.D. Forum, Design Automation Conference (DAC) 2021

VisSched: An Auction based Scheduler for Vision Workloads on Heterogeneous Processors
D. Moolchandani, A. Kumar, J.F. Martínez, and S.R. Sarangi
Design Automation Conference (DAC) 2020

Patents

System and Method for Improving Stereo Vision Accuracy
Diksha Moolchandani, Nivedita Shrivastava, Anshul Kumar, and Smruti R. Sarangi
Filed at the Indian patent office. Date: June 24, 2021. Number: 202111028215

Research Software

Tejas Power Pack (Aug-Oct 2017)
Advisor: Prof. Smruti Ranjan Sarangi, IIT Delhi
- Power model add-on for Tejas architectural simulator
- Released under the open source Apache-v2 license here

Professional Experience

- **Visiting Research Scholar** (Sept.-Nov. 2019)
  Innopolis University, Republic of Tatarstan, Russia
- **Project Associate** (Jun-Dec 2015)
  IIT Delhi (*Top-ranked institute in Computer Science and Engineering in India*)
- **Project Based Internship** (May-Dec 2014)
  Bhabha Atomic Research Centre Mumbai (*BARC Mumbai*)
- **Summer Internship** (May-Jul 2013)
  BARC Mumbai
- Summer training in Embedded Systems and Robotics, (May-Jun 2012)
  BRiCS Simplifix Automation & Solutions Pvt. Ltd., IIT Kanpur

Teaching Experience

Computer Architecture (Spring 2020)
Instructor: Prof. Preeti Ranjan Panda

Accelerator Design for CNNs (Spring 2020, Fall 2019)
Instructor: Prof. Smruti Ranjan Sarangi

Operating Systems (Spring 2019)
Instructor: Prof. Smruti Ranjan Sarangi

Advanced Computer Architecture (Fall 2018)
Instructor: Prof. Smruti Ranjan Sarangi

Computer Architecture (Spring 2018, Spring 2017)
Instructor: Prof. Anshul Kumar

Digital Logic and System Design (Fall 2017, Fall 2016)
Instructor: Prof. Anshul Kumar

Student Mentoring

Kishore Yadav (Master's thesis) 2020-2021
Unity-based simulator for drone swarms

Mohammad Atif (Bachelor's thesis) 2020-2021
Self-driving simulator: lane change, steering, and braking

Satyam Jay (Master's project) 2020-2021
Self-driving simulator: lane change, steering, and braking

Kishore Yadav, Yash Malviya, Aniket Kumar (Master's project) 2019-2020
Self-driving simulator - detection, tracking, localization

Yash Singla, Pranay Singh, Mudit Soni (Winter Internship) 2019
Added scenes and features to our self-driving car simulator

Chinmay Rai (Bachelor's thesis) 2019-2020
Compiler for Tejas-CNN

Aditya Jain, Sarthak Vishnoi (Bachelor's thesis) 2019-2020
Added multiple dataflows and DRAM module to Tejas-CNN

Shivangi Sharma, Ravi Prakash, Goverdhan Mishra (Summer Internship) 2019
Tejas-CNN: Simulator for CNN accelerators (basic implementation)

Prabhleen Kaur (Master's thesis) 2018-2019
Unity-based simulator for self-driving cars (basic)

Sudhanshu Gupta (Bachelor's thesis) 2018-2019
Characterization of autonomous driving workloads

Rishabh Singh, Parul Gupta (Summer Internship) 2018
Generic plotting library for the statistics generated by Tejas architectural simulator

Dhruv Mishra (Summer Internship) 2018
Analyzed MEVBench suite for invariants using Daikon

Ryan Dsouza (Bachelor's thesis) 2017-2018
Extended Tejas x86 architectural simulator for SIMD instructions

