Web: atalnarayan.github.io

ATAL NARAYAN SAHU

Email: atalnsahu@gmail.com; atal.sahu@kaust.edu.sa

Ph: +91-7755-057-610; +966-54-575-4208

EDUCATION

King Abdullah University of Science and Technology (KAUST), Thuwal, KSA *Sep'20 – present*
Doctor of Philosophy (Ph.D.) – **Computer Science,** Advisor: *Prof. Marco Canini*

King Abdullah University of Science and Technology (KAUST), Thuwal, KSA *Feb'19 – Aug'20*
Master of Science (M.S.) – **Computer Science**, Advisor: *Prof. Marco Canini*

Indian Institute of Technology, Kanpur, India *Jul'14 - Jun'18*
Bachelor of Science (B.S.) - **Mathematics & Scientific Computing** *with Minors in*- **Algorithms** and **Machine Learning**

RESEARCH EXPERIENCE

Weakly supervised activity detection in videos *Jun'20-Aug'20*

Master's Summer Internship, Mentor: Prof. François Brémond, STARS, INRIA, Sophia Antipolis, France

- Goal: To perform activity detection in videos using only the temporally ordered set of actions in video as supervision.
- Developed and implemented various ordering-based losses to ensure that an action pair follows ground truth order

Compressed SGD for distributed Machine Learning *Feb'19 - till date*

Master's Directed Research, Mentors: Prof. Marco Canini , Prof. Panos Kalnis and Prof. Peter Richtárik, KAUST, KSA

- Developed and implemented novel compression algorithms and/or analyzed their convergence.
- Explored and developed various sparsification selection strategies.
- Presently focused on characterizing which sparsification scheme is best at extreme sparsification and why.

Solving Linear System of Equations using Randomized Methods *May'17 - July'17*

Undergraduate Summer Internship, Mentor: Prof. Peter Richtárik, KAUST, KSA

- Analyzed Asynchronous parallel SGD for solving a linear system of equations.
- Investigated various distributions to find out the optimal distribution of stochastic preconditioner.

Infinite color extension to Pólya urn model *Dec'16*

Undergraduate Winter Internship, Mentor: Prof. Krishanu Maulik, ISI, Kolkata, India

- Developed and implemented a finite space algorithm to measure the population ratio of a specified color after a finite number of draws when there are infinitely many colors in the pólya urn scheme.
- Analyzed experimentally through the algorithm the convergence of the ratio for different setups.

PUBLICATIONS

1. A. Dutta, E. H. Bergou, A. M. Abdelmoniem, Chen-Yu Ho, **A. N. Sahu**, M. Canini, & P. Kalnis. **On the Discrepancy between the Theoretical Analysis and Practical Implementations of Compressed Communication for Distributed Deep Learning.** In *Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20), February 2020.* [arXiv]

PREPRINTS

1. **A. N. Sahu**, A. Dutta, A. Tiwari, & P. Richtárik. **On the Convergence Analysis of Asynchronous SGD for Solving Consistent Linear Systems.** (Under review) [arXiv]
2. S. Horváth, Chen-Yu Ho, L. Horváth, **A. N. Sahu**, M. Canini, & P. Richtárik. **Natural Compression for Distributed Deep Learning.** (Under review) [arXiv]
3. J. Fei, Chen-Yu Ho, **A. N. Sahu**, M. Canini, & A. Sapio. **Efficient Sparse Collective Communication and its application to accelerate Distributed Deep Learning.** (Under review) [Link]

WORK IN PROGRESS

1. **A. N. Sahu**, A. Dutta, A. M. Abdelmoniem, T. Banerjee, M. Canini, & P. Kalnis. **Identifying the Limits of Gradient Sparsification.**

SELECTED PROJECTS

Understanding Variance Reduction by DIANA for compression induced variance *Oct'19 - Nov'19*

*Course project for the course **Big Data Optimization** under Prof. Peter Richtárik*

- Implemented DIANA using various compression schemes and experimentally analyzed its convergence based on various parameters such as variance of compression scheme, regularization, and number of processors. [Report]

Word2Exps: log-scale quantized word vectors for resource constrained devices *Sep'19 - Oct'19*

*Course project for the course **Computational Methods in Data Mining** under Prof. Xiangliang Zhang*

- Proposed a new quantization scheme for storing word embeddings for resource constrained devices. [Report]

Link prediction in signed networks using multi-head attention *Oct'19 - Nov'19*

*Course project for the course **Computational Methods in Data Mining** under Prof. Xiangliang Zhang*

- Used multi-head attention to perform link prediction in signed networks using elementary motifs. [Report]

Deep Reinforcement Learning in Tentacle Wars *July'17 - Nov'17*

*Course project for the course **Introduction to Machine Learning** under Prof. Purushottam Kar*

- Designed a game-bot for Tentacle Wars, a challenging 2-player Real-Time Strategy game using Deep Q-Learning. [Report]

TECHNICAL SKILLS

- **Programming languages:** Python | Julia | MATLAB |R | Go | C
- **Machine Learning Packages:** PyTorch | TensorFlow | Keras | Numpy
- **Software and Utilities:** LaTeX | Docker | Microsoft Office

RELEVANT COURSES

- **Algorithms:** Data Structures & Algorithms, Randomized Algorithms, Algorithms-II, Applications of Markov Chains in Combinatorial Optimization and Evolutionary Dynamics
- **Optimization:** Big Data Optimization
- **Probability & Statistics:** Applied Stochastic Processes, Statistical Inference, Elementary Probability theory
- **Mathematics:** Linear Algebra, Real & Complex Analysis, Mathematical Logic, Multivariate Calculus & Differential Geometry, Theory of Computation, Measure Theory
- **Machine Learning:** Introduction to Machine Learning, Combinatorial Machine Learning, Deep Learning for Computer Vision, Data Efficient Deep Learning
- **Game Theory:** Applied Game Theory
- **Data Mining:** Computational Methods in Data Mining, Data Mining & Knowledge Discovery

SCHOLASTIC ACHIEVEMENTS & AWARDS

- Recipient of **KAUST graduate fellowship** awarded to KAUST MS-PhD students from February 2019 till present.
- Recipient of the **KVPY fellowship** (Stream: SB) from 2015-2018 with **ALL INDIA RANK 9**, awarded by Department of Science & Technology, India aimed at promoting research careers among promising students in the sciences.
- Recipient of the **INSPIRE fellowship** for 2014 awarded by Department of Science & Technology, India to meritorious students pursuing an undergraduate in sciences at premier institutes.
- **99.86 percentile** (among 1,500,000 candidates) in **Joint Entrance Examination** (Main) 2014.
- **98.9 percentile** (among 150,000 screened candidates) in the prestigious **IIT-JEE(Advanced)** 2014.
- Awarded **Certificate of Merit** by CBSE for being in **top 0.1 percent among 2.26 million students** in XII Grade.

EXTRACURRICULAR ACTIVITIES

- **Winner**- Design and Build Medical devices at Winter Enrichment Program, 2020, KAUST.
- Part of silver medal winner Institute Table Tennis team in Udghosh 2014, the sports festival of IIT Kanpur.
- Represented KVS Jabalpur Region, Table Tennis (U-17) in **KVS National Sports Meet** 2011-12.
- Secured **3rd** position in **KVS Regional Youth Parliament** 2012 acting as Deputy Speaker.