Debdipta Goswami

Contact Information

Mechanical and Aerospace Engineering
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Education

Electrical and Computer Engineering Department, University of Maryland

Doctor of Philosophy, 2020

- Dissertation Title: *Estimation and Control of Nonlinear System: Model-based and Model-free Approaches*
- Adviser: Dr. Derek A. Paley

Department of Electronics and Telecommunication, Jadavpur University

Bachelor of Electronics and Telecommunication Engineering, 2015

Research Interests

I am broadly interested in designing safety-critical controller for robotic automation from the noisy sensor data and resource constraints. I want to apply tools from dynamical systems, Koopman operator theory, machine learning, and temporal logic to develop a framework of data-driven model identification, estimation, and control with a guarantee of performance to achieve "assured autonomy". Some of my past and current research interests are

- learning dynamical systems with unknown parameters,
- nonlinear estimation and stochastic control,
- data-driven reduced-order modeling and control of complex systems,
- transfer operator based approach to dynamical systems,
- autonomous tracking and search using drones.

Scientific Research Experience

Sep 2020 - Current	Postdoctoral Research Associate Control design with learning on the fly Adviser: Dr. Clarence W. Rowley, Mechanical and Aerospace Engineering, Princeton University.
Jan 2016 - May 2020	Graduate Research Assistant Estimation and Control of A Nonlinear System Using Mixture-Model and Transfer Operators Adviser: Dr. Derek A. Paley, Aerospace Engineering, University of Maryland, College Park.
May 2014 - Aug 2014	Summer Research Intern. Investigation of a collective decision making system of different neighbourhood-size based on hyper-geometric distribution Adviser: Dr. Heiko Hamann, Department of Computer Science, Universität Paderborn.

Book Chapters

1. **D. Goswami** and D. A. Paley, "Global Bilinearization and Reachability Analysis of Control-Affine Nonlinear Systems", *The Koopman Operator in Systems and Control: Concepts, Methodologies, and Applications*, Springer International Publishing, 2020.

Selected Journal Publications

1. **D. Goswami**, A. Riggins and D. A. Paley, "Data-driven prediction of urban micromobility: A study of dockless e-scooters", accepted for publication in *IEEE Control Systems Magazine*.
2. **D. Goswami** and D. A. Paley, "Bilinearization, reachability, and optimal control of control-affine nonlinear systems: a Koopman spectral approach", *IEEE Transactions on Automatic Control*, vol. 67, no. 6, pp. 2715 - 2728, Jun 2022.
3. J. Lidard, **D. Goswami**, D. Snyder, G. Sedky, A. Jones, and D. A. Paley, "Output feedback control for lift maximization of a pitching airfoil", *AIAA Journal of Guidance, Control, and Dynamics*, vol, 44, no. 3, pp. 587-594, Mar 2021.
4. **D. Goswami** and D. A. Paley, "Non-Gaussian estimation and output feedback using the Gaussian Mixture Kalman Filter", *AIAA Journal of Guidance, Control, and Dynamics*, vol. 44, no. 1, pp. 15-24, Jan 2021.
5. A. Wolek, S. Cheng, **D. Goswami**, and D. A. Paley, "Cooperative mapping and search over an unknown occupancy graph using mutual information", *IEEE Robotics and Automation Letters*, vol. 5, pp. 1071-1078, Apr 2020.
6. **D. Goswami**, E. Thackray and D. A. Paley, "Constrained Ulam Dynamic Mode Decomposition: Approximation of the Perron-Frobenius Operator for deterministic and stochastic systems", *IEEE Control Systems Letters*, vol. 2, pp. 809-814, Oct 2018.
7. S. Mukherjee, **D. Goswami** and S. Chatterjee, "A Lagrangian approach to modeling and analysis of a crowd dynamics", *IEEE Transactions on Systems, Man and Cybernetics: Systems*, Vol. 45, Issue: 6, June 2015, pp. 865-876.

