

Anindya Bijoy Das

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Summary	<ul style="list-style-type: none">• Won Karas Award for outstanding dissertation in Iowa State University in 2022• Highly experienced in coding, specifically in Python and MATLAB and their toolboxes• Got best paper awards; also got research and teaching excellence awards in Iowa State University• Highly experienced in carrying out large-scale simulations in AWS using MPI toolbox• Research experience in federated Learning, distributed computations, signal processing etc.
Education	<p>PhD in EE in Iowa State University May 2022</p> <ul style="list-style-type: none">• Major Professor: Dr. Aditya Ramamoorthy• Specialization: Signal Processing, Minor: Mathematics <p>M.Engg. in EE in Iowa State University May 2018</p> <p>B.Sc. in EEE, in Bangladesh Univ. of Eng. & Tech. Jul 2014</p>
Research Grant	<p>A Grant of \$73,000: awarded by Autonomous and Connected Systems of Purdue Engineering Initiatives to conduct research on AI tensor computations in edge network.</p>
Professional Experiences	<p>Postdoctoral Researcher in ECE in Purdue University May 2022 - Present</p> <p>Conducting research on federated learning, edge computation, and machine learning applications in communications and guiding PhD students for their research under the direction of Prof. David Love and Prof. Christopher Brinton</p> <p>Research Assistant, Iowa State University May 2019-May 2022</p> <p>Conducting research on straggler mitigation in distributed computations, developing novel theorems to enhance numerical stability and computation speed and carrying out necessary simulations in AWS</p> <p>Teaching Assistant, Iowa State University Aug 2016-May 2019</p> <p>Conducted Laboratory Courses: Introduction to Circuits and Instruments and Introduction to AC Circuits and Motors. Duties also include preparing exam rubrics, grading the exams, office hours etc.</p> <p>Lecturer, Presidency University, Bangladesh Feb 2015-Jul 2016</p> <p>Undergraduate Courses instructed: Numerical Methods, Digital Signal Processing (theory and laboratory), Electronics, Engineering Electromagnetics, Programming Language (C), Properties of Materials. Duties also include preparing the corresponding course outlines, preparing exam questions etc.</p>
International Journals	<p>A. B. Das and A. Ramamoorthy,, “A Unified Treatment of Partial Stragglers and Sparse Matrices in Coded Matrix Computation”, IEEE Jour. on Sel. Areas in Info. Th., 2022.</p> <p>A. B. Das and A. Ramamoorthy, “Coded sparse matrix computation schemes that leverage partial stragglers,” IEEE Trans. on Info. Theory, 2022.</p> <p>A. B. Das, A. Ramamoorthy and N. Vaswani, “Efficient and Robust Distributed Matrix Computations via Convolutional Coding,” IEEE Trans. on Info. Theory, 2021.</p> <p>A. Ramamoorthy, A. B. Das and L. Tang, “Straggler-Resistant Distributed Matrix Computation via Coding Theory: Removing a Bottleneck in Large-Scale Data Processing”, IEEE Sig. Proc. Mag., 2020.</p> <p>M. M. Rahman, M. I. H. Bhuiyan and A. B. Das, “Classification of focal and non-focal EEG signals in VMD-DWT domain using ensemble stacking”, Biomed. Sig. Proc. and Control, Elsevier, 2019.</p> <p>A. B. Das and M. I. H. Bhuiyan, “Discrimination and classification of focal and non-focal EEG signals using entropy-based features in the EMD-DWT domain”, Biomed. Sig. Proc. and Control, 2016.</p>

A. B. Das, M. I. H. Bhuiyan and S M S. Alam, "Classification of EEG signals using normal inverse Gaussian parameters in the DT-CWT domain for seizure detection", **Sig., Img. and Vid. Proc.**, 2016.

Manuscripts Under Review

A. B. Das, A. Ramamoorthy, D. J. Love and C. G. Brinton, "Distributed Matrix Computations with Low-weight Encodings", under review in **IEEE Jour. on Sel. Areas in Info. Th.**.

M. S. Oh, **A. B. Das**, S. Hosseinalipour, T. Kim, D. J. Love and C. G. Brinton, "A Decentralized Pilot Assignment Methodology for Scalable O-RAN Cell-Free Massive MIMO", under review in **IEEE Jour. on Sel. Areas in Comm.**.

Selected Conference Papers

A. B. Das and A. Ramamoorthy, D. Love and C. Brinton, "Preserving Sparsity and Privacy in Straggler-Resilient Distributed Matrix Computations", Ann. Allerton Conf. on Comm., Control, and Comput. (**Allerton**), 2023.

