

Anindya Bijoy Das

Assistant Professor, The University of Akron, Ohio
ASEC 364, Akron, OH 44325, USA

Phone: +1-515-708-5455
Email: adas@uakron.edu

Summary	<ul style="list-style-type: none">• Won Karas Award for outstanding dissertation in Iowa State University in 2022• 2024 Postdoctoral Mentor Award Nominee for The Graduate School, Purdue University• 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.• Research interest: Cloud & Edge Computing, AI/ML applications, Data Analytics, Signal Processing
Education	<p>PhD in Electrical Engineering 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. from Electrical and Computer Engineering in Iowa State University May 2018</p> <p>B.Sc. in EEE, in Bangladesh University of Engineering & Technology (BUET) Jul 2014</p>
Grant Writing Experiences	<ul style="list-style-type: none">• 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.• Assisted to write NSF proposals during the PhD study (CCF- 1910840 and CCF-2115200)• Assisted in proposal writing and presentation during the postdoctoral tenure: this includes proposals in NSF, ONR, IoT4Ag etc. along with internal proposals which often requested for seed funding.
Professional Experiences	<p>Assistant Professor in ECE in the University of Akron Aug 2024 - Present Conducting courses in Electrical and Computer Engineering and guiding PhD students for their research.</p> <p>Postdoctoral Researcher in ECE in Purdue University May 2022 - Aug 2024 Conducting research on federated learning, edge computation, and AI/ML applications 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 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 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, ECE, Presidency University, Bangladesh Feb 2015-Jul 2016 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>
Selected International Journals	<p>A. B. Das, A. Ramamoorthy, D. J. Love and C. G. Brinton, "Sparsity-Preserving Encodings for Straggler-Optimal Distributed Matrix Computations at the Edge", IEEE Internet of Things Journal, 2024.</p> <p>M. S. Oh, A. B. Das, T. Kim, D. J. Love and C. G. Brinton, "Minimum Description Feature Selection for Complexity Reduction in Machine Learning-based Wireless Positioning", IEEE Journal on Selected Areas in Communications, 2024.</p>

A. N. Arun, **A. B. Das**, C. G. Brinton, D. J. Love and J. V. Krogmeier “Do Small Cells Make Sense for Simple Low Cost LPWANS?”, **IEEE Wireless Communications Letters**, 2024.

A. B. Das, A. Ramamoorthy, D. J. Love and C. G. Brinton, “Distributed Matrix Computations with Low-weight Encodings”, **IEEE Journal on Selected Areas in Information Theory**, 2023.

M. S. Oh, **A. B. Das**, S. Hosseinalipour, T. Kim, D. J. Love and C. G. Brinton, “A Decentralized Pilot Assignment Algorithm for Scalable O-RAN Cell-Free Massive MIMO”, **IEEE Journal on Selected Areas in Communications**, 2023.

A. B. Das and A. Ramamoorthy, “A Unified Treatment of Partial Stragglers and Sparse Matrices in Coded Matrix Computation”, **IEEE Journal on Selected Areas in Information Theory**, 2022.

A. B. Das and A. Ramamoorthy, “Coded sparse matrix computation schemes that leverage partial stragglers,” **IEEE Transaction on Information Theory**, 2022.

A. B. Das, A. Ramamoorthy and N. Vaswani, “Efficient and Robust Distributed Matrix Computations via Convolutional Coding,” **IEEE Transaction on Information Theory**, 2021.

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.

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.

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.

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

J. Kim, T. Kim, **A. B. Das**, S. Hosseinalipour, D. J. Love and C. G. Brinton, “Coding for Gaussian Two-Way Channels: Linear and Learning-Based Approaches”, under review.

B. Lee, **A. B. Das**, D. J. Love, C. G. Brinton and J. V. Krogmeier, “Constant Modulus Waveform Design with Interference Exploitation for DFRC Systems: A Block-Level Approach”, under review.

S. Wagle, **A. B. Das**, D. Love and C. Brinton, “Multi-Agent Reinforcement Learning for Graph Discovery in D2D-Enabled Federated Learning”, under review.

Selected Conference Papers

S. K. Sakib and **A. B. Das**, “Challenging Fairness: A Comprehensive Exploration of Bias in LLM-Based Recommendations”, IEEE Intl. Conf. on Big Data (**BigData**), 2024.

S. K. Sakib and **A. B. Das**, “Explainable Vertical Federated Learning for Healthcare: Ensuring Privacy and Optimal Accuracy”, IEEE (**BigData**) Workshop: Big Data and AI for Healthcare, 2024.

S. Lee, **A. B. Das**, S. Wagle and C. Brinton, “A Reinforcement Learning-Based Approach to Graph Discovery in D2D-Enabled Federated Learning”, IEEE Intl. Conf. Commun. (**ICC**), 2024.

S. Wagle, **A. B. Das**, D. Love and C. Brinton, “A Reinforcement Learning-Based Approach to Graph Discovery in D2D-Enabled Federated Learning”, IEEE Glob. Comm. Conf. (**GLOBECOM**), 2023.

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 & Comput. 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.

A. B. Das and M. I. H. Bhuiyan, “Discrimination of Focal and Non-focal EEG Signals using Entropy-based Features in EEMD and CEEMDAN Domains”, IEEE Conf. Elec. Comp. Engr. (**ICECE**), 2016.

