Srinivas Eswar

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RESEARCH INTERESTS

Machine Learning and High Performance Computing.

EDUCATION

PhD, Computer Science   May 2022
MS, Computer Science   May 2016
Georgia Institute of Technology, Atlanta, GA
Advisors: Prof. Richard Vuduc, Prof. Haesun Park
GPA 3.95/4

MSc, Mathematics
BE, Computer Science   (Double Major)
Birla Institute of Technology and Science, Pilani, India   June 2012
GPA 8.53/10

HONOURS

- Wilkinson Fellowship, Argonne National Laboratory, 2022.
- INTERN Fellowship, National Science Foundation (NSF), 2020.
- INSPIRE Scholar, Dept. of Science and Technology, Govt. of India, 2010.
- Winner Men's Tennis Team Event at BITS Open Sports Meet (BOSM), 2008.
- Qualified for Indian National Mathematics Olympiad (INMO), 2006.
- Ramanujan Award by Association of Mathematical Teachers of India (AMTI), 2005.
- Gold Medal in Indian National Science Olympiad Level-1, 2004.

ACADEMIC SERVICE

- Reviewer for Springer JOGO, ACM TKDD, IEEE TETC, IEEE TSP, Elsevier JPDC, IP JOC, AIS-TATS '23, SC '23, HiPC '23.
- Organised a mini symposium at ICIAM '23 titled "Efficient computational methods for data matrices: exploiting sparsity and structure".
- Ran the Georgia Tech CSE student seminar HotCSE (2018-2020).

PUBLICATIONS

- "Distributed-Memory Parallel JointNMF",
  S. Eswar, B. Cobb, K. Hayashi, R. Kannan, G. Ballard, R. Vuduc, H. Park
  ACM International Conference on Supercomputing (ICS), 2023.

- "An Alternating Rank-K Nonnegative Least Squares Framework (ARkNLS) for Nonnegative Matrix Factorization",
  D. Chu, W. Shi, S. Eswar, H. Park
  SIAM Journal on Matrix Analysis and Applications (SIMAX), 2021.

- "PLANC: Parallel Low Rank Approximation with Nonnegativity Constraints",
  S. Eswar, K. Hayashi, G. Ballard, R. Kannan, M. Matheson, H. Park
  ACM Transactions on Mathematical Software (TOMS), 2021.

- "ORCA: Outlier detection and Robust Clustering for Attributed graphs",
  S. Eswar, R. Kannan, R.Vuduc, H. Park
  Springer Journal of Global Optimization (JOGO), 2021.

- "Distributed-Memory Parallel Symmetric Nonnegative Matrix Factorization",
  S. Eswar, K. Hayashi, G. Ballard, R. Kannan, R. Vuduc, H. Park
  IEEE International Conference for High Performance Computing, Networking, Storage and Analysis (SC), 2020.

- "Self-stabilizing Connected Components",
  P. Sao, C. Engelmann, S. Eswar, O. Green, R. Vuduc
  IEEE/ACM 9th Workshop on Fault Tolerance for HPC at eXtreme Scale (FTXS), 2019.

- "Programming strategies for irregular algorithms on the Emu Chick",
  E. Hein, S. Eswar, A. Yasar, J. Li, J. Young, T. Conte, U. Catalyurek, R. Vuduc, J. Riedy, B. Ucar
  ACM Transactions on Parallel Computing, 2019.

- "A microbenchmark characterization of the Emu Chick",
  J. Young, E. Hein, S. Eswar, P. Lavin, J. Li, J. Riedy, R. Vuduc, T. Conte
  Journal of Parallel Computing, 2019.

- "An initial characterisation of the Emu Chick",
  E. Hein, T. Conte, J. Young, S. Eswar, J. Li, P. Lavin, R. Vuduc, J. Reidy
  IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW) 2018.

- "Deep Neural Network Based Models for Mortality Prediction in Intensive Care Units",
  R. Chen, S. Eswar
  IEEE Engineering in Medicine and Biology Conference (EMBC) 2016, Poster Session.

- "If Performance Metrics were Signals",
  S. Eswar, A. Madaan, V. Mathur, J.Basak
  IEEE International Conference on High Performance Computing (HiPC) 2011,
  Student Research Symposium Poster Session.

TALKS

- "Randomized Approaches for Optimal Experimental Design",
  S. Eswar, V. Rao, A. K. Saibaba
  SD38: Optimization with Rare Events,
  INFORMS Annual Meeting, 2023

- "Structured Matrices in Unsupervised Cross-Validation",
  S. Eswar
  MS02178: Efficient computational methods for data matrices: exploiting sparsity and structure,
  International Congress on Industrial and Applied Mathematics (ICIAM23), 2023

- "Static Analysis of Malware using Tensor Decomposition",
  S. Eswar, R. Vuduc, C. Battaglino, D. Joseph
  MS133: High-Performance Tensor Computation and Applications,
  SIAM Conference on Computational Science and Engineering (CSE21), 2021

- "PLANC: Parallel Low Rank Approximation with Non-negativity Constraints",
  S. Eswar, K. Hayashi, G. Ballard, R. Kannan, M. Matheson, H. Park
  MS370: Tensor Decomposition for High Performance Data Analytics,
  SIAM Conference on Computational Science and Engineering (CSE19), 2019

- "Sparse Tensor Decomposition on EMU Platform",
  S. Eswar, J. Li, R. Vuduc, P. Lavin, J. Young
  MS97: Emerging Architectural Support for Scientific Kernels,
  SIAM Conference on Parallel Processing for Scientific Computing (PP18), 2018

RESEARCH EXPERIENCE

Low Rank Approximation Algorithms   January 2017 – May 2022
Georgia Institute of Technology,
Advisors: Prof. Richard Vuduc, Prof. Haesun Park

- Modelling various data analysis tasks as constrained low rank matrix approximation problems.
- Implementing distributed versions of Nonnegative Matrix and Tensor Factorisation algorithms.