A. B. Das and A. Ramamoorthy, D. Love and C. Brinton, "Distributed Matrix Computations with Low-weight Encodings", IEEE Intl. Symp. on Info. Theory (**ISIT**), 2023.

A. B. Das and A. Ramamoorthy, D. Love and C. Brinton, "Coded Matrix Computations for D2D-Enabled Linearized Federated Learning", IEEE Intl. Conf. Acoustics, Speech, & Sig. Proc. (**ICASSP**), 2023.

A. B. Das and A. Ramamoorthy, "An Integrated Method to Deal with Partial Stragglers and Sparse Matrices in Distributed Computations", accepted in IEEE Intl. Symp. on Info. Theory (**ISIT**), 2022.

A. B. Das and A. Ramamoorthy, "A Unified Treatment of Partial Stragglers and Sparse Matrices in Coded Matrix Computation", IEEE Info. Theory Workshop (**ITW**), 2021.

A. B. Das and A. Ramamoorthy, "Coded sparse matrix computation schemes that leverage partial stragglers", IEEE Intl. Symp. on Info. Theory (**ISIT**), 2021.

A. B. Das, A. Ramamoorthy and N. Vaswani, "Efficient and Robust Distributed Matrix Computations via Convolutional Coding", IEEE Intl. Symp. on Info. Theory (**ISIT**), 2021.

A. B. Das and A. Ramamoorthy, "Distributed Matrix-Vector Multiplication: A Convolutional Coding Approach", IEEE Intl. Symp. on Info. Theory (**ISIT**), 2019.

A. B. Das, A. Ramamoorthy and L. Tang, " C^3LES : Codes for Coded Computation that Leverage Stragglers", IEEE Info. Theory Workshop (**ITW**), 2018.

M. I. H. Bhuiyan and **A. B. Das**, "A subband correlation-based method for the automatic detection of epilepsy and seizure in the DT-CWT domain", IEEE Conf. on Biomed. Eng. and Sci. (**IECBES**), 2014.

Research Experiences

Improving communication delay and privacy in Federated Learning

- Developed algorithms for linearized federated learning in a **D2D setting** for data offloading
- Utilized the **heterogeneity** of the clients and exploited the stragglers to enhance the overall speed
- Reduced communication delay and **privacy** leakage for some specific federated learning settings

Enhancing the numerical stability and speed of distributed computation

- Novel connections among convolutional codes, **block Toeplitz Matrices** and the condition number
- Numerical stability: the **recovery error has been reduced** by 2 orders of magnitude than others
- One of the **fastest decoding** schemes: no need of division and multiplication
- Computation speed: preserving sparsity in coded computation enhances the worker node speed

Classification of EEG data for detection of epilepsy and epileptogenic zone

- Modeled the wavelet subbands of EEG data with suitable probability density functions (NIG, BKF)
- Utilized SVM and kNN classifiers to classify EEG datasets with at least 4% higher accuracy
- Worked on practical datasets: CHB-MIT datasets, Bern-Barcelona dataset, Bonn EEG dataset etc.

Awards	Karas Award , 2022, Iowa State University For the Outstanding Dissertation in Mathematical and Physical Sciences and Engineering
	Research Excellence Award , Fall-2021 Department of Electrical and Computer Engineering, Iowa State University
	Teaching Excellence Award , Fall-2020 Department of Electrical and Computer Engineering, Iowa State University
	National Science Foundation (NSF) Travel Grant For travelling to Paris, France for International Symposium on Information Theory (ISIT), 2019
	1st Position , Best Paper Award IEEE Intl. Conf. on Electrical Engineering and Info. and Comm. Tech. (ICEEICT), 2015
	2nd Position , Best Paper Award IEEE Intl. Conf. on Electrical Info. & Comm. Tech., 2013
	National Champion , in the higher secondary category Bangladesh Mathematical Olympiad, 2008
Relevant Graduate Projects	Image recognition from CIFAR-10 dataset using deep residual learning <ul style="list-style-type: none"> Implemented convolutional neural network in TensorFlow using GPU Utilized different related functions and parameters to achieve higher accuracy
	Generative adversarial networks (GAN) in image super-resolution <ul style="list-style-type: none"> Reviewed different types of GANs and their corresponding properties Implemented deep convolutional GANs to upscale images by $4\times$ factor
	Classification of ‘20 Newsgroups’ dataset using Bayes Classifier <ul style="list-style-type: none"> Implemented multinomial naive Bayes model to classify $20k$ documents Compared the performance between MLE and Bayes model for text clustering
	Prediction of a time series sequence using recurrent neural network <ul style="list-style-type: none"> Implemented TF-based RNN for the prediction of multidimensional data Trained the RNN to use the information of long sequences
	Application of decision tree for ‘Breast Cancer Wisc. (Original)’ dataset <ul style="list-style-type: none"> Utilized sklearn (scikit-learn) toolbox to implement decision tree Visualized the decision trees for k-fold cross-validation
	Designing the university course registration system using C <ul style="list-style-type: none"> Designing a system where students can enter and register or drop courses Implementing all the primary concepts of programming languages
	Review of ADMM and its applications <ul style="list-style-type: none"> Reviewing the idea of ADMM for optimization algorithms Estimation of the underlying pdf parameters for EEG data using ADMM
	Optimization algorithms and machine learning for X-ray CT Images <ul style="list-style-type: none"> Developed a regularized MM algorithm to recover images from sparse sampling Appropriate CT image reconstruction from Limited Angle Projections

