Mishal Assif P K

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EDUCATION

University of Illinois Urbana-Champaign — **Urbana-Champaign, IL, USA**
Ph.D. in Electrical Engineering, GPA: 3.97/4.00 — *08/19 - 05/24 (Expected)*
M.S. in Mathematics, GPA: 4.00/4.00 — *08/19 - 05/23 (Expected)*

Indian Institute of Technology Bombay — **Bombay, India**
B.Tech + M.Tech in Mechanical Engineering, GPA: 8.63/10.00 — *07/14 - 08/19*

PUBLICATIONS

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

1. **M. Assif P K**, W. Kennedy, I. Saniee *Fair Allocation in Crowd-Sourced Systems,* Submitted to IEEE International Conference on Computer Communications (INFOCOM)
2. **M. Assif P K** *Singularities of Gaussian random maps into the plane,* Under Revision in Journal of Applied and Computational Topology [arXiv preprint]
3. **M. Assif P K**, Y. Baryshnikov *Biparametric persistence of smooth filtrations,* Submitted to SIAM Journal of Applied Algebra and Geometry [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, USA**
Graduate Research Assistant, Advisor: Prof. Yuliy Baryshnikov — *08/19 - 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 on manifolds
- 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, USA**
Math & Algorithms Intern, Advisors: Dr. Iraj Saniee, Dr. Carl Nuzman — *06/22 - Present*

- Designed autoencoder based neural compression architectures to efficiently compress Channel State Information matrices in Massive MIMO wireless communication systems
- 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, USA**
Research Intern — *06/20 - 08/20*

- 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 — *09/14 - 05/16*

- 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

- **Math**: Algebraic topology (I, II), Differentiable manifolds (I, II), Lie groups and Lie algebras, Complex analysis
- **Probability**: Probability and random processes, Information theory, Markov chains, Stochastic calculus
- **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
- **Software Skills:** Python, C++, Matlab, PyTorch, Tensorflow, Keras, scikit-learn, ROS
- **Languages**: English (Full professional), Malayalam (Native), Hindi (Limited working)