P. N. Karthik

Personal Data

Date of Birth:	20 Apr 1992
Address:	06-12, Block E4, Engineering Drive 3, National University of Singapore, 117583
Phone:	+65 8043 2990
Email:	pnkarthik1992@gmail.com (personal), karthik@nus.edu.sg (official)
Website:	https://karthikpn.com
LinkedIn:	https://www.linkedin.com/in/pnkarthik/
Google Scholar:	https://scholar.google.com/citations?user=D39u7bkAAAAJ&hl=en&authuser=1

Research Interests

Multi-armed bandits, statistical learning, federated learning, transfer learning, information theory, sequential analysis, hypothesis testing, Markov decision processes, anomaly detection, stochastic adaptive control

Experience

Jan'22 - present **Research Fellow**
Institute of Data Science, National University of Singapore (NUS), Singapore
Supervisor: Prof. Vincent Y. F. Tan

May'23 - Jun'23 **Visiting Researcher**
Technion Israel Institute of Technology, Haifa, Israel
Host: Prof. Nir Weinberger

Nov'19 - Mar'20 **Research Intern**
Netradyne Technology India Pvt. Ltd., Bengaluru
In collaboration with Bengaluru Metropolitan Transport Corporation (BMTC)
Academic Mentor: Prof. Rajesh Sundaresan
Industry Mentor: Pratik Verma

Aug'19 - Dec'19
Aug'18 - Dec'18
Aug'17 - Dec'17 **Graduate Teaching Assistant**
Department of ECE, Indian Institute of Science, Bengaluru
Courses: Information Theory (E2 201), Random Processes (E2 202)
Instructors: Prof. Himanshu Tyagi, Prof. Utpal Mukherji, Prof. Parimal Parag

Aug'14 - Jun'15 **Project Assistant**
Department of ECE, Indian Institute of Science, Bengaluru
Supervisor: Prof. Chandra R. Murthy

Education

Jul'15 - Mar'22 **Doctor of Philosophy and Master of Science (Engineering)**,
Indian Institute of Science, Bengaluru
Department: Electrical Communication Engineering
Thesis: Sequential Controlled Sensing to Detect an Anomalous Process
Supervisor: Prof. Rajesh Sundaresan
GPA: 7.0/8.0

Aug'10 - Jul'14 **Bachelor of Engineering,**
R V College of Engineering, Bengaluru
Major: Electronics and Communications
GPA: 9.72/10.00 (RANK 2 among 140 students)

Publications

Preprints

1. *Optimal Best Arm Identification with Fixed Confidence in Restless Bandits* arxiv
   P. N. Karthik, Vincent Y. F. Tan, Arpan Mukherjee, and Ali Tajer
   Submitted, IEEE Transactions on Information Theory, Oct 2023
2. *Fixed-Budget Differentially Private Best Arm Identification*
   Chen Zhirui, P. N. Karthik, Yeow Meng Chee, and Vincent Y. F. Tan
   Submitted, Sep 2023
3. *Learning to Detect an Odd Restless Markov Arm with a Trembling Hand* arxiv
   P. N. Karthik and Rajesh Sundaresan
4. *Axiomatic Characterisation of Projection Rules: An Open Question* draft
   P. N. Karthik and Rajesh Sundaresan

Journal Publications

1. *Federated Best Arm Identification with Heterogeneous Clients*
   Chen Zhirui, P. N. Karthik, Vincent Y. F. Tan, and Yeow Meng Chee
   IEEE Transactions on Information Theory, 2023+
   Doi: 10.1109/TIT.2023.3338027
2. *Bus Priority lane in Bengaluru: A Study of its Effectiveness and Driver Stress*
   P. N. Karthik, Nihesh Rathod, Sarath Yasodharan, Wilson Lobo,
   Ajeesh Sahadevan, Rajesh Sundaresan and Pratik Verma
   Special Issue on Sustainable City Transportation in the Indian Subcontinent, Transport Policy, 2023.
   Doi: 10.1016/j.tranpol.2023.04.018
3. *Best Arm Identification in Restless Markov Multi-Armed Bandits*
   P. N. Karthik, Kota Srinivas Reddy, and Vincent Y. F. Tan
   IEEE Transactions on Information Theory, volume 69, number 5, pp. 3240-3262, 2023.
   Doi: 10.1109/TIT.2022.3230939
4. *Detecting an Odd Restless Markov Arm with a Trembling Hand*
   P. N. Karthik and Rajesh Sundaresan
   IEEE Transactions on Information Theory, volume 67, number 8, pp. 5230-5258, 2021.
   Doi: 10.1109/TIT.2021.3075021
5. *Learning to Detect an Odd Markov Arm*
   P. N. Karthik and Rajesh Sundaresan
   IEEE Transactions on Information Theory, volume 66, number 7, pp. 4324-4348, 2020.
   Doi: 10.1109/TIT.2020.2972875

