# Mohammed Adnan

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## EDUCATION

**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI**
B.Tech in Electronics and Electrical Engineering | Expected May 2019

**SENIOR SECONDARY SCHOOL** | CBSE
90.6% | March, 2014

**SECONDARY SCHOOL** | CBSE
CGPA 10/10 | March, 2012

## EXPERIENCE

**WATERLOO AI INSTITUTE** | Indo-Canadian Research Fellow
May 2018 – July 2018 | Waterloo, Canada

- Awarded fellowship by Govt. of India and Canada to do research at Waterloo AI Institute.
- Worked on One-Shot Content Based Image Retrieval for histopathology images.
- Designed GUI based image retrieval system for computer aided diagnosis. The network is fine tuned as per pathologist's subjective opinions using their feedbacks.
- Collected feedbacks from five experts in Waterloo.
- Precision at 1 accuracy for the proposed model is 0.69.
- Worked on Representation Learning problem for histopathology images for unsupervised classification of histopathology images. Tried different methods such as InfoGAN and beta-VAE.
- Used the Keras framework for the project with TensorFlow backend along with Numpy, Matplotlib and scikit-learn.

**NATIONAL UNIVERSITY OF SINGAPORE & SINGAPORE HEALTH** | Visiting Researcher
May 2017 – July 2017 | Singapore

- Worked on a joint project between National University of Singapore and SingHealth to study the effect of topography on liver and dental cells using machine learning algorithms.
- Worked in a multidisciplinary team consisting of medical doctors, biologists and engineers.
- Developed Image processing algorithms for prepossessing high throughput medical images.
- Implemented machine learning algorithms for analyzing high throughput medical images.
- Our paper got accepted in Duke-NUS Scientific Congress, 2018.

## PROJECTS

**ONE-SHOT IMAGE SUPER RESOLUTION USING CNN**
B.Tech Thesis
August 2018 – Present
Working on single image super resolution using Deep Learning. Current supervised Super Resolution methods are restricted to specific training data, where lower resolution images are obtained from corresponding high-resolution images using predetermined method(e.g., bicubic downscaling), without any distracting artifacts like sensor noise, compression method etc.

**ONLINE WRITER IDENTIFICATION**
In this project an end-to-end framework is used for online writer identification by using a recurrent neural network. The handwriting data of a particular writer are represented by a set of random hybrid strokes (RHS). Each RHS is a randomly sampled short sequence representing pen tip xy-coordinates.
RNN model with bidirectional long short-term memory is used to encode each RHS into a fixed-length vector for final classification. All the RHSs of a writer are classified independently, and then, the posterior probabilities are averaged to make the final decision. The framework is end-to-end and does not require any domain knowledge for handwriting data analysis. Experiments on both English (133 writers) and Chinese (186 writers) databases verify the advantages of the method compared with other state-of-the-art approaches. Experiments on both English and Chinese databases resulted in >95% accuracy.

## USER FEEDBACK BASED CBIR SYSTEM FOR HISTOPATHOLOGY IMAGES

Proposed Siamese Network, a popular one-shot learning method for user relevance feedback on the retrieved images. This allows continuous training of the CBIR system adapting itself to the pathologist's subjective opinion. Soft training is done using Self Organizing Map for the initial training of the CBIR system and subsequently use relevance feedback for further training. The observed MAP and Precision at 1 score are 0.69 and 0.64 respectively for histopathology images.

## SPEAKER DIARIZATION USING AUTO-ENCODERS

Speaker Sequence Segmentation is the first step in many audio-processing applications and aims to solve the problem "who spoke when". It therefore relies on efficient use of temporal information from extracted audio features. In this project, we have utilized the Linear Predictive Coefficients of the speech signal and derived features to segment out the speech of individual speakers. We have employed both supervised and unsupervised learning using both auto-encoders and GMM to approach the problem.

## DETECTION OF FOCUSED Z-STACK IN CONFOCAL MICROSCOPY IMAGES

Confocal microscopes captures images at different focus. Often different part of the image is in-focus at different Z-Stack. This make the analysis challenging and time consuming for biologists.
Developed an algorithm for detecting focused z stack using Wavelet Power Spectral Density and k-means clustering. The algorithm is currently in use by Confocal Microscopy Lab, National University of Singapore.

## PERSON IDENTIFICATION USING RETINAL FUNDUS IMAGES

Proposed a retinal fundus image based biometric system. Veins network formed in the retina is unique to each individual and can be used for biometric system. Gabor wavelet filter and kernel matching are used for veins segmentation. Features representing the pattern of vein network are extracted at each point of intersection of veins. Identification is done using Bag of Words (BoW) model.

## ACTIVE NOISE CANCELLATION

Implemented LMS and RLS algorithm for active noise cancellation headphones.

## PUBLICATIONS

**"A MATERIOMICS APPROACH TO PULP REGENERATION"** Pei Fang, Aliz Kunstar, Apoorva Shivankar, Mohammed Adnan, Hemant Unadkat
AMERICAN ASSOCIATION OF ENDODONTISTS (AAE) CONFERENCE, 2018

**"A NOVEL TOPOGRAPHICAL DRIVEN BIOACTIVE MEMBRANE FOR GUIDED TISSUE REGENERATION"** Aliz Kunstar, Apoorva Shivankar, Mohammed Adnan, Hemant Unadkat
SINGHEALTH DUKE-NUS SCIENTIFIC CONGRESS 2018, SINGAPORE

**"PATHOLOGY IMAGE SEARCH FOR WHOLE-SLIDE IMAGING: A COMPLETE USER-CENTRIC CBIR SYSTEM"** Mohammed Adnan, Shivam Kalra, Hamid Tizhoosh
IN PROGRESS

## AWARDS

**SHASTRI INDO-CANADIAN RESEARCH FELLOWSHIP 2018**
**VECTOR INSTITUTE SCHOLARSHIP IN AI 2019**

## RESEARCH INTERESTS

COMPUTER VISION, MACHINE LEARNING, REPRESENTATION LEARNING, UNSUPERVISED DEEP LEARNING, GRAPH CNN, PROBABILISTIC DEEP LEARNING, GENERATIVE MODELS

## COURSEWORK

- PATTERN RECOGNITION & MACHINE LEARNING
- PROBABILITY RANDOM PROCESS
- DEEP LEARNING
- NATURAL LANGUAGE PROCESSING
- IMAGE PROCESSING
- SPEECH SIGNAL PROCESSING
- DIGITAL SIGNAL PROCESSING
- SIGNALS AND SYSTEMS

# LANGUAGES

**PROGRAMMING**
•C • C++ • Python • Matlab

**DEEP LEARNING FRAMEWORKS**
•Tensorflow • Keras • Pytorch

**FAMILIAR:**
• Verilog • 8086 Assembly • ARM Assembly •Caffe

# VOLUNTEER SERVICE

Mentor at IITG.AI

Campus Director for Hult Prize 2017

Teaching Assistant for Signals and Systems Course

Coordinator for Guwahati Half Marathon '17