Selected Conference Publications

1. D. Gurevich, **D. Goswami**, C. L. Fefferman, C. W. Rowley, "Optimal Control with Learning on the Fly: System with Unknown Drift", accepted for presentation in *4th Conference on Learning for Dynamics and Control, L4DC 2022*, Stanford University.
2. **D. Goswami**, Artur Wolek, and Derek A. Paley, "Data-driven estimation using an Echo-State Neural Network equipped with an Ensemble Kalman Filter", In *Proc. 2021 American Control Conference*, New Orleans, Louisiana, pp. 2543-2548
3. J. Lidard, **D. Goswami**, D. Snyder, G. Sedky, A. Jones, and D. A. Paley, "Output feedback control for lift maximization of a pitching airfoil", In *Proc. AIAA SciTech*, Orlando, Florida, 2020, number AIAA-2020-1836, pp. 1-13.
4. **D. Goswami** and D. A. Paley, "Global bilinearization and controllability of control-affine nonlinear systems: A Koopman spectral approach", In *Proc. IEEE Conference on Decision and Control*, Melbourne, Australia, 2017, pp. 6107-6112.
5. **D. Goswami** and D. A. Paley, "Non-Gaussian estimation and observer-based feedback using the Gaussian Mixture Kalman and Extended Kalman Filters", In *Proc. 2017 American Control Conference*, Seattle, Washington, 2017, pp. 4550-4555.

Teaching Experience

Spring 2022	Associate in Instruction, Mathematical Methods for Engineering Analysis II (MAE 546), Princeton University
Fall 2021	Associate in Instruction, Optimal Control and Estimation (MAE 546), Princeton University
Spring 2020	Co-instructor, Applied Nonlinear Control for Aerospace Systems (ENAE 743)
Fall 2017	Graduate Teaching Fellow, Random Processes for Communication and Control (ENEE 620)
Fall 2015 - Spring 2016	Teaching Assistant, Electromagnetic Wave Propagation (ENEE 381)

Invited Talks

- "Data-Driven Identification and Control of Complex Systems with Guaranteed Performance", in *Washington State University*, Pullman, WA, Feb 15, 2022, *Ohio State University*, Columbus, OH, Mar 10, 2022, *Auburn University*, Auburn, AL, Apr 12, 2022, *Utah State University*, Logan, UT, Apr 14, 2022.
- "Koopman Based Control: Bilinearization, Controllability and Optimal Control of Control-Affine Nonlinear Systems", in *Université catholique de Louvain*, Louvain la Neuve, Aug 27, 2019.

Service

Aug 2018-May 2019	Graduate student member	UMD ECE Department Council
Jun 2018- Jul 2019	President	ECE Graduate Student Association, UMD
August 2017-June 2018	Vice-President of Academic Affairs	ECEGSA, UMD
Apr 2016- Mar 2019	Editorial assistant	Automatica Editor Prof. André L. Tits

Honors and Awards

October 2019	Graduate Student Service Award from UMD ECE
May 2019	Outstanding Graduate Assistant Award from UMD Graduate School
2018	Travel Award from Institute for Systems Research (ISR)
May 2018	Summer Research Fellowship from UMD Graduate School
May 2018	Outstanding Teaching Assistant Award from UMD ECE
May 2018	Future Faculty Fellowship from A. J. Clark School of Engineering
August 2015	Distinguished Graduate Fellowship from A. J. Clark School of Engineering
December 2015	University Gold Medal in Engineering from Jadavpur University
May 2014	WISE Fellowship from DAAD (German Academic Exchange Service)

References

Derek A. Paley, Willis H. Young Jr. Professor, Aerospace Engineering, University of Maryland, College Park, `dpaley@umd.edu`

Clarence W. Rowley, Professor, Mechanical and Aerospace Engineering, Princeton University, `cwrowley@princeton.edu`

P. S. Krishnaprasad, Professor, Electrical and Computer Engineering, University of Maryland, College Park, `krishna@isr.umd.edu`

André L. Tits, Professor, Electrical and Computer Engineering, University of Maryland, College Park, `andre@umd.edu`

Eyad H. Abed, Professor, Electrical and Computer Engineering, University of Maryland, College Park, `abed@umd.edu`