

**Shubhanshu Shekhar**  
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**EMPLOYMENT** **Postdoctoral Researcher**, August 2021 –  
**Mentor:** Prof. Aaditya Ramdas  
Department of Statistics and Data Science  
Carnegie Mellon University

**EDUCATION** **Ph.D in Electrical Engineering**, 2021  
**Advisor:** Prof. Tara Javidi  
University of California, San Diego  
GPA = 3.98/4  
**M.E. in Electrical Engineering**, 2015  
Indian Institute of Science, Bangalore,  
GPA = 7.4/8 (graduated with *Distinction*)  
**B.E. in Electrical Engineering**, 2012  
Indian Institute of Technology , Kharagpur  
GPA = 8.3/10

**HONORS &  
AWARDS**

- Awarded the *Shannon Memorial Fellowship* by CMRR, UCSD, 2020-2021 (awarded to one graduate student for research in information theory).
- Awarded the *Dr. Sassan Sheedvash Award* by ECE Department, UCSD, 2021 (awarded to one graduate student for research in AI and neural networks).
- Among six finalists for *Jack K. Wolf Student Paper Award* at ISIT, 2020.
- Selected by the ECE department, UCSD, to present at *ITA 2020 Graduation day*.
- Finalist for *Qualcomm Innovation Fellowship*, 2018.
- Awarded *ECE Department Fellowship*, UCSD, 2015-2016.
- Offered the *Annenberg Ph.D Fellowship*, USC 2015-19 (declined).

**PUBLICATIONS**

**Preprints / In preparation**

- S. Shekhar and A. Ramdas, “*Game-Theoretic Formulation of Sequential Nonparametric One- and Two-Sample Testing*”, preprint, (under revision, TransIT).
- S. Shekhar, I. Kim and A. Ramdas, “*A Permutation-Free Kernel Test of Independence*”, (in preparation).
- S. Shekhar, A. Ramdas, “*Sequential Changepoint Detection using Confidence Sequences*”, (in preparation).
- S. Shekhar, N. Xu and A. Ramdas, “*Confidence Sequences for Weighted Sampling without Replacement*”(in preparation).

## Journal Publications

- [S. Shekhar](#) and T. Javidi, “*Gaussian Process Bandits with Adaptive Discretization*”, *Electronic Journal of Statistics*, 2018.
- [S. Shekhar](#), S. Roch and S. Mirarab, “*Species Tree Estimation using ASTRAL: how many genes are enough?*”, in *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2018.
- [S. Shekhar](#), M. Ghavamzadeh and T. Javidi, “*Active Learning for Classification with Abstention*”, *IEEE Journal on Selected Topics in Information Theory*, 2021.

## ML Conference Publications

- [S. Shekhar](#) and T. Javidi, “*Multiscale Gaussian Process Level Set Estimation*”, *AISTATS* 2019.
- [S. Shekhar](#), T. Javidi and M. Ghavamzadeh, “*Adaptive Sampling for Estimating Probability Distributions*”, *ICML* 2020.
- J. Tarbouriech, [S. Shekhar](#), M. Pirodda, M. Ghavamzadeh and A. Lazaric, “*Active Model Estimation in Markov Decision Processes*”, *UAI* 2020.
- [S. Shekhar](#) and T. Javidi, “*Significance of Gradient Information in Bayesian Optimization*”, *AISTATS* 2021.
- [S. Shekhar](#), G. Fields, T. Javidi and M. Ghavamzadeh, “*Adaptive Sampling for Minimax Fair Classification*”, *NeurIPS* 2021.
- [S. Shekhar](#) and T. Javidi, “*Instance Dependent Regret Analysis of Kernelized Bandits*”, *ICML* 2022.
- [S. Shekhar](#), I. Kim and A. Ramdas, “*A Permutation-Free Kernel Two-Sample Test*”, *NeurIPS* 2022.

## Other Conference Publications

- M. Lee, [S. Shekhar](#) and T. Javidi, “*Multi-Scale Zero Order Optimization of Smooth Functions in an RKHS*”, *ISIT* 2022.
- D. Sun, M.J. Khojasteh, [S. Shekhar](#) and C. Fan, “*Uncertainty-aware Safe Exploratory Planning using Gaussian Process and Neural Control Contraction Metric*”, *L4DC* 2021.
- [S. Shekhar](#), M. Ghavamzadeh and T. Javidi, “*Active Learning for Classification with Abstention.*” *ISIT* 2020.
- [S. Shekhar](#), and T. Javidi, “*Bayesian Function Optimization with Adaptive Discretization,*” *Allerton* 2017.

