Niladri Das

ROLE	Postdoctoral Appointee, Sandia National Laboratories, USA. Computational Data Science	April 2021 - Present
PRIMARY RESEARCH	ML Methods & its application in Climate Science, Material Science, & Power Systems | Controls | Estimtaion | UQ | Experiment Design.	
CONTACT	E-Mail : ndas@sandia.gov | GitHub : github.com/niladridas | Web : www.niladridas.com	
PAST RESEARCH	Nonlinear estimation | Optimal sensing and data sharing | Machine learning | Nonlinear control & robotics | Space situational awareness | Satellite tracking	

EDUCATION

Doctor of Philosophy in **Aerospace Engineering** — Adviser: Dr. R. Bhattacharya
Texas A&M University (TAMU), USA — Sep 2015 - Dec 2020
Dissertation: Optimal sensing for estimation of nonlinear dynamical systems.

Master of Technology in **Electrical Engineering** — Adviser: Dr. L. Behera
Indian Institute of Technology Kanpur (IIT-K), India — 2012 - 2014
Dissertation: Learning to grasp & programming by demonstration using a 7-DOF Barrett WAM.

Bachelor of Engineering in **Electrical Engineering** — Adviser: Dr. A. Chatterjee
Jadavpur University, Kolkata, India — 2008 - 2012

RESEARCH EXPERIENCES

Postdoctoral Appointee at Sandia National Laboratories — April 2021 - Present
— Worked on multiple ASRC and LDRD projects
— Developed statistical models for power systems device failure.
— Optimal Experiment Design with ML for new material manufacturing processing.
— C-GAN for Optimal Experiment Design (OED)
— Bayesian NN and OED for climate studies
— Developed methods to increase computational speed of Variational Inferencing.
— Developed methods for Variational Kalman Filtering.
— Worked on Adaptive nary Activation Functions for Probabilistic Boolean Logic.

Graduate Research Assistant at TAMU — Adviser: Dr. K. DeMars, Summer 2020
— Investigated Information Flow filter.
— Developed multiple information theoretic interpretations of Baye's rule.
— Developed homotopy relations with Gaussian Mixtures as prior and posterior.

Graduate Research Assistantship at TAMU — Adviser: Dr. R. Bhattacharya
— Worked on optimal sensing for nonlinear filters from utility and privacy perspective
— Worked on an AFRL project project: *Adaptive Markov Inference Game Optimization for Rapid Discovery of Evasive Satellite Behaviors*, in collaboration with Intelligent Fusion Technology, Inc., where I developed an in-house orbit propagator. (2018-2019)
— Worked on an AFOSR project: *Cloud Computing Based Robust Space Situational Awareness (SSA)*, in collaboration with Dept. of Statistics (TAMU), where I developed Optimal Transport filter based framework for SSA. (2015-2018)

Project Associate at IIT-K PI: Dr. L. Behera, Aug 2014 - Jun 2015
— Developed Gaussian Mixture based model to compensate the unknown non-linearities of 7 degree of freedom Barrett WAM.
— Collaborated in implementing a inverse kinematic model and higher order Sliding Mode Control for 7 degree of freedom Barrett WAM. [C++ codes][video]
— Developed dynamical system based trajectory learning for Barrett WAM.
— Served as a Thesis mentor for a master's student.
—Taught ROS to two Master's student.

Graduate Research Assistant at IIT-K Adviser: Dr. L. Behera, July 2013-July 2014
— Developed Inverse Kinematic model for Barrett WAM.
— Implemented Kinect based Object segmentation for grasping using **Deep Learning**.
— Developed a hand-eye autonomous calibration technique for Barrett WAM.
— Implemented Symbolic Encoding based skill learning on Barrett WAM.[video]
— Mentored two Under-Graduate interns.

Publications

Journals

1. **Use of Bayesian Component Failure Models in E1 HEMP Grid Analysis**| [2024][preparing]
2. **Optimal Experiment Design for E3SM Climate Model Calibration**| [2024][preparing]
3. **Logical Activation Functions for Training Arbitrary Probabilistic Boolean Operations** | [2022][paper]
4. **Optimal Sensor Precision for Multirate Sensing for Bounded Estimation Error** | IEEE Transactions on Aerospace and Electronic Systems [2021][paper]
5. **Optimal Sensor Precision and Sensor Selection for Kalman Filtering with Bounded Errors** | IEEE Transactions on Aerospace and Electronic Systems [2021][paper]
6. **Privacy and Utility Aware Data Sharing for Space Situational Awareness from Ensemble and Unscented Kalman Filtering Perspective** | IEEE Transactions on Aerospace and Electronic Systems [2020][paper]
7. **Optimal Transport Based Tracking of Space Objects in Cylindrical Manifolds** | Journal of Astronautical Sciences, Springer [2019][paper]
8. **Optimal Transport based Tracking of Space Objects using Range Data from a Single Ranging Station** | Journal of Guidance, Control, and Dynamics [2019][paper]

