

AKASH DOSHI

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Nationality: US Citizen

EDUCATION

- University of Texas At Austin** *Aug 2018 - Jul 2022*
PhD in Electrical and Computer Engineering - DICE track *GPA: 4.0/4.0*
Passed Progress Review on Oct 4, 2021 and Defense on Jul 11, 2022.
Advised by Prof Jeffrey G. Andrews
- University of Texas At Austin** *Aug 2018 - May 2020*
MS in Electrical and Computer Engineering - DICE track *GPA: 3.97/4.0*
- Indian Institute of Technology Bombay, India** *Jul 2014 - May 2018*
B.Tech(with Honors) in Electrical Engineering with Minor in Computer Science. *GPA: 9.62/10.0*

RESEARCH EXPERIENCE

- Contention-based Spectrum Sharing using Deep Reinforcement Learning** *Sep 2020 - Present*
University of Texas at Austin
- Designing adaptive modulation and power control mechanisms for shared spectrum access, along with interference estimation modules, building on the initial work done at Qualcomm in Summer 2020.
 - Adopting policy gradient techniques to develop fast and robust training algorithms with online capabilities for dynamic spectrum access.
- Massive MIMO Channel Estimation using Deep Generative Learning** *Jan 2019 - Present*
University of Texas at Austin
- Utilizing deep generative networks for channel estimation. Found to outperform conventional CS techniques and required fewer pilots. Developing extensions to this GAN-based technique for quantized channel estimation by modifications to the optimization objective.
 - Developed a novel deep learning-based channel estimation method for multi-cell interference-limited massive MIMO systems. The aim was to make the system robust to pilot contamination and perform uplink interference cancellation by exploiting the denoising and region inpainting abilities of untrained neural network architectures.
- Joint Data Detection and Channel Estimation using Autoencoders** *Aug 2018 - Jan 2019*
University of Texas at Austin
- Developing an autoencoder-based architecture that could incorporate the design for an optimal encoder and decoder in an 16x4 MU-MIMO scenario in the presence of a fading channel.
- Improved Data Fusion for Multi-Sensor Tracking** *Jul 2017- May 2018*
Indian Institute of Technology Bombay
- Delved into how measurements from two spatially separated sensors could be combined in an intelligent manner to track the position of a moving target in the common FoV of the sensors, by combining Viterbi Data Association and Data Fusion in an intuitive fashion.

PUBLICATIONS

Journal Papers

- **Akash Doshi**, Manan Gupta and Jeffrey G. Andrews. “Over-the-Air Design of GAN Training for mmWave MIMO Channel Estimation”. *Submitted to IEEE Journal on Sel. Areas in Information Theory. Available at arXiv: 2205.12445 [eess.SP]*
- **Akash Doshi**, Srinivas Yerramalli, Lorenzo Ferrari, Taesang Yoo, Jeffrey G. Andrews. “A Deep Reinforcement Learning Framework for Contention-Based Spectrum Sharing”. *IEEE Journal on Sel. Areas in Comm. 39(8), pp. 2526-2540, Jun. 2021*

- Eren Balevi, **Akash Doshi**, Ajil Jalal, Alexandros Dimakis, Jeffrey G. Andrews. “High Dimensional Channel Estimation Using Deep Generative Networks”. *IEEE Journal on Sel. Areas in Comm.* 39(1), pp. 18-30, Jan. 2021
- Yi Zhang, **Akash Doshi**, Rob Liston, Wai-tian Tan, Xiaoqing Zhu, Jeffrey G. Andrews, R. W. Heath Jr. “DeepWiPHY: Deep Learning Based Equalizer for IEEE 802.11ax WLAN Systems” *IEEE Trans. on Wireless Comm.* 20(3), pp. 1596-1611, Mar. 2021
- Balevi, Eren, **Akash Doshi**, and Jeffrey G. Andrews. “Massive MIMO Channel Estimation with an Un-trained Deep Neural Network.” *IEEE Trans. on Wireless Comm.* 19(3), pp. 2079–2090, Jan. 2020
- Sahu, B. N., **Akash S. Doshi**, R. Prabhu, N. Venkataramani, Shiva Prasad, and R. Krishnan. “Temperature dependence of FMR and magnetization in nanocrystalline zinc ferrite thin films.” *AIP Advances* 6(5), Oct 2016: 055928.