## RESEARCH INTERESTS

Broadly, in the area of *sequential and adaptive decision-making under uncertainty*. Specific topics include:

- Nonparametric hypothesis testing, Changepoint detection, Uncertainty quantification
- Bayesian Optimization, Kernelized Bandits, Reinforcement Learning
- Nonparametric Active Learning
- Fair Resource Allocation

## RESEARCH PROJECTS

**Nonparametric Statistical Inference:** Designed sequential hypothesis tests and changepoint detection methods that adapt to the unknown hardness of the problem in a data-driven manner under minimal model assumptions using ideas from universal information theory and online learning. Also developed permutation-free minimax optimal nonparametric two-sample and independence tests in the batch setting.

**Bayesian Optimization and Kernelized Bandits:** Proposed algorithms with better performance guarantees as well as lower computational complexity. Also obtained novel regret bounds establishing the instance-dependent performance guarantees for kernelized bandits.

**Nonparametric Active Learning:** Designed active learning strategies for the problems of level-set estimation and classification with abstention in general nonparametric setting. Obtained theoretical guarantees on their performance and established their minimax near-optimality.

**Fair Resource Allocation:** Designed sampling strategies for allocating resources for learning the probability distributions in terms of different metrics under different observation models (bandit feedback, MDPs and classification tasks). Employed these ideas to the application of constructing minimax-fair classifiers.

**Sample complexity of Species Tree Reconstruction:** Obtained upper bounds and matching lower bounds on the number of gene trees required by the widely used algorithm ASTRAL for correctly reconstructing a species tree under multi-species coalescent model.

## WORK EXPERIENCE

**Research Intern: Facebook AI Research, Menlo Park (June-Sep 2019)**  
Worked on designing active resource allocation strategies for learning multiple probability distributions uniformly well in terms of various distance measures.

**Research Intern: Qualcomm Inc., San Diego (June-Sep 2018)**  
Designed a hierarchical sampling technique for optimizing the low-level representation of common Deep Learning operators.

## PHD STUDENT SUPERVISION

1. Greg Fields (PhD student, UCSD): Adaptive Sampling for Minimax Fair Classification (NeurIPS, 2021).
2. Madison Lee (PhD student, UCSD): Multiscale Zeroth Order Optimization of Smooth Functions in an RKHS (ISIT, 2022).

## RELEVANT GRADUATE COURSEWORK

**ECE Courses:** Information Theory, Random Processes, Matrix Theory, Detection and Estimation Theory, Communication Networks, Wave theory of information, Convex Optimization, Pattern Recognition, Stochastic Processes in Dynamical Systems.  
**Math Courses**<sup>1</sup> : Real Analysis (3), Functional Analysis (2), Probability Theory (3), Mathematical Statistics (2), Statistical Learning Theory (1), Applied Algebra (2).

## TEACHING EXPERIENCE

- Teaching Assistant for ECE 158A (Data Networks), Fall 2016.
- Teaching Assistant for ECE 257A (Communication Networks), Winter 2017.

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<sup>1</sup>term in parentheses denotes the number of courses in the series.

- Teaching Assistant for ECE 272A (Dynamical Systems), Winter 2018.
- Teaching Assistant for ECE 101 (Linear System Fundamentals), Spring 2018.
- Teaching Assistant for ECE 153 (Probability and Random Processes), Fall 2018.
- Teaching Assistant for ECE 267 (Network Algorithms and Analysis), Winter 2019.

## **TECHNICAL SKILLS**

- **Programming Languages:** Python, MATLAB, C++.
- **ML libraries:** scikit-learn, Pytorch, Scipy.
- **Typesetting:** L<sup>A</sup>T<sub>E</sub>X, Markdown.

## **SERVICE**

Served as a reviewer for

- AISTATS, ICML, NEURIPS and JMLR.
- IEEE Transactions on Information Theory, and International Symposium on Information Theory (ISIT).
- American Control Conference (ACC) and Conference on Control and Decisions (CDC).