Practical Cache-Oblivious Algorithms   January 2015 – December 2016
Georgia Institute of Technology,
Advisor: Prof. Richard Vuduc

- Studied various memory models - Pebbling Games, S-partitions and External Memory Model.
- Implemented and analysed sensitivity of Cache-Oblivious sorting to system parameters.

Hybrid RAID Storage   January – June 2012
NetApp Research, Bangalore, India
Advisor: Priya Sehgal

- Built a prototype hybrid RAID layer for NetApp using SSDs and HDDs.
- Improved the array's space and cost efficiency and improved its lifetime with minimum performance penalty.

Periodicity and ICA   July – December 2011
NetApp Research, Bangalore, India
Advisor: Dr. Vipul Mathur and Dr. Jayanta Basak

- Discovered workload patterns on NetApp storage systems from time series analysis of sensor data.
- Built a prototype system for automatic failure detection.
- Performed Independent Component Analysis to detect counter interdependency and cluster formations.

Visual Data Mining   January – December 2011
BITS-Pilani,
Advisor: Prof. Navneet Goyal

- Worked on visualisations for market basket analysis.
- Incorporated temporal information to visualise seasonal trends.
- Implemented Association Rules learning using FP-tree.

Exploring Data Handling through R for Pattern Recognition   May – July 2009
Central Electronics Engineering Research Institute, Chennai, India
Advisor: Dr. V. Venkatraman

- Built framework for automatic detection of spoilt oil using NIR spectral information.
- Worked on information extraction and spectral analysis of edible oils.

PROFESSIONAL EXPERIENCE

Argonne National Laboratory, Lemont, IL   September 2022 – present
Mentor: Dr. Todd Munson

- Working on parallel algorithms for unsupervised cross-validation of low-rank factorisations.
- Applying randomised low-rank approximation methods to optimal experiment design.

Amazon, Seattle, WA   May – August 2021
Mentors: Dr. Chiranth Hegde and Dr. Yu Gan

- Worked on an explainability toolbox for some of the neural networks in the advertising pipeline.
- Focused on detecting influential training samples as a means to characterise model behaviour.

Oak Ridge National Laboratory, Oak Ridge, TN   Jan – May 2020
Mentor: Dr. Ramakrishnan Kannan
- Studied connections between different RNNs and low rank approximation models.

Arm, Austin, TX   May – August 2019
Mentors: Casey Battaglino and Dr. Doug Joseph

- Performing static analysis of malware using tensor decomposition as a feature extractor.
- Developing randomized algorithms to reduce the time and space complexity of tensor methods.

Oak Ridge National Laboratory, Oak Ridge, TN   May – August 2018
Mentor: Dr. Ramakrishnan Kannan   May – August 2017

- Studied various Tensor Factorisation properties and methods.
- Implemented a part of the tensor factorisation package PLANC.
- PLANC is slated to be released as a miniapp in OLCF.

Yahoo!, Sunnyvale, CA   June – August 2016
Summer Intern
- Developed an experiment configuration tool for A/B testing.

- The tool would ensure experiments are conducted with sufficient statistical significance.

Akuna Capital LLC, Chicago, IL   June – August 2015
Summer Intern
- Created a rules engine to optimise trading engine configurations based on underlying system specification.

- Created a tool to rapidly create, validate and test different trading engine configurations.

Citigroup, Pune, India   July 2012 – July 2014
Application Developer
- Programmer for the Trading Analytics team.

- Built services to provide Impact Cost analysis to the Equities Trading Desks.

- Built services to track real time trade executions, PNL and risk across portfolios, clients and other groups.

COMPUTER SKILLS

- Proficient in C/C++, kdb+/q, Python.
- Have experience in R, Matlab, bash.

RELEVANT COURSES

Graduate Level

- *Graduate Level:* Computability, Complexity and Algorithms, Data and Visual Analytics, High Performance Parallel Computing, Numerical Linear Algebra, Advanced Classical Probability, Machine Learning, Stochastic Processes, Pattern Recognition, Linear Optimization, High Performance Computing, Machine Learning Theory, Deep Learning, Iterative Methods, Parallelising Compilers, Computation and the Brain, Numerical Algorithms for Data Analytics

- *Graduate Teaching Assistant:* Computability, Complexity and Algorithms (OMSCS), Numerical Linear Algebra, Introduction to Computing for Data Analysis, Numerical Algorithms for Data Analytics

Undergraduate Level

- Graphs and Networks, Data Mining, Introduction to Artificial Intelligence, Image Processing, Optimisation, Operations Research, Data Structures and Algorithms, Measure and Integration, Differential Geometry, Operating Systems, Advanced Computer Organisation, Digital Electronics and Computer Organisation

- *Teaching Assistant:* Computer Programming I