Conference Papers

- **Akash Doshi** and Jeffrey G. Andrews. “Combining Contention-Based Spectrum Access and Adaptive Modulation using Deep Reinforcement Learning”. *To appear in 56th Asilomar Conference on Signals, Systems, and Computers.*
- William Blount, Kris Li, Amrith P. Lotlikar, **Akash Doshi**, Jeffrey G. Andrews. “Evaluation of Adaptation Methods for Deep Learning-based Wi-Fi Receivers”. *In IEEE Wireless Communications and Networking Conference (WCNC)* (pp. 656-661).
- **Akash Doshi** and Jeffrey G. Andrews. “Distributed Proximal Policy Optimization for Contention-Based Spectrum Access”. *In 55th Asilomar Conference on Signals, Systems, and Computers* (pp. 340-344).
- **Akash Doshi**, Eren Balevi and Jeffrey G. Andrews. “Compressed Representation of High Dimensional Channels using Deep Generative Networks”. *In IEEE 21st Intl. Workshop on Signal Processing Adv. in Wireless Comm. (SPAWC)* (pp. 1-5).
- Biswas, R., **Doshi, A. S.**, Bhatta, A., Pillai, S. R. B. “Improved Data Fusion for Multi-Sensor Tracking using a Reinforced Viterbi Algorithm.” *In 2019 National Conference on Communications (NCC)* (pp. 1-6).

PATENT APPLS.

- **Akash Doshi**, Srinivas Yerramalli, Lorenzo Ferrari, Taesang Yoo. “Multi-Stage Markov Decision Process (MDP) Model for a Spectrum Sharing System” *US Patent App. 17/478,669, March 24, 2022*
- **Akash Doshi**, Srinivas Yerramalli, Lorenzo Ferrari, Taesang Yoo. “Spectrum Sharing with Deep Reinforcement Learning (RL)” *US Patent App. 17/463,053, March 10, 2022*

WORK EXPERIENCE

QuantumSine Operating PTE, Austin, TX Part-Time Contractor

November 2020 - Present

- Using a multi-dimensional vector space approach to modulation design, QuantumSine provides the ability to optimize the modulation for Spectral Efficiency, Peak to Average Power Ratio and Bit Error Rate performance under different SNR’s. We combined high-order modulation, machine learning and noise prediction algorithms to design new modulation paradigms.

FinMechanics, India Associate Consultant

June - August 2018

- Integrated a Trinomial Tree using the Hull White 1 Factor Model to price Bermudan Swaptions and Callable Range Accrual Swaps. Wrote a Monte Carlo based Simulation Path Pricing algorithm to price Bermudan Swaptions with improved accuracy. Developed an iterative Newton-Raphson based algorithm to price and find implied Swaption volatilities under the Hull White 1 Factor Model

INTERNSHIPS

Qualcomm Technologies, Inc., San Diego, CA Research Intern, Wireless R&D Team

May - August 2021
Manager: Taesang Yoo

- Designed a Convolutional Network for Interference Prediction in Wireless Networks involving a licensed indoor hotspot mmWave MIMO setup with XR traffic. The convolutional net outputted the predicted change in SINR for the next time slot, and was found to outperform a Markov baseline in terms of the cumulative distribution function learnt.

Qualcomm Technologies, Inc., San Diego, CA

Research Intern, Wireless R&D Team

May - August 2020

Manager: Lorenzo Ferrari

- Formulated medium access for gNBs operating on shared spectrum as a Dec-POMDP. Developed a distributed Reinforcement Learning framework adapted to a contention-based medium access mechanism that provided for long term PF of the throughput delivered. Its maximization of the PF metric was found to be competitive with an adaptive energy detection threshold. This approach provided for online adaptability and was well tailored to the design of a learning-based transmitter.

Cisco Systems, San Jose, CA

Research Intern, ENB CTO Team

May - August 2019

Manager: Rob Liston

- Developed **DeepWiPHY**, a deep neural network based equalizer, to replace the conventional channel equalizer and phase error corrector. Evaluated **DeepWiPHY** with a simulated dataset under various scenarios and working modes and developed a prototyping framework using USRP and CISCO 11ax access point (AP) for validation with real data. Achieved a **33%** reduction in PER(Packet Rate) and an average of **1.5 dB** gain in SNR in **WiFi 6** AP's.

FinMechanics, India

Summer Intern

May - July 2017

- Implemented modules for pricing European Swap Options using Bachelior Model. Built an interface to display the Vega value for all the deals displayed on the trading screen. Validated Interest Rate Swap data for a hedge fund manager using the method of "Yield Curve Bootstrapping". Applied Convexity Adjustment using the Hull-White Model for the validation of deals having Futures as underlying instruments.

Cadence Design Systems, India

Technical Intern

May - July 2016

- Implemented offload of MP3 decode to Tensilica DSP by modifying the Android Audio Policy and writing customized device drivers for use under Android's Goldfish Kernel, which runs the Android Emulator. Wrote DSP code for Hifi-EP® Audio Engine to implement an on-board equalizer which accepted control information and PCM data from SPI.