Doctoral Dissertation

- *Sequential Controlled Sensing to Detect an Anomalous Process* pdf source etd iisc
  Ph.D. thesis, Department of ECE, Indian Institute of Science, Nov 2021

Conference Publications

1. *Best Arm Identification in Bandits with Limited Precision Sampling*
   Kota Srinivas Reddy, P. N. Karthik, Nikhil Karamchandani, and Jayakrishnan Nair
   IEEE International Symposium on Information Theory (ISIT 2023), Jun 2023
   Doi: 10.1109/ISIT54713.2023.10206610
2. *Almost Cost-Free Communication in Federated Best Arm Identification*
   Kota Srinivas Reddy, P. N. Karthik, and Vincent Y. F. Tan
   Proceedings of the 37th AAAI Conference on Artificial Intelligence (AAAI 2023), Washington D.C., Feb 2023.
   Doi: 10.1609/aaai.v37i7.26010
3. *Best Restless Markov Arm Identification*
   P. N. Karthik, Kota Srinivas Reddy, and Vincent Y. F. Tan
   Proceedings of the 2022 IEEE Information Theory Workshop (ITW 2022), IIT Mumbai, Nov 2022.
   Doi: 10.1109/ITW54588.2022.9965908

4. *Learning to Detect an Odd Restless Markov Arm*
   P. N. Karthik and Rajesh Sundaresan
   Proceedings of the 2021 IEEE International Symposium on Information Theory (ISIT 2021), virtual, Jul 2021.
   Doi: 10.1109/ISIT45174.2021.9518083
5. *Detecting an Odd Restless Markov Arm with a Trembling Hand*
   P. N. Karthik and Rajesh Sundaresan
   Proceedings of the 2020 IEEE International Symposium on Information Theory (ISIT 2020), virtual, Jun 2020.
   Doi: 10.1109/ISIT44484.2020.9174397
6. *Learning to Detect an Odd Markov Arm*
   P. N. Karthik and Rajesh Sundaresan
   Proceedings of the 2019 IEEE International Symposium on Information Theory (ISIT 2019), Paris, France, Jul 2019.
   Doi: 10.1109/ISIT.2019.8849807
7. *On The Equivalence of Projections in Relative α-Entropy and Rényi Divergence*
   P. N. Karthik and Rajesh Sundaresan
   Proceedings of the 34th National Conference on Communications (NCC 2018), IIT Hyderabad, Feb 2018.
   Doi: 10.1109/NCC.2018.8599980
8. *Model-Based Interference Cartography and Visualization*
   P. N. Karthik, Raksha Ramakrishna, Geethu Joseph, Chandra R. Murthy,
   Joyson Sebastian, and Neelesh B. Mehta
   Proceedings of the 22nd National Conference on Communications (NCC 2016), IIT Guwahati, Mar 2016.
   Doi: 10.1109/NCC.2016.7561174

Ph.D. Mentorship Assistance

Candidate: Bharati Kamakoti (Ph.D., 3rd year)
Supervisor: Prof. Krishna Jagannathan
Institute: IIT Madras
Topic: Transfer learning, best arm identification

Candidate: Chen Zhirui (Ph.D., 2nd year)
Supervisor: Prof. Vincent Y. F. Tan
Institute: National University of Singapore
Topic: Federated learning, best arm identification

Research Presentations

2023

1. *Optimal Best Arm Identification with Fixed Confidence in Restless Bandits* slides video
   National University of Singapore
   A talk presented to Prof. Vincent Tan's research group, Nov 2023
2. *Almost Optimal Best Restless Markov Arm Identification with Fixed Confidence* slides video
   CNI Networks Seminar Series, Indian Institute of Science, Bengaluru, Aug 2023
3. *Best Arm Identification with Limited Precision Sampling* slides
   National University of Singapore
   A talk presented to Prof. Vincent Tan's research group, Mar 2023
4. *Almost Cost-Free Communication in Federated Best Arm Identification* poster
   Poster presentation, 37th AAAI Conference on Artificial Intelligence,
   Walter E. Washington Convention Center, Washington D.C., Feb 2023
5. *Almost Cost-Free Communication in Federated Best Arm Identification* slides video
   Invited talk, Workshop on Information Theory and Data Science,
   Institute for Mathematical Sciences, National University of Singapore, Jan 2023

2022

1. *Best Restless Markov Arm Identification* slides
   IEEE Information Theory Workshop, Mumbai, India, Nov 2022
2. *Behind the Scenes of $Ax = b$: Axioms and an Open Question* slides video
   National University of Singapore
   A talk presented to Prof. Vincent Tan's research group, Mar 2022