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.

A. B. Das and M. I. H. Bhuiyan, “Bessel k-form parameters in the dual tree complex wavelet transform domain for the detection of epilepsy and seizure”, (**ICECE**), 2014

A. B. Das, M. I. H. Bhuiyan and S M S. Alam, “A Statistical Method for Automatic Detection of Seizure and Epilepsy in the Dual Tree Complex Wavelet Transform Domain”, (**ICIEV**), 2014

Research Experiences

Backdoor Attacks on Vertical Federated Learning (VFL)

- Developed a novel backdoor attack on VFL which does not rely on server gradient information
- Considered collusion among multiple adversaries for sample selection and trigger embedding
- Conducted onvergence analysis that reveals the impact of backdoor perturbations on VFL.

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

Machine Learning applications in Wireless Communications

- Developed PNN for complexity reduction in ML-based wireless positioning
- Decentralized Pilot Assignment Methodology for Scalable O-RAN Cell-Free Massive MIMO
- Joint SSRA to maximize a CRN’s net communication rate subject to different constraints

Improving the numerical stability of distributed matrix computations

- Novel connections among convolutional codes, **block Toeplitz Matrices** and the condition number
- **Recovery error has been reduced** by 2 orders of magnitude than other baselines
- One of the **fastest decoding** schemes: no need of division and multiplication

Enhancing the overall speed of distributed sparse matrix computations

- Resilience to optimal number of stragglers while maintaining low-weight encodings
- Developed combinatorial design based methods to leverage the partial stragglers
- Preserving sparsity and leveraging stragglers lead to the enhancement of 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.

Teaching Experiences

- **Assistant Professor**, ECE, The University of Akron
Conducted Course: Digital Communication, ELEN: 441/541 for senior level undergrad and masters students in Fall-2024. Teaching duties also include preparing and grading assignments and exams.
- **Teaching Assistant**, ECE, Iowa State University
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.
- **Lecturer**, ECE, Presidency University, Bangladesh
Conducted Courses: 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.
- **Volunteer Tutor**, CyMath
Served as a tutor for 3rd and 4th grade kids in the program **Cymath-kids**

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. and Comm. Tech. (EICT), 2013
- National Champion**, in the higher secondary category
Bangladesh Mathematical Olympiad, 2008

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 | Data Analytics | Abstract Algebra |
| Statistical Machine Learning | Linear Algebra | Convex Optimization |
| Detection and Estimation Theory | Non-linear Programming | Real Analysis |

Students Guided

- **Myeung Suk Oh**, a PhD student
First, we developed a low-complexity pilot assignment scheme which can be incorporated in O-RAN cell free massive MIMO architecture. Second, we have developed positioning neural network (PNN) for complexity reduction in ML-based wireless positioning. Both of these papers are accepted in IEEE Journal on Selected Areas in Communications (**JSAC, Impact Factor: 16.4**).

- **Satyavrat Wagle**, a PhD student.

We developed a decentralized RL methodology for D2D graph discovery that promotes communication of data-points over trusted yet reliable links to enhance the convergence of federated learning. Our paper is accepted in IEEE Glob. Comm. Conf. (GLOBECOM), 2023, and the full work is under review.

- **Junghoon Kim**, a PhD student.

We developed linear and learning-based coding schemes to enhance the communication reliability and to improve the power management in Gaussian two-way channels. Our manuscript is under review.

- **Byunghyun Lee**, a PhD student.

We designed a constant modulus waveform with spatial-range sidelobe suppression for dual-functional radar and communication systems. Our paper is published in IEEE International Conference on Communications (ICC), 2024, and the full work is under review.

- **Ashwin Natraj**, a PhD student.

Assessing the success probability for end devices at the cell edge using stochastic geometry to model intra-cell interference in multi-cell networks and to enhance SINR. Our paper has been published in IEEE Wireless Communications Letters.

- **Seohyun Lee**, an undergraduate (senior) student.

We worked on the optimal graph discovery for D2D data exchange among the clients to enhance the convergence of unsupervised federated learning. Our paper is published in IEEE International Conference on Communications (ICC), 2024. We also worked on developing novel backdoor attacks in vertical federated learning (VFL). This work is currently under review.

- **David Nickel**, a PhD student.

Formulating joint spectrum sensing and resource allocation as an optimization aiming to maximize the average sum throughput of the secondary users in the cognitive radio network. Our paper is currently under preparation.

Membership Member, **Sigma Xi**, The Scientific Research Honor Society (May 2022 - Present)
 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

Reviewer Experiences IEEE Transactions: TCOM, TPDS, TPAMI, TNSRE, TWC etc.
 Other Journals: PLOS ONE, IEEE Access, BSPC, IET Image Processing etc.
 International Conferences: ICASSP, Globecomm, ISIT etc.

Others

- **Invited talk**, arranged by IEEE Sig. Proc. Society, Bangladesh Chap., 2019
- Certified as **‘Preparing Future Faculty Associate’** by Iowa State University
- Served as an examiner for **National Mathematical Olympiad** in Bangladesh
- Attended courses on **Quantum Computation** and **Quantum Info. Theory**