Technical Skills	Programming Languages: C, Python, 8086 Assembly Language Numerical Analysis and Signal Processing: MATLAB Deep Learning Toolbox: TensorFlow, Torch, Keras Parallel Computation: AWS, MPI, Cuda, Cudnn Document Preparation & Illustration: LATEX, MS Office Circuit Design tools: Proteus, PSPICE, Orcad, Simulink		
Graduate Courses	Deep Machine Learning Statistical Machine Learning Detection and Estimation Theory	Data Analytics Linear Algebra Non-linear Programming	Abstract Algebra Convex Optimization Real Analysis
Undergrad Courses	Random Signals and Processes Numerical Methods Digital Signal Processing I & II	Probability and Statistics Digital Communication Digital Electronics	Signals and Systems Microprocessor & interfacing Properties of Materials
Students Guided	<ul style="list-style-type: none"> • Myeung Suk Oh, a PhD student. Topic: Pilot Assignment in O-RAN Cell-Free Massive MIMO • Junghoon Kim, a PhD student. Topic: Coding for Gaussian Two-way Gaussian Channel • Satyavrat Wagle, a PhD student. Topic: Smart Data Exchange in D2D-enabled Federated Learning • Ashwin Natraj, a PhD student. Topic: Queuing Theory for Wireless Multihop Networks • Byunghyun Lee, a PhD student. Topic: Sidelobe Suppression in Radar and Communication Systems • Seohyun Lee, an undergrad student. Topic: Optimal Graph for Unsupervised Federated Learning 		
Professional Membership	Member, IEEE (June 2019 - Present) Member, Information Theory Society (June 2019 - Present) Member, Signal Processing Society (April 2023 - Present)		
Attended Workshops	IEEE Intl. Conf. on Acoustics, Speech and Sig. Proc. (ICASSP) , Rhodes, Greece, 2023 North American Sch. of Info. Theory , British Columbia, 2021, & Boston, 2019 Midwest Machine Learning Symposium (MMLS) , Wisconsin, 2019 IEEE Intl. Symp. on Info. Theory (ISIT) , Melbourne, 2021 & Paris, 2019 Bangladesh Math Camp for the selection of Bangladesh Team for Intl. Math Olympiad 2007		
Leadership Experiences	Secretary , Bangladesh Student Association, August 2019 - August 2021 Organizer , Signal Processing Workshop, Presidency University, 2016		
Reviewer Experiences	IEEE Transactions: TCOM, TPDS, TPAMI, TNSRE, TWC etc. Other Journals: PLOS ONE, IEEE Access, BSPC, IET Image Processing etc. International Conferences: ICASSP, Globecom, ISIT etc.		
Others	<ul style="list-style-type: none"> • Invited talk, arranged by IEEE Sig. Proc. Society, Bangladesh Chap., 2019 • Certified as ‘Preparing Future Faculty Associate’ by Iowa State University • Attended courses on Quantum Computation and Quantum Info. Theory • Volunteer tutor for 3rd and 4th grade kids in the program Cymath-kids 		
References	Dr. Aditya Ramamoorthy , Email: adityar@iastate.edu Professor, Electrical and Computer Engineering, Iowa State University Dr. Christopher Brinton , Email: cgb@purdue.edu Assistant Professor, Electrical and Computer Engineering, Purdue University Dr. David Love , Email: djlove@purdue.edu Professor, Electrical and Computer Engineering, Purdue University		