MISHAL ASSIF P K

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EDUCATION

PhD Electrical Engineering, University of Illinois Urbana-Champaign 2019-2024 (Expected)
MS Mathematics, University of Illinois Urbana-Champaign 2019-2023 (Expected)
B.Tech + M.Tech Mechanical Engineering, Indian Institute of Technology Bombay 2014 - 2019

PUBLICATIONS

Research interests: Topological data analysis and machine learning, Nonlinear control and optimization, Game theory

1. **M. Assif P K**, Y. Baryshnikov *Biparametric persistence of smooth filtrations*, Submitted to SIAM Journal of Applied Algebra and Geometry [arXiv preprint]
2. **M. Assif P K**, W. Kennedy, I. Saniee *Fair Allocation in Crowd-Sourced Systems*, Accepted to Games, 2023 (Poster presented at ACM Conference on Economics and Computation, 2023) [arXiv preprint]
3. **M. Assif P K** *Singularities of Gaussian random maps into the plane*, Journal of Applied and Computational Topology, Vol.7, 2023 [doi] [arXiv preprint]
4. **M. Assif P K**, M. R. Sheriff, D. Chatterjee *Measure of quality of finite-dimensional linear systems: A frame-theoretic view,* Systems and Control Letters, Vol.151, 2021 [doi] [arXiv preprint]
5. **M. Assif P K**, D. Chatterjee, R. Banavar *Scenario approach for minmax optimization in the nonconvex setting: Positive results and caveats*, SIAM Journal on Optimization, Vol.30(2), 2020 [doi] [arXiv preprint]
6. **M. Assif P K**, D. Chatterjee, R. Banavar *A simple proof of the discrete time geometric Pontryagin maximum principle, Automatica*, Vol.114, 2020 [doi] [arXiv preprint]
7. **M. Assif**, R. Banavar, A. M. Bloch, M. Camarinha, L. Colombo *Variational collision avoidance on Riemannian manifolds*, Proceedings of the IEEE Conference on Decision and Control, 2018 [doi] [arXiv preprint]

EXPERIENCE

Coordinated Sciences Laboratory, UIUC **Urbana, IL**
Graduate Research Assistant, Advisor: Prof. Yuliy Baryshnikov *Aug 2019 - Present*

- Theoretical aspects of Biparametric persistent homology(BPH) (see publications #2 and #3)
  - Developed a geometric theory of BPH for extracting robust topological features from data
  - Derived asymptotic laws for statistical properties of BPH descriptors extracted from Gaussian random fields
- Applications of Persistent homology
  - Recovering the topology of state space of dynamical systems from low dimensional observations of trajectories
  - Machine learning models for 3D shape classification using the persistent homology transform

Nokia Bell Labs **Murray Hill, NJ**
Math & Algorithms Intern, Advisors: Dr. Iraj Saniee, Dr. Carl Nuzman *Jun 2022 - Present*

- Wireless Machine Learning: Designed convolutional autoencoder based neural compression architectures to efficiently compress Channel State Information matrices in Massive MIMO wireless communication systems
- Game theory in Wireless: Determined fair reward allocation schemes for various crowd sourced systems, such as decentralized wireless networks, using tools from cooperative game theory (see publication #1)

Corteva Agriscience **Champaign, IL**
Research Intern *Jun 2020 - Aug 2020*

- Mathematical modelling and simulation of onset of genetic resistance to various pest management techniques in insects

Autonomous Underwater Vehicle team (AUV-IITB) **Bombay, India**
Software Developer *Sep 2014 - May 2016*

- Part of a 25 member team developing an underwater robot that secured second place at the International AUVSI Robosub competition 2016
- Developed a motion controller, debug interface and simulator for the robot and maintained a modular software stack written in C++ and Python using ROS for integration of various subsystems

COURSEWORK & SKILLS

Technical Skills Python, C++, Matlab, PyTorch, Tensorflow, Keras, scikit-learn, ROS
Languages English (Full professional), Malayalam (Native), Hindi (Limited working)

TEACHING ASSISTANTSHIPS

- ECE 486 Control Systems, UIUC — Fall 2020/Spring 2021
- ME 310 Microprocessors and Automatic Control(Theory + Lab), IITB — Fall 2018/Spring 2019
- SC 624 Differential Geometric Methods in Control, IITB — Spring 2018

COURSEWORK

- **Math**: Algebraic topology (I, II), Differentiable manifolds (I, II), Lie groups and Lie algebras, Stochastic Calculus
- **Probability**: Probability and random processes, Information theory, Markov Chains
- **ML**: Pattern recognition, Generative AI, High dimensional geometric data analysis, Statistical learning theory
- **Control theory**: Geometric control, Adaptive and Nonlinear control, Optimization, Sparse methods in control

SERVICE

- Reviewed articles for Journal of Computational Geometry, IEEE L-CSS, Automatica