Rishik kumar
Electrical Engineering
Indian Institute of Technology, Bombay

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Dual Degree (B.Tech. + M.Tech.)
Gender: Male
DOB: 10-02-1999

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2021	

RESEARCH EXPERIENCE

HF Radar for Estimation of Ocean Surface Currents Map | **Radar**   *(Aug 2020 - Present)*
Master's Thesis | Prof. Siddharth Duttagupta

- Reviewed the Method of Obtaining **Doppler Spectrum** received from **Bragg Scattering** by surface waves and various algorithms for estimating its **location** and **velocity** of **current** beneath it
- Working on Design of **Co-located Orthogonal Loops Antenna** for **Bearing Determination** of surface waves

Vertex Coloring using Oscillators | **Neuromorphic**   *(Aug 2019 - Nov 2019)*
Supervised Research Exposition | Prof. Udayan Ganguly

- Solved Vertex Colouring using **Ring Oscillator** ,modelled vertex as a oscillator and edge as **Coupling Capacitor**
- Solved the same problem using **Relaxation Oscillator** and compared the two methods.

Speech Localisation for Audio of 5th Chime Challenge | **Signal Processing**   *(Aug 2019 - Nov 2019)*
Summer Project | Prof. Rajbabu Velmurugan

- Studied Various Methods used in Signal processing like **Cross correlation** , **GCC** etc for calculation of **Time Difference of Arrival** and analysed them **quantitatively** using probabilistic approach of random processes
- Applied the methods on Sample audio files of short duration recorded on array with **known geometry** of mics and speakers. Using MATLAB verified the **location** of mics in array
- Applied the above method for **moving speakers** and using it **estimated the movements** of speakers
- Used **wiener filter** on the audio files recorded on various microphones and channels, estimated the the **location**

WORK EXPERIENCE

Audio Speech Recognition | **Meru Cabs, Mumbai**   *(May 2019 - Jul 2019)*
Guide: Jagrat Khandelwal

- Implemented **Detection of against policy behaviours** from **Call Recordings** of Customers and Drivers by recognising **certain words** and achieved Accuracy of **0.85** on validation dataset
- Experimented with **Hidden Markov Model** by mapping into **32 cepstral coefficients** from every time bin of recording (of **25ms** with sliding of **10ms**)
- Trained mapping of **32 cepstral coefficients to phonemes** (from **HMM**) using Fully Connected Nueral Networks and **phonemes to text** by training **Recurrent Neural Network** , achieving accuracy of **0.65**
- Obtained **Auditory Spectrogram** of time bins using **512** point **Fast Fourier Transform**
- Trained direct mapping of Above audio Spectrogram **64x64 images** to text by **CNN** , achieving accuracy of **0.85**
- Compared various parameters for evaluation of **HMM and CNN based model**

KEY PROJECTS

Non Invasive Glucometer | **Electronics**   *(Apr 2019)*
Course Project | Prof. Shalabh Gupta

- Designed Analog Circuit of **NIR Spectroscopy** based Noninvasive measurement of Blood Glucose
- Data collection of **100** Actual Blood glucose against Corresponding Voltage readings of designed circuit and mapped the two using **Regression Model**
- Displayed the real time readings on LCD and delivered a final alternative **low cost solution** for **monitoring blood-related** ailments achieving of accuracy of **75%**

Active Noise Cancellation Headphones —Control Systems   *(Apr 2019)*
Course Project | Prof. Debraj Chakroborty

- Designed circuit for active noise cancellation by **Negative Feedback** of real time **outer noise**.
- Designed and Implemented **Compensator** Circuit for Stabilising Open Loop system using **Bode Plots** of Magnitude and Phase.
- Achieved **20 Db** SNR at **100Hz** Noise input and tolerable performance for real noise environment

Inverted Pendulum |Control Systems *(Apr 2019)*
Course Project | Prof. Debraj Chakroborty
- Modeled the **State Space equations** for **2 states** for system and linearize it .
- Stabilised the System by designing **LQR control** and obtain the suitable **2X2 feedback matrix**
- Achieved stable inversion with error in **vertical** and **Base** angle within **3** degrees and **30** degrees

