

# Mayank Mishra

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## ACADEMIC DETAILS

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Year	Degree	Institute	GPA
2016-2020	B.Tech, Electrical Engineering (Power & Automation)	Indian Institute of Technology, Delhi	8.171/10
2016	Higher Secondary School (CBSE)	Delhi Public School	94%
2014	High School (CBSE)	Delhi Public School	10/10

- Secured All India Rank 921 in JEE Advanced 2016
- Secured All India Rank 682 in JEE Mains 2016

## WORK EXPERIENCE

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### IBM Research

*Aug 2020 - present*

- Participated in the **DSTC9 challenge** organized by Amazon Alexa to support conversations grounded in documents
- Worked as a **Watson Assistant** developer by contributing on aspects of planning, automation and customer care
- Worked on **COVID-ASSIST** (a conversational platform) centered around Watson in response to the COVID pandemic
- Worked on the research paper titled "**Variational Learning for Unsupervised Knowledge Grounded Dialogs**"

### SAMSUNG R&D Institute, Noida

*May 2019 - Jul 2019*

- Implemented a new user authentication system using smartphone sensors for real-time authentication
- Used LSTM based Variational Autoencoders for projecting the obtained time-series on a lower dimensional manifold
- Implemented few-shot learning to learn user profiles with minimal data points in an online learning environment
- Created and deployed an android application on several devices and optimized the battery consumption of the same

## PUBLICATIONS

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### Variational Learning for Unsupervised Knowledge Grounded Dialogs

- Proposed a model to generate responses for dialogs grounded on information present in external knowledge sources
- Retrieved the relevant textual documents from a large indexed collection of documents in an unsupervised fashion
- Used a variational framework to take advantage of the posterior distribution to retrieve better documents during training
- Also showed the efficacy of the proposed model on other tasks like question answering, classification etc
- Published in International Joint Conferences on Artificial Intelligence (IJCAI 2022) - [Arxiv preprint](#)

### Adversarial Approximate Inference for Speech to Electroglottograph Conversion

- Optimized the Speech to Laryngograph encoder using adversarial training for the network using informative priors
- Created a cosine based loss function for enforcing amplitude invariance between ground truth and network output
- Used a variational inference approach for learning optimal representations for speech signal to infer the EGG signal
- Demonstrated the advantages of using informative priors over Gaussian priors in the variational autoencoder setting
- Utilized continuous wavelet transforms using Ricker wavelets for robust peak picking
- Published in [IEEE/ACM Transactions on Audio, Speech, and Language Processing \(Volume 27, Issue 12\)](#)

## Variational Inference with Latent Space Quantization for Adversarial Resilience

- Implemented a defense mechanism capitalizing on the expressive power of regularized latent space generative models
- Trained Variational Autoencoders with a K-Lipschitz encoder to ensure closeness of similar images in the latent space
- Proposed a mechanism for defending neural networks against adversarial examples using latent space quantization
- Demonstrated the efficacy of the proposed mechanism against multiple attack types (black and white box) and methods
- Submitted to Association for the Advancement of Artificial Intelligence (AAAI 2020) - [Arxiv preprint](#)

## PROJECTS

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### COVID-ASSIST

*IBM Research, Jul 2021 - Sep 2021*

- Worked on authoring a Watson Assistant skill to help out fellow IBMers in India during the COVID pandemic
- Authored the skill such that the users can request for medicines, emergency supplies, vaccination, information about COVID, doctor's appointment etc
- The work involved external collaborations including organizations such as Indian Council of Medical Research (ICMR), Department of Health Research, Ministry of Health and Family Welfare, Government of India

### Watson Assistant Dialog Runtime

*IBM Research, Feb 2021 - Jul 2021*

- Worked on improving customer experience, fixing customer issues, PII leaks, providing new features for easier authoring of skills, catching unexpected exceptions that sometimes led to the Assistant getting stuck in unforeseen states
- Also worked on upgrading dependencies like Google's gson project and the spring expressions project, to reduce vulnerabilities, which serve as the backbone of the dialog runtime
- Removed the cloned repos for these open-source projects and modified the entire codebase of the dialog runtime to source the jars (of these projects) from org.apache.maven's jar repository rather than building their entire repos from scratch
- Doing so reduced the dialog runtime's build times from 10-11 mins to 4-5 mins and also reduced the code size by 30,000 lines (approx.) making the code easier to understand for new team members. This also makes future upgrades a lot easier

