Supun Nakandala

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Research Interests My research interest lies broadly in the intersection of Systems and Machine Learning, an emerging area which is increasingly referred to as *Systems for ML*. In this space I operate as a data management researcher. Taking inspirations from classical data management techniques, I build new abstractions, algorithms, and systems to improve efficiency, scalability, and usability of machine learning workloads. I am also interested in large-scale applied ML, which opens new systems challenges.

Education

University of California, San Diego, CA   Sept 2017 - Present
PhD, Computer Science. GPA: 3.96/4.00
Thesis Advisor: Prof. Arun Kumar
Courses: Database System Implementation, Advanced Data Analytics Systems, Data Models in Big Data Era, Advanced Compiler Design, Machine Learning, Recommender Systems and Web Mining, Algorithm Design and Analysis

University of Moratuwa, Sri Lanka   Aug 2010 - April 2015
Bachelor of the Science of Engineering, Computer Science & Engineering.
GPA: 4.11/4.20.
Department Topper and Gold Medalist

Publications

Extending Relational Query Processing with ML Inference
Konstantinos Karanasos, Matteo Interlandi, Doris Xin, Fotis Psallidas, Rathijit Sen, Kwanghyun Park, Ivan Popivanov, **Supun Nakandala**, Subru Krishnan, Markus Weimer, Yuan Yu, Raghu Ramakrishnan, Carlo Curino
CIDR 2020

Incremental and Approximate Inference for Faster Occlusion-based Deep CNN Explanations
Supun Nakandala, Arun Kumar, and Yannis Papakonstantinou
ACM SIGMOD 2019
Honorable Mention for Best Paper Award. Invited to ACM TODS.

Compiling Classical ML Pipelines into Tensor Computations for One-size-fits-all Prediction Serving
Supun Nakandala, Gyeong-In Yu, Matteo Interlandi, and Markus Weimer
NeurIPS 2019 MLSys Workshop

Cerebro: Efficient and Reproducible Model Selection on Deep Learning Systems
Supun Nakandala, Yuhao Zhang, and Arun Kumar
ACM SIGMOD 2019 DEEM Workshop

Demonstration of Krypton: Optimized CNN Inference for Occlusion-based Deep CNN Explanations
Allen Ordookhanians, Xin Li, **Supun Nakandala**, and Arun Kumar
VLDB 2019 Demo | SysML 2019 Demo

Materialization Trade-offs for Feature Transfer from Deep CNNs for Multimodal Data Analytics
Supun Nakandala, Arun Kumar
SysML 2018 Short paper

Gendered Conversation in a Social Game-Streaming Platform
Supun Nakandala, Giovani Cimpaglia, Norma Su, and Yong-Yeol Ahn
AAAI ICWSM 2017

Apache Airavata Security Manager: Authentication and Authorization Implementations for a Multi-Tenant eScience Framework
Supun Nakandala, Hasini Gunasinghe, Suresh Marru, and Marlon Pierce
IEEE e-Science 2016

Anatomy of the SEAGrid Science Gateway
Supun Nakandala, Sudhakar Pamidigantam, Suresh Marru, Marlon Pierce
NSF XSEDE 2016

Pre-Prints	*Deep Learning Algorithms for Identifying Sedentary Behavior from Hip Worn Accelerometer Data*

Supun Nakandala, Marta Jankowaska, Fatima Tuz-Zahra, John Bellettiere, Arun Kumar, and Loki Natarajan
Under Submission

Resource-Efficient and Reproducible Model Selection on Deep Learning Systems
Supun Nakandala, Yuhao Zhang, and Arun Kumar
Under Submission
`https://adalabucsd.github.io/papers/TR_2019_Cerebro.pdf`

Vista: Declarative Feature Transfer from Deep CNNs at Scale
Supun Nakandala, Arun Kumar
Under Review at SIGMOD 2020
`https://adalabucsd.github.io/papers/TR_2019_Vista.pdf`

Work Experience	**Research Intern - Systems for ML**	June 2019 - Sept 2019

Microsoft Cloud Information Services Lab
Mentors: Matteo Interlandi, Markus Weimer
Designed and implemented a compiler for translating classical machine learning pipelines into tensor computations for unified and faster scoring of machine learning models. The initial workshop paper has been accepted to the Neurips 2019 MLSys Workshop. Full conference publication is in progress.

