

# Aditya Deshmukh

## CONTACT INFORMATION

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## RESEARCH INTERESTS

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Large Language Models (LLMs), Reinforcement Learning, Prompt Engineering, Deep Learning, Robust Machine Learning, Statistical Inference, Compression, High-dimensional Statistics & Information Theory

## EDUCATION

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**University of Illinois at Urbana-Champaign (UIUC)** 2017 – 2023  
*Ph.D. in Electrical and Computer Engineering* 3.97/4.0

**Indian Institute of Technology Madras (IIT Madras)** 2012 – 2017  
*B.Tech. & M.Tech. in Electrical Engineering* 8.81/10.0

## PROFESSIONAL EXPERIENCE

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### Coordinated Science Laboratory, UIUC

*Postdoctoral Research Associate* – Urbana, US June 2024 – August 2025

- Developed a novel automatic prompt generator with [Lav Varshney](#) which gives user the control to tradeoff between different objectives.
- Developed a novel RL policy optimization algorithm for multi-objective model alignment and prompt optimization.

### Amazon

*Research Scientist Intern* – Remote, US May - Aug 2021

- Identified relevant features using windowed statistics for the problem of online defect identification to improve erroneous responses of Alexa's NLP model.
- Built a pandas framework for creating training data by extracting aforementioned statistics from the vast Alexa utterances data, and analyzed machine learning models trained on collected features.

### Tata Institute of Fundamental Research (TIFR)

*Junior Research Fellow* – Mumbai, India May – July 2015

- Conducted research under the mentorship of [Rahul Vaze](#) and developed an online algorithm to improve energy efficient packet scheduling with provable guarantees.

### Phasorz Technologies (MediBuddy)

*Android Development Intern* – Chennai, India March – July 2014

- Developed the XMPP and SQLite framework of [DocsApp](#) (now [MediBuddy](#)) - an android based messaging and consulting platform for patients and doctors.

## FELLOWSHIPS & ACHIEVEMENTS

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- [Mavis Future Faculty Fellowship](#) (conferred by UIUC) 2021
- [Joan and Lalit Bahl Fellowship](#) (conferred by UIUC) 2021, 2022
- [Dr. Ok Kyun Kim Fellowship](#) (conferred by UIUC) 2019
- All India Rank 599 in [IIT-JEE](#) among half million applicants 2012
- Selected for [KVPY](#) Scholarship (SX Stream) by IISc 2011

## PROGRAMMING SKILLS

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Python (including PyTorch, scikit-learn, pandas, cvxpy), Java  
MATLAB (including SDPT3)

## SELECTED RESEARCH PROJECTS

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### Multi-objective Prompt Optimization and Alignment in LLMs

- Developed prompt optimization techniques and architectures for multi-objective optimization which allows the user to control the trade-off between different objectives.
- Designed robust and efficient reinforcement learning policy optimization algorithms to optimize single and multiple objectives.
- Applications: *Automatic prompt generation, Learning from Human Feedback (LHF)*.

### Distributed and Adaptive Feature Compression

- Proposed an efficient adaptive scheme using deep neural networks for optimizing data compression in distributed sensor network without compromising performance of downstream task.
- Applications: *Internet of Things (IoT) devices, edge computing*.

### Robust Estimation

- Designed a computationally efficient, outlier-fraction agnostic, optimal estimator for the problem of robust mean estimation.
- Applications: *Robust federated learning, robust LDA, robust linear regression*.

### Hypothesis Testing in Multi-Armed Bandits

- Formulated a general framework of hypothesis testing which encompasses identification problems (e.g. top- $k$  arms identification) in multi-armed bandits, and proposed an asymptotically optimal policy for quickest detection.
- Applications: *Medical diagnostic systems, recommendation systems, clinical trials, A/B testing*.

## SELECTED PUBLICATIONS

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- Multi-objective Prompt Optimization at the Information-Theoretic Limit  
**A. Deshmukh** and L. Varshney [full paper under preparation]  
*Accepted in AAAI 2024 Fall Symposium on Integrated Approaches to Computational Scientific Discovery (AAAI Fall Symposium 2024)*
- Distributed and Rate-Adaptive Feature Compression using VQ-VAEs  
**A. Deshmukh**, V. Veeravalli, and G. Verma [arXiv]  
*Accepted in 58th Asilomar Conference on Signals, Systems, and Computers (Asilomar 2024)*
- Robust Mean Estimation in High Dimensions: An Outlier Fraction Agnostic and Efficient Algorithm  
**A. Deshmukh**, J. Liu, and V. Veeravalli [arXiv]  
*IEEE Transactions on Information Theory* (2023)
- Robust High-Dimensional Linear Discriminant Analysis under Training Data Contamination  
Y. Shi, **A. Deshmukh**, Y. Mei, and V. Veeravalli [IEEE Xplore]  
*IEEE International Symposium on Information Theory (ISIT 2023)*
- Information Flow Optimization for Estimation in Linear Models Using a Sensor Network  
**A. Deshmukh**, J. Liu, V. Veeravalli, and G. Verma [IEEE Xplore]  
*IEEE Signal Processing Letters* (2023)
- Sequential controlled sensing for composite multihypothesis testing  
**A. Deshmukh**, S. Bhashyam, and V. Veeravalli [arXiv]  
*Sequential Analysis* (2021)
- Information Flow Maximization in Inference Networks  
**A. Deshmukh**, J. Liu, and V. Veeravalli [arXiv]  
*IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2020)*