Shaan ul Haque

Electrical Engineering | Indian Institute of Technology, Bombay

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Examination	University	Year	CPI/%
Graduation	IIT Bombay	2022	9.45
Intermediate/+2	Delhi Public School, Ranchi	2018	92.7
Matriculation	Delhi Public School, Ranchi	2016	10

SCHOLASTIC ACHIEVEMENTS

- Pursuing a Minor Degree in **Computer Science and Engineering** [Present]
- Awarded **Undergraduate Research Award-01** (URA-01) for research on **RADAR Imaging** ['20]
- Secured **All India Rank 111** in JEE Advanced among selected 172,000 aspirants ['18]
- Bagged a rank of **481** in JEE Mains among 1.2 million students across the whole country ['18]
- Stood among the **state wise top 1%** in National Standard Examination in Chemistry (NSEC)['18]
- Recipient of fellowship by the **Indian Institute Of Science (IISc), Banglore** for securing All India Rank of 847 in **Kishore Vagyanik Protsahan Yojana (KVPY)** ['17]
- Cleared **National Talent Search Examination (NTSE)**, standing among top 1000 students from the whole country and receiving scholarship from Government of India ['16]

RESEARCH EXPERIENCE

- **Micro-Doppler Effects in RADAR** [May '20 - Present]
  Prof. V.M. Gadre | Research
  - Studied the effects of rotating and vibrating parts in target object, also called Micro-Doppler effects, in RADAR Imaging and **Inverse-Radon Transform** based analysis
  - Devised an algorithm by employing **Bessel function** of first kind to express the demodulated signal and use the expression to filter the signal into its different Micro-Doppler components
  - Explored the accuracy of the proposed algorithm as the number of signal samples are reduced and came up with a mathematical formulation on what should be the reduction limit
  - Analyzed the use of **L-Statistics** in the removal of Micro-Doppler components for the estimation of **Body-Doppler** parameters and proposed a different approach to assess the same
  - Explored the effect of window length on **spectrogram visualization** and researched how to optimize the window length to achieve best **concentration measure**

TECHNICAL PROJECTS

- **Deep Learning for Channel Coding via Neural Mutual Information Estimation**[Apr '21]
  Prof. Abir De | Introduction of Machine Learning
  - Explored how machine learning algorithms are being applied in field of **communication**
  - Applied end-to-end learning to automatize channel encoding for given set of messages without knowing the channel's noise probability distribution by optimizing **Mutual Information**
  - Alternately trained two neural networks one for automatic channel encoding and one for estimating the Mutual Information and **achieved accuracy close to theoretical limit**

- **Statistical Compressed Sensing of Gaussian Mixture Models** [Apr '21]

  Prof. Ajit Rajwade | Advanced Image Processing

  - Course project to study the applications of **Gaussian Mixture Models** to estimate a large signals such as image from **under-determined system of linear equations**
  - Implemented the idea of **EM-algorithm** to approximate image patches coming from a set of Gaussian distributions and reconstruct the image from measured samples using linear decoder
  - Even with no knowledge of the signal or the distribution parameters achieved better performance than conventional compressed sensing techniques in image reconstruction

- **Temperature Display and Controller** [Apr '21]

  Prof. Joseph John and Prof. Kushal Tuckley | Electronic Design Lab

  - Designed a low-cost circuit that can be installed on any air-conditioning device for automatically maintaining temperature at a certain level and displaying it on LCD.
  - Designed an **on-off controller** to control the temperature along with proper interfacing with a high power circuit and used **PT-51 microcontroller** to display the measured temperature
  - Critically analyzed all the error incurred by the measurement devices and their effects on controlling the temperature

- **Fischer Faces vs Eigen Faces** [Nov '20]

  Prof. Ajit Rajwade and Prof. Suyash Awate | Digital Image Processing

  - Part of our course project which dealt with experimentation and comparison on face recognition algorithms on various face datasets like **Yale and CMU Face Database**
  - Implemented the idea of **Fischer Faces** for face recognition by employing the technique of **Fischer Linear Discriminant** and comparing the results with Eigen faces method which uses PCA
  - Applied the algorithm on different types of data set, discovered and reasoned on how the two algorithms work on non-cropped/cropped images and with/without changing postures

- **Image Processing Assignments** [Nov '20]

  Prof. Ajit Rajwade and Prof. Suyash Awate | Digital Image Processing

  - Studied and implemented various image processing algorithms as a part of CS663 course
  - Some of the algorithms used were various **interpolation techniques**, **bilateral filtering**, **Harris Corner detection** algorithm, **face recognition using PCA**

- **Product Planning Problem** [Nov '20]

  Prof. Abhiram Ranade | Design and Analysis of Algorithm

  - Applied the idea of **Linear Programming** on a real life situation problem to plan production output according to given constraints, using Pulp Library in Python and studied the dependence of time complexity of the algorithm on the given parameters