### DSTC9 Track 1 Challenge

*IBM Research, Aug 2020 - Oct 2020*

- Participated in the DSTC9 challenge organized by Amazon Alexa
- Created models for generating responses to task-oriented dialogs where the required knowledge lies in external documents
- Worked on retrieving the relevant knowledge in both supervised and unsupervised settings

### Real-time Visual Respiration Rate Estimation with Dynamic Scene Adaptation

*IIT Delhi, Feb 2019 - May 2019*

- Used Computer Vision based techniques for estimating the respiration rate from the video footage of an individual
- Used the proposed algorithm to correctly identify the patients suffering from pneumonia (fast breathing)
- Implemented and optimized the algorithm to run on Raspberry Pi for detection in real-time in hospitals

### Resource and profit optimization in electricity market

*IIT Delhi, Sep 2019 - Dec 2019*

- Developed new models for evaluating flexible resources in two-settlement electricity markets (day-ahead and real-time)
- Worked on achieving equilibrium in two settlement electricity markets using ADMM

### Bias Correction in Deep Neural Networks

*IIT Delhi, Aug 2018 - Nov 2018*

- Worked on reducing dataset bias in neural networks for better generalization without training on multiple datasets
- Trained an Auxilliary Classifier GAN (ACGAN) to generate images conditionally given the class from MNIST dataset
- Used the original MNIST images and the conditionally generated images from the ACGAN to train a CNN classifier
- Tested this classifier on a hand-written digits dataset collected in classroom and achieved state of the art performance

### Lecture Summarization using Deep Learning

*SAMSUNG Research, IIT Delhi, Feb 2019 - May 2019*

- Trained Convolutional LSTMs for summarizing video lectures of various online courses
- Used Computer Vision techniques to find edge maps, optical flows and difference of consecutive frames of the videos
- Used the engineered features for increased accuracy over conventional recurrent networks trained using raw frames
- Implemented a WPF software in C# to summarize the video lectures and generate lecture notes in PDF format

### Touch-Point Prediction using Deep Learning

*IIT Delhi, May 2018 - Dec 2018*

- Worked on improving touch-screen latency for the SAMSUNG Flip device without explicitly changing the hardware
- Trained and benchmarked Fully Connected, RNNs and LSTMs and analyzed the performance of the said algorithms
- Implemented the said algorithms on the device yielding a low error rate with no significant impact on performance

**Braille Tutoring Application***IIT Delhi, Jan 2018 - May 2018*

- Implemented tutorials and games using Python for comprehensive learning of Braille by visually challenged students
- Created a Linux based secondary software for the tutor to add customized exercises or games in the application
- Deployed the application on a Beaglebone-based Refreshable Braille Device
- Worked on providing tactile output, sound and an external Arduino based serial LCD display through the Braille device
- Tested the application with visually challenged students in the National Association for Blind

**Identifying the Diabetic Neuropathic Patients using Machine Learning***IIT Delhi, Sep 2017 - Dec 2017*

- Trained bi-directional LSTMs for the identification of Diabetic Neuropathic patients using foot pressure data
- Implemented a WPF software in C# to record data using an Arduino based pressure mat

**Crystal Ball Interface to view 3D Objects***IIT Delhi, Aug 2017 - Dec 2017*

- Implemented a crystal ball interface using OpenGL in C++ for viewing 3D objects saved in .obj file format

## COURSES UNDERTAKEN

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Machine Learning, Advanced Machine Learning, Information Theory, Data Structures, Computer Architecture, Embedded Systems Design Project, Probability and Stochastic Processes, Linear Algebra and Differential Equations, Calculus, Micro Economics, Signals and Systems, Control Engineering, Digital Electronics, Analog Electronics

## TECHNICAL SKILLS

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- **Programming Languages:** Python, Java, C++, C#
- **Machine Learning Frameworks:** TensorFlow, PyTorch, Keras, sklearn
- **Softwares:** Visual Studio, Android Studio, Eclipse, Vivado, Linux, MATLAB, Simulink, Unreal Engine 4, 3ds Max
- **Interests:** Deep Learning, Quantum Computing, Information Theory