2021

1. *Sequential Controlled Sensing to Detect an Anomalous Process* slides video
   Ph.D. defence, Department of ECE, Indian Institute of Science, Nov 2021
2. *Finding a Markov Anomaly Quickly and Accurately* video certificate
   100 seconds competition organised by INAE Kanpur Chapter, Oct 2021
   First place under "Electronics and Communication Engineering" category
3. *GATE 2022: A Pathway to Research* video
   An online interactive session on the Graduate Aptitude Test in Engineering as a pathway to research organised by the Division of EECS, Indian Institute of Science, Oct 2021
4. *Information Geometry and its Applications to Statistics* video notes
   An online lecture for the students of Indian Institute of Science, Sep 2021
5. *Learning to Detect an Odd Restless Markov Arm* slides video
   IEEE International Symposium on Information Theory, Jul 2021
6. *Sequential Controlled Sensing to Detect an Anomalous Process* slides video
   Ph.D. colloquium talk, Department of ECE, Indian Institute of Science, Jun 2021
7. *Crack Open the GATE* video
   A session conducted for the students of R V College of Engineering, May 2021
8. *Probability in Real-Life: Example Applications from Visual Neuroscience, Colour Blindness Detection, and Covid-19 Outbreak Modelling* slides video
   A talk presented virtually to the 5th semester students and the faculty of the Department of Electronics and Communication Engineering, R V College of Engineering, Sep 2020

2020

1. *Odd Arm Identification in Multi-armed Bandits with Markov Observations* slides video certificate
   EECS Research Students' Symposium, Indian Institute of Science, Jul 2020
   Best paper award under "Signal Processing, Communication Networks, and Information Theory" track
2. *Detecting an Odd Restless Markov Arm with a Trembling Hand* slides video
   IEEE International Symposium on Information Theory, Jun 2020
3. *Visual Search with a Trembling Hand: An Analysis of Odd Arm Identification in Restless Multi-armed Bandits* slides video
   Centre for Networked Intelligence, Indian Institute of Science, May 2020
4. *On Detecting an Anomalous Arm in a Multi-armed Bandit with Markov Observations* slides
   STCS Symposium, Tata Institute of Fundamental Research, Mumbai, Jan 2020

2019

1. *Search in Research: The Importance of the Theory of Probability in Real-Life* slides
   R V College of Engineering, Dec 2019
2. *Learning to Detect an Odd Markov Arm* slides
   Lectures on Probability and Stochastic Processes XIV, Indian Statistical Institute Delhi, Dec 2019
3. *On Detecting an Anomalous Arm in Multi-armed Bandits with Markov Observations* slides
   Networks Seminar, Robert Bosch Centre for Cyber Physical Systems, Indian Institute of Science, Nov 2019
4. *Learning to Detect an Odd Markov Arm* poster
   Joint Telematics Group Summer School, Indian Institute of Technology, Madras, Aug 2019
5. *Learning to Detect an Odd Markov Arm* slides
   Program on Advances in Applied Probability, International Centre for Theoretical Sciences, Aug 2019
6. *Learning to Detect an Odd Markov Arm* slides
   IEEE International Symposium on Information Theory, Jul 2019
7. *A Short Course on Probability and Random Processes* course material
   R V College of Engineering, Jun 2019

8. *$Ax = b$: A Familiar Setup, Axioms and An Open Question* slides
   ECE Students' Seminar Series, Department of Electrical Communication Engineering,
   Indian Institute of Science, FEB 2019

2018 AND EARLIER

1. *On the Equivalence of Projections in Relative α-Entropy and Rényi Divergence* slides
   National Conference on Communications,
   Indian Institute of Technology, Hyderabad, FEB 2018
2. *On the Equivalence of Projections in Relative α-Entropy and Rényi Divergence* slides
   Lectures on Probability and Stochastic Processes XII,
   Indian Statistical Institute, Kolkata, DEC 2017

AWARDS AND HONORS

- First place in the 100 seconds competition organised by INAE Kanpur Chapter
- Best paper award at the 2020 EECS Research Students' Symposium, Indian Institute of Science
- Best 3-minute presentation, ECE Students' Seminar Series, Department of ECE, Indian Institute of Science
- Rank 136 (among the top 0.01%) in the 2015 Graduate Aptitude Test in Engineering
- Infineon India scholarship for securing rank 2 in the 2011 Visvesvaraya Technological University examinations.
- Rank 23 (among the top 0.02%) in the 2010 Karnataka Common Entrance Test

PROFESSIONAL SERVICE

- Reviewer, IEEE Transactions on Information Theory
- Reviewer, IEEE Transactions on Signal Processing
- Reviewer, Journal on Selected Areas in Communications (JSAC)
- Reviewer, International Conference on Learning Representations (ICLR 2024)
- Reviewer, Conference on Neural Information Processing Systems (NeurIPS 2023)
- Reviewer, Conference on Decision and Control (CDC 2023)
- Reviewer, IEEE International Symposium on Information Theory (ISIT 2019, 2023)
- Reviewer, National Conference on Communications (NCC 2018)

SOFTWARE KNOWLEDGE

Python | Microsoft PowerBI | Notion | LaTeX | MATLAB