Talks & Seminars

- Scheduling and Characterization of Computer Vision Workloads on Heterogeneous Systems
  virtually at DAC Ph.D. Forum (Dec. 2021)
- Game Theory-based Parameter-Tuning for Path Planning of UAV
  virtually at IBM Research's flagship event Maitreyee (Sept. 2021)
- VisSched: An Auction-based Scheduler for Vision Workloads on Heterogeneous Processors
  virtually at AMD Bangalore (Sept. 2021)
- Accelerating CNN Inference on ASICs: A Survey
  virtually at Qualcomm Hyderabad (Sept. 2021)
- VisSched: An Auction-based Scheduler for Vision Workloads on Heterogeneous Processors
  virtually at IMEC Belgium (July 2021)
- Game Theory-based Parameter-Tuning for Path Planning of UAV
  virtually at VLSI Design (Feb. 2021)
- VisSched: An Auction-based Scheduler for Vision Workloads on Heterogeneous Processors
  virtually at IBM Research's flagship event Maitreyee (Oct. 2020)
- VisSched: An Auction-based Scheduler for Vision Workloads on Heterogeneous Processors
  virtually at ESWEEK CASES (Sep. 2020)

- Performance Prediction for Multi-Application Concurrency on GPUs
  virtually at ISPASS (Aug. 2020)
- VisSched: An Auction-based Scheduler for Vision Workloads on Heterogeneous Processors
  virtually at DAC (July 2020)
- Benchmark Characterization and Optimizations for Path Planning of Drones
  Innopolis University, Russia (Nov. 2019)
- Architectural Characterization of Vision Workloads
  Innopolis University, Russia (Sept. 2019)
- Architectures for Vision and Image Processing Applications
  PhD Symposium CSE IIT Delhi (Dec. 2017)
- Architectures for Vision and Image Processing Applications: Survey and Research Proposal
  IIT Delhi, India (Jun. 2017)
- Implementation of FPGA based Communication Network using High Speed PCIe and Multi Gigabit Transceivers
  National Workshop on Cryptology (NWC), 2014
- Implementation of FPGA based Communication Network using High Speed PCIe and Multi Gigabit Transceivers
  Bhabha Atomic Research Center Mumbai (Aug. 2014)

Professional Service

- Reviewer for JSA Journal, ICCD 2021, ICPP 2021, HPCA 2021, ICPP 2020, HiPC 2020, VDAT 2020, ICCD 2019, EMC^2 2018, IPDPS 2018, ICCD 2017
- PC member Nonlinearity, Information, and Robotics 2021

Past Selected Projects

Super Resolution Imaging on Reconfigurable Arrays, IIT Delhi (Jun 2015-May 2016)
Advisors: Prof. Kolin Paul and Prof. Anshul Kumar, IIT Delhi
- Implemented a Convolutional Neural Network on a Virtex-6 FPGA to convert an SD video to an HD video at real time.
- Optimizations include computation time reduction by exploiting inherent parallelism, efficient matrix multiplication by using Toeplitz representation and memory footprint reduction by using a rotating buffer instead of a full-size input buffer.
- Designed a self-defined protocol, partially exploiting the OCP protocol, to fetch image data in parallel from four DDR3 banks.

FPGA Cluster based Parallel Architecture for Cryptanalysis, BARC Mumbai
Advisor: Mr. Abhishek Bajpai, BARC Mumbai (May-Nov 2014)
- Developed a network of four Virtex-6 FPGAs that communicated via the MGT protocol.
- Developed Python and C wrappers for PCIe bus drivers to implement DMA from Linux Kernel Memory to FPGA BRAM space
- Presented paper at National Workshop on Cryptology 2014 (NWC).

Course Projects

- Implemented a distributed ledger of transactions using Google GO, IIT Delhi

- Designed a resource-constrained scheduling algorithm to maximize the performance in a system with multi-port memories, IIT Delhi
- Compared the impact of uniform and non-uniform caches on the performance of the processor, IIT Delhi
- Designed and fabricated a hand-held device to aid in sending flood alerts to the people and rescue location to the rescue team, IIITDM Jabalpur