Conferences

1. **Robust Bayesian Optimal Experimental Design for Misspecified Linear and Nonlinear Models** | SIAM Conference on Uncertainty Quantification (UQ24)
2. **E3SM Uncertainty Quantification using Surrogate Neural Networks** | SIAM Conference on Mathematics of Planet Earth 2024
3. **Metrics for Bayesian Optimal Experiment Design under Model Misspecification** | Tommie A. Catanach and Niladri Das | IEEE Conference on Decision and Control 2023 [arXiv]
4. SIAM Annual Meeting 2022 [Talk]
5. ISBA 2022 Annual Meeting [Poster — Best Poster Award — Travel Award]
6. **Variational Kalman Filtering with Hinf-Based Correction for Robust Bayesian Learning in High Dimensions** | CDC 2022
7. **A Study of Bias-Variance in Variational Inferencing Using Delta Method** | SIAM UQ 2022 [talk — organized a mini-symposium]

8. **Utility and Privacy in Object Tracking from Video Stream using Kalman Filter** | International Conference on Information Fusion 2020
9. **Modeling and Optimal Control of Hybrid UAVs with Wind Disturbance** | International Conference on Systems and Control 2020 [second author]
10. **Eigen Value Analysis in Lower Bounding Uncertainty of Kalman Filter Estimates** | IFAC World Congress 2020
11. **Optimal Transport Based Filtering with Nonlinear State Equality Constraints** | IFAC World Congress 2020
12. **Optimal Sensing Precision in Ensemble and Unscented Kalman Filtering** | IFAC World Congress 2020
13. **On Neural Network Training from Noisy Data using a Novel Filtering Framework** | AIAA SciTech Forum and Exposition 2020 [second author]
14. **Sparse Sensing Architecture For Kalman Filtering With Guaranteed Error Bound.** | IAA Conference on Space Situational Awareness 2017
15. **Control of a 4 DoF Barrett WAM Robot - Modeling, Control Synthesis and Experimental Validation** | IEEE First International Conference on Control, Measurement and Instrumentation 2016 [second author]
16. **Learning Object Manipulation from Demonstration through Vision for the 7-DOF Barrett WAM** | IEEE First International Conference on Control, Measurement and Instrumentation 2016
17. **A probabilistic framework of learning movement primitives from unstructured demonstrations** | IEEE 13th International Conference on Industrial Informatics 2015
18. **Robot Learns from Human Teacher Through Modified Kinesthetic Teaching** | International conference on Advances in Control and Optimization of Dynamic Systems 2014

Teaching Experiences

Graduate Teaching Assistant at TAMU — Aug - Dec 2020
Assisting Dr. Raktim Bhattacharya with *Aerospace Dynamics.*
Assisting Dr. Shinivas Rao Vadali with *Advanced Control for Aerospace Vehicles*

Graduate Teaching Assistant at TAMU — 13 Jan - May 2020
Assisting Dr. Kyle DeMars with *Advanced Control for Aerospace Vehicles*

Graduate Teaching Fellow at TAMU — 26 Aug - 12 Dec 2019
Taught *Advanced Control for Aerospace Vehicles* to senior Aerospace undergrads (72 students).
Taught LTI system, PID, root locus and freq. domain based controller design using Matlab.

Graduate Teaching Assistant at IIT-K — July 2012 - July 2014
Assisting Dr. L. Behera, Dr. R. Potluri, and Dr. N. K. Verma

Skills

Programming Languages and Packages: Matlab | Python| Julia | Docker | PyTorch | Jax.

Current Professional Affiliations

— American Institute of Aeronautics and Astronautics
— Institute of Electrical and Electronics Engineers
— Society for Industrial and Applied Mathematics
— American Astronautical Society

Past Affiliations

— Student Council member of Aerospace Engineering department at TAMU (2017)
— Graduate and Professional Student Council department delegate at TAMU (2017)

SERVICES

Journal Reviewer: IEEE Systems Journal
Conference Reviewer: IFAC World Congress, CDC, ACC
Organizer: Mini-symposium organiser at SIAM UQ 2022

AWARDS

— Winner of A-Hack-of-the-Drones (28-30 Sep 2018)
Member of the **A-Team** from Texas A&M that won the A-Hack-of-the-Drones competition (Sponsor: USArmy Futures Command and MD5) in Austin, Texas. We developed vision based solution for C-SUAS and co-founded AIMS Technologies, LLC
— Awarded Graduate Teaching Fellowship for Fall 2019 at TAMU
— Awarded AERO Graduate Excellence Fellowship for Fall 2019 and Spring 2020 at TAMU
— Awarded AERO Travel Grant for Spring 2019 at TAMU

HONORS

Served as a Student Council **Mentor** of Aerospace Engineering Department at TAMU (2018)

WORK PERMIT

— **H1B Visa** : Eligible to work in the USA till 2027.
— **Green Card** : Applied for marriage based permanent residency in USA.