Greendzine Technologies Pvt. Ltd.

Technical Intern

Dec 2015 - Jan 2016

- Designed a Bluetooth Protocol and a Chat Based Wi-Fi Protocol for obtaining diagnostic data of the MoPTRO(Motorized Order Picking Trolley) from remote locations, thus helping to solve problems in the hardware in real time. This was done by modifying the Android App of the MoPTRO and designing a GUI in Netbeans for viewing diagnostic data of MoPTRO's scattered all over India.

PROJECTS

Deep Stock Predictions

Data Mining, UT Austin

- Design a trading strategy that performs portfolio optimization using LSTM stock price predictions for four different companies. Customized the loss function used to train the LSTM to increase the profit earned. We also proposed a data driven approach for optimal selection of window length and multi-step prediction length, and considered the addition of analyst calls as technical indicators to a multi-stack Bidirectional LSTM strengthened by the addition of Attention units.

AirSPY: An eavesdropping framework for low resolution mmWave vehicular communication

Reinforcement Learning: Theory and Practice, UT Austin

- Depicted how unmanned aerial vehicles (UAVs) could eavesdrop on the communication between a road side unit (RSU) equipped with a low resolution phased array and a vehicular receiver. Used a reinforcement learning-based approach to optimize the flight path of the eavesdropping UAV under a velocity constraint, and proposed a randomized beamforming strategy for the RSU to make the communication robust to such attacks.

Stochastic Block BFGS: Squeezing More Curvature out of Data

Large Scale Optimization, UT Austin

- Developed stochastic block versions of a subset of well-studied quasi-Newton methods, including the DFP and the generalized Broyden class of methods. The proposed stochastic block DFP method was very robust to small batch sampling sizes, and significantly outperformed existing stochastic block quasi-Newton methods that exist in literature.

A Study of A Hierarchical Crowd-sourcing Queuing Model

Design & Analysis of Comm. Networks, UT Austin

- Analyzed different policies to ensure stability and throughput optimality in a hierarchical task-expert system with opportunity for job completion at higher levels in case of failure at one level.

Building a Li-Fi System

Electronics Design Lab, IIT Bombay

- Implemented a synchronous receiver using a Phase Locked Loop and a transmitter using a flashing high frequency LED to achieve speeds of upto 200 kbps over a distance of 10m. Data processing at both ends was done on TI Tiva TM4C123GXL board

Document Summarization using Key Sentence Extraction

Machine Learning, IIT Bombay

- Implemented Convolutional Neural Networks and Bagging of FC Neural Networks in Keras. Involved a PCA based algorithm to remove common words that do not contribute to the discourse vector. Used the Google Word2Vec dataset and scanned articles for summarization from the New York Times.

RELEVANT COURSEWORK & SKILLS

UT Austin	<i>Wireless Comm., Space Time Comm., Probability & Stoch. Processes I, Large Scale Learning, Design & Analysis of Comm. Networks, Reinforcement Learning, Theory of Probability I & II, Statistical Machine Learning, Data Mining, Combinatorial Optimization, Stochastic Control Theory, Randomized Algorithms, Information Theory.</i>
IIT Bombay	<i>Machine Learning, Convex Optimization, Error Correcting Codes, Adv. Topics in Signal Processing, Adv. Concentration Inequalities, Graph Theory, Design & Analysis of Algorithms, Computer & Network Security.</i>
Programming	<i>Python, Tensorflow, Pytorch, Keras, Scikit-learn, MATLAB, C, Java, C++</i>

ACADEMIC ACHIEVEMENTS

UT Austin	Recipient of the <i>Qualcomm Innovation Fellowship</i> 2021 Recipient of the <i>Cockrell School of Engineering Multi-Year Fellowship</i> 2018-22 Finalist at <i>Qualcomm Innovation Fellowship</i> 2020
IIT Bombay	Ranked 7/140 in the Electrical Engg. Dept, IIT Bombay Received the <i>Undergraduate Research Award</i> 2016 at IIT Bombay

TEACHING EXPERIENCE & SERVICE

Reviewer	<i>IEEE Trans. on Wireless Communication, Trans. on Communications, Journal on Sel. Areas in Communications, Globecom Workshop 2019 & 2021, Intl. Conference on Communications 2021 & 2022, Communication Letters, Wireless Communication Letters</i>
Teaching Assistant	<i>EE 381K-11: Wireless Communications in Spring 2021</i>
Session Chair	<i>IEEE Wireless Comm. & Networking Conference (WCNC) 2022</i>