- **Autonomous Security Bot** [July '19]

  Institute Technical Summer Project (ITSP)

  - **Developed an autonomous security bot** installed with **Raspberry-Pi** as a microprocessor which could be used as a substitute for security personnel in an industrial or residential complex
  - Successfully employed **Wavefront Mapping Algorithm** to map the area, avoid any obstacle and find the shortest path possible to take the authorized person to his destination
  - Implemented the idea of **Face Recognition** through **OpenCV** to identify if a person is stranger or already known in the database of the bot and then take actions as required

- **Image Inpainting via Sparse Representation** [July '20]
  Self-Learning Project
  - Explored relevant papers on signal recovery via **Matching Pursuit**, **Orthogonal Matching Pursuit** and **K-SVD** algorithm to design a **Dictionary** for sparse representation of a signal
  - Implemented **lasso regression** to obtain a sparse representation of an image and use it to hide the target patch in it, such that the texture and style of the patch matches with the background

- **Prototype of digital display on LED matrix** [April '19]
  Prof. M.B. Patil | *Introduction to Electronics* (Course Project)
  - **Designed a circuit** to light up specific grid points on the matrix to generate a smiley face on it
  - Employed **555 Timer** with a potentiometer and applied the concept of **persistence of vision of human eye** to show the effect of resistance in timer on the voltage supplied to matrix
  - Made use of **decoders** and various **logic gates (74xx series)** to create the logic circuit which alternatively changes the voltage provided to a row based on the input voltage to the circuit

- **Immersive Pedagogical Practices and Twinning Activities** [Oct '19]
  Prof. V.M. Gadre | *Network Theory* (Course Project)
  - Explored how the application of **moving average filters** helps in noise reduction
  - Demonstrated the application of **Central Limit Theorem** for **Digital Noise Generation**

TECHNICAL SKILLS

- **Programming Languages and Software** - C++, Python, MATLAB, Keras, NumPy, HTML, GNUPlot, Keil μVision, Scilab, LaTeX, SolidWorks, NgSpice, Microsoft Packages, Quartus, Eagle, AutoCAD, XCircuit

KEY COURSES

- **Electrical engineering-** Digital Communication, Information Theory, Communication Lab, Controls Systems, Digital Signal Processing, Communication Systems, Electromagnetic Waves, Signal and Systems, Network Theory, Analog Circuits, Digital Systems
- **Mathematics and Statistics-** Probability and Random Processes, Data Analysis and Interpretation, Complex Analysis, Calculus, Linear Algebra, Partial Differential Equations
- **Computer Science-** Fundamentals of Machine Learning, Advanced Algorithms for Image Processing, Design and Analysis of Algorithms, Fundamentals of Digital Image Processing, Data Structure and Algorithm, Computer Programming and Utilization

MOOCs

- **Convolutional Neural Networks** [July '20]
  Self-Learning | *Coursera*
  - Implemented **YOLO algorithm** along with **non-max suppression** to detect cars in an image
  - Applied the technique of **Neural Style transfer** to create a new image with style taken from one image while content taken from the other

- **Natural Language Processing with Classification and Vectors Spaces** [July '20]
  Self-Learning | *Coursera*
  - Performed **sentiment analysis** of tweets using logistic regression and naive Bayes

- Learnt the notion of **vector space models** to vectorize words and use it for language translation

POSITIONS OF RESPONSIBILITY

- **Activity Associate | Green Campus, National Service Scheme, IITB** [Apr '19 - Apr '20]
  NSS is the largest student volunteer body in IITB, serving 1 Million+ people nationwide
  - **Worked in a team of 7 members** and **mentored 100+ volunteers** for the rejuvenation and preservation of flora and fauna of the institute
  - **Content Editor** for an online forum **Prakriti** to discuss and create awareness about various **ongoing environment related issues** throughout the world
  - **Marketing coordinator at Flare-Igniting Social Conscience** a pan-India socio-art competition which targeted over 25000+ schools and colleges to increase nature awareness among youth
  - Maintained **NSS Nursery** and sensitized the students about the environment by donating saplings, carrying out sapling collection drives and plantation drives in hostels
  - Played an integral role in the coverage of **Invisible Humans of IITB**, a Facebook series

EXTRA CURRICULAR ACTIVITIES

- Participated in **Van Mahotsav 2019-Tree Plantation Drive** organised by IIT Bombay
- Completed **80 hours** of social work under the **National Service Scheme, IIT Bombay**
- Awarded **silver medal** in shot put in inter-hostel **General Championship (GC)**, IIT Bombay
- Represented school in a science quiz, **Jharkhand State Level**, organised by **CSIR** in Jamshedpur
- Won First Prize in group singing in **Pandit Uma Dutt Sharma Sangeet Mahotsav, Jammu**
- Participated in **painting competition** conducted by **Jammu and Kashmir pollution board**
- Fluent in four languages - **English, Hindi, Urdu, Arabic**