Shaleen Garg

Fifth Year Dual Degree Student

Computer Science and Engineering

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Research Interests

Parallel & Distributed Algorithms, IoT, Cloud Computing, Computer Architecture and Compilers.

Education

Masters by Research in Computer Science	August 2018 - May 2019(expected)
International Institute of Information Technology, Hyderabad, GPA: 9.25/10	
Bachelor of Technology in Computer Science	August 2014 - May 2018
International Institute of Information Technology, Hyderabad, GPA: 7.06/10	
AISSE(CBSE) Class XII	August 2013 - May 2014
FAIPS(DPS), Kuwait, 91.2%	

Research Summary

A lot of co-processors and accelerators are being used across different fields these days for example algorithmic trading, crypto-currency mining, deep learning, computational natural sciences etc. Research in these fields has burgeoned many folds; but most accelerators give a limited API level control to the user and do not expose an operating system. They also do not support time sharing.

This inability limits their applicability especially in environments such as Platform-as-a-Service (PaaS) and Resource-as-a-Service (RaaS). In the former, elastic demands may require preemption where as in the latter, fine-grained economic models of service cost can be supported with time sharing. Moreover, the demand for these accelerators has far exceeded their supply making them very costly; inaccessible to people in resource constrained environments.

As a part of my research, we have created a deployable system which, with minimal programmer support, efficiently emulates preemption on accelerators and also provide memory guarantees to the workloads contending for accelerator time. This system aims to provide a software abstraction for all the underlying heterogeneous accelerators so that workloads can be created and executed agnostic to specific hardware.

This will reduce our dependence on a specific accelerator, enable elastic allocation of accelerators for PaaS environments, enable automatic checkpointing of workloads, enable elastic time sharing for RaaS environments and most importantly reduce the cases of starvation experienced by small processes contending for accelerator time.

Publications

Share-a-GPU: Providing Simple and Effective Time-Sharing on GPUs
Shaleen Garg, Kishore Kothapalli, Suresh Purini
25th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC), Bengaluru, India, December 17-20, 2018.

GPUScheduler: User Level Preemptive Scheduling for NVIDIA GPUs
Shaleen Garg, Kishore Kothapalli, Suresh Purini
24th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC-SRS10), Jaipur, India, December 18-21, 2017. (Student Research Poster)

Honours And Awards

Dean's Undergraduate Research Award, IIIT-H	AY '17 - '18

Current Research Projects

Expedited Results using Online Prioritization of GPU Kernels *September'18 - Ongoing*
Dr. Kishore Kothapalli, Dr. Suresh Purini & Dr. Pawan Kumar
- Automatically changing priorities of different parts of a kernel on GPU to expedite coarse grain results.
- Concurrently calculate the saturation condition on CPU to prioritize kernel without additional overheads on GPU.

Reinforcement Learning for Financial Portfolio Management *August'18 - Ongoing*
Dr. Pawan Kumar
- Reducing the portfolio management problem to a typical game(MDP).
- Design the agent to predict the price of a commodity after some time using SARSA.
- Let the agent master the game on historical trading data by maximizing the portfolio value.
- Allow the agent to explore by changing the commodities in the portfolio.

Performance Engineering of Wireless IoT Sensors
November'16 - December'16

Course Project: Dr. Anil Gurijala

- Designed a low-cost Wireless IoT Boilerplate hardware platform using readily available 8-Bit micro-controller (arduino micro) and other hardware modules like ESP 8266.
- The hardware is capable of housing 5-10 sensors (depending on the pins available on the arduino model).
- Tested the designed hardware platform to maximize both data transmission frequency and up-time (of the hardware), when connected to a finite remote power source like commodity "AA" batteries.
- Was successful in keeping the cost of the whole system as low as $22.

Distributed Grep (Team-Mate Mr.Vinaya Khandelwal)
October'16 - November'16

Course Project: Dr.Vivekananda Vellanki

- Implemented Hadoop Distributed File System(HDFS) in Java. Took care of underlying failures associated with these systems.
- Implemented generic Map-Reduce program over the HDFS and tested distributed grep on it.

Bflat Programming Language
August'17 - November'17

Course Project: Dr.Suresh Purini

- Implemented a interpreter for Bflat(self-defined) language using C++.
- Implemented front-end compiler for LLVM Intermediate Representation generation.
- Used Flex(for tokens) and Bison(for grammar).

Distributed Graph Algorithms
May'16 - July'16

Summer Project: Dr.Govindarajulu R

- Implemented "Asynchronous concurrent-initiator depth first search spanning tree" and "Synchronous Breadth First Spanning Tree" using Erlang
- Tested the above algorithms on 15 nodes with graphs of size as large as 50 million vertices.

Teaching Assistant
August'17 - May'18

Course: Distributed Systems (CSE431)

- Prepared class activities focusing on the real work applications of distributed systems for $\sim$100 senior level undergraduate and postgraduate students.
- Created and graded course assignments to ensure students understood material and stayed on track.

Graduate Research Assistant
AY '18 - '19

Centre for Security Theory and Algorithmic Research(CSTAR)

- Modifying Unums/Posits for optimizing floating pointing representation.
- Trying to come up with alternate ways for representing floating point numbers with efficient arithmetic logic.
- Aiming to optimize bit representation, energy impact and implementation area of floating points for DSP applications on FPGAs.

Volunteer - Gave weekly science lessons to local underprivilged children at Ashakiran (IIIT-H initiative)	AY '16 - '17
Student System Administrator - Maintained all the compute and storage nodes at CSTAR.	AY '17 - '19
Student's Parliament	AY '18 - '19

- Elected Member of the student's parliament representing the Masters Students at IIIT Hyderabad.
- Chief Election Commissioner for Student's Parliament Elections.
- Student Member of the Disciplinary Sub-Committee(DISCO) at IIIT Hyderabad.

Languages: C, C++, CUDA, Java
Scripting Languages: Python, Bash
Other Tools/Languages: LaTeX
Platforms: Linux
Hardware: Arduino, ESP8266(wifi module)