Real Time DTMF Generation and Decoding — Signal Processing *(Apr 2019)*
Course Project | Prof. Preeti Rao
- Generated **Dual Tone Multi Frequency** Signals using MATLAB and DSP processor
- Implemented **Real Time** Decoding generated from Cellphone **Dial Pad** by **FFT** using C5515 eZDSP

RISC Microprocessor | Processor *(Nov 2018)*
Course Project | Prof. Virendra Singh
- Designed **Datapath** having **ALU, IR, Memory, Decoders** for **8 Register 16 bit** Microprocessor
- Designed **Level 1** and **2 Flowcharts, FSM of Controlpath** for Set of **14** instructions from given **ISA**.
- Implemented the design in **Quartus** using **VHDL** , simulated in **RTL**, and tested the design on **FPGA**

Image Edge Detection |Image Processing *(Mar 2019)*
Course Project |Prof. V.M. Gadre
- Implemented **Smoothening of noisy Image** using **2-D Guassian filter** to remove False edges
- Implemented Convolution of Smoothened images with **Vertical** and **Horizontal Edge Filters** and generated a **Magnitude based Edge Image** using **Thresholding**
- Adding the **Magnitude Matrix and Direction Matrix** to generate Final Image of the original Edges

Digital Filter Design |Digital Filters *(Mar 2019)*
Course Project |Prof. V.M. Gadre
- Designed **IIR Bandpass** and **IIR Bandstop** filters with given specifications from analog **Butter-worth** and **Chebyschev** filters respectively using **bilinear transformation** formula
- Used **Kaiser** Window in MATLAB for designing **FIR filters**

Gender Recognition |Deep Learning *(Mar 2019)*
Course Project | Prof. Biplab Banerjee
- Extracted **20 features** such as meanfreq, median etc. from a .mp3 file using specan in R
- Build a **Fully Connected Neural Network** with 4 hidden layers and output containing 2 neurons
- Trained the implemented Neural Network for Gender classification on **Voice-Gender** dataset and fine tuned on **self-created dataset** to increase accuracy from **86%** to **90%** on Indian speakers

TECHNICAL SKILLS

Programming	Python, C++, VHDL. Embedded-C, Assembly Language
Area of Interest	Analog Electronics, Processors, Antenna/RADAR systems, Control Systems
Software	TCAD, Cadence, SPICE, MATLAB, ADS, CST
ML Frameworks	PyTorch, Tensorflow, Keras

KEY COURSES UNDERTAKEN

Antenna/RADAR:	Electromagnetic Waves, Microwave Integrated Circuits, Radiating Systems*, RADAR Systems*, Advance Antennas, EMIC
Signal Processing:	Signal Systems, Digital Signal Processing, Digital Communication, Comm. Systems
Processor Design:	Digital Systems ,Microprocessors, Processor Design, Microprocessor Lab
VLSI/Analog:	Analog Circuits, VLSI Design, VLSI Technology, Electronic Design LaB
Microelectronics	Microelectronics Simulation Lab, Microelectronics Lab, Physics of Transistors
Others:	Control Systems, Control Systems Lab, Nueromorphic Engineering, Biosensors and Bio-MEMS, Electrical Machines and Power Electronics, Machines lab

POSITION OF RESPONSIBILITIES

Teaching Assistant |*Prof. M.B. Patil* *(Aug 2020 - Present)*
- Tutoring a batch of **200+** students for the course **Introduction to Electronics** to assist the Professor.
- Entrusted with solving **tutorial problems**, clearing **concepts** and **evaluating answer sheets** of students

EXTRA-CURRICULARS
- Completed a year long course under **National Sports Organization** in **Atheletics** *(2017)*
- Secured **AIR 129** and **State rank 10** in **National Science Talent Search Examination - II Level** *(2016)*

Scholastic achievements and extracurricular activities are not verified by the Placement Cell