Research Software Developer   Oct 2015 - Aug 2017
Science Gateways Research Center - Indiana University
Manager: Marlon Pierce
Developed APACHE AIRAVATA, which is a software framework to compose, manage, execute, and monitor large scale applications and workflows on distributed computing resources such as local clusters, supercomputers, computational grids, and computing clouds.

Teaching Experience	Teaching Assistant - Systems for Scalable Analytics	UCSD - Winter 2020
	Teaching Assistant - Advanced Data Analytics Systems	UCSD - Spring 2019

Scholarships and Awards	NSF travel award to attend ACM SIGMOD 2019	NSF - 2019
	Gold Medal for the Best Academic Performance	University of Moratuwa - 2015
	Travel award to attend 4th South Asia Workshop on Research Frontiers in Computing	National University of Singapore - 2014
	Mahapola Higher Education Merit Scholarship	Govt. of Sri Lanka - 2010

Research Impact	Ideas from project CEREBRO integrated into MADlib/Greenplum by Pivotal	2019
	CEREBRO system is being used by behavioral science researchers at UC San Diego	

medical school   2019

"Gendered Conversation in a Social Game-Streaming Platform" paper gains lot of media attention and creates awareness about the bleak issue of sexism in online game streaming platforms   2017

APACHE AIRAVATA science gateways middleware and the SEAGRID science gateway are widely used by computational science researchers to execute and manage computational jobs on university clusters and national supercomputing infrastructure   2017

Ongoing Projects	**Project: Medical Data to Knowledge**	Started September 2018

In this joint project between UCSD CS department and UCSD Medical School, I develop new deep learning-based techniques for predicting human activity (e.g., sitting, standing, and stepping) from accelerometer data. The data is collected from a large cohort of patients who wore accelerometer devices for seven days of free living. The goal is to develop accurate methods to predict human activity from these accelerometer data and then use them in downstream human activity and metabolic health correlation analysis. The challenges of this project include working with large volumes of training data (1 TB) and performing extensive *model selection* such as neural architecture search and hyperparameter tuning.

Project: Cerebro   Started September 2018

Deep neural networks are revolutionizing many ML applications. But there is a major bottleneck to wider adoption: the pain of *model selection.* This empirical process involves exploring the deep net architecture and hyper-parameters, often requiring hundreds of trials. Alas, most ML systems focus on training one model at a time, reducing throughput and raising costs; some also sacrifice reproducibility. We are developing Cerebro, which is a system to raise deep net model selection throughput at scale and ensure reproducibility. CEREBRO uses a novel parallel execution strategy we call *model hopper parallelism* which is inspired by the multi-query optimization technique. Experiments on *Criteo* and *ImageNet* datasets show CEREBRO offers up to 10X speedups and improves resource efficiency significantly compared to existing systems like Parameter Server, Horovod, and task-parallel tools.

Technical Talks   *Resource-Efficient and Reproducible Model Selection on Popular Deep Learning Systems*   UCSD CNS Research Review 2019

Compiling Classical ML Pipelines into Tensor Computations for One-size-fits-all Prediction Serving   Microsoft Cloud Information Services Lab 2019

Incremental and Approximate Inference for Faster Occlusion-based Deep CNN Explanations   ACM SIGMOD 2019

Cerebro: A System for Efficient and Reproducible Model Selection on Deep Learning Systems   ACM SIGMOD 2019

Materialization Trade-offs for Feature Transfer from Deep CNNs for Multimodal Data Analytics   UCSD CNS Research Review 2018