ADWAY GIRISH

SENIOR UNDERGRADUATE

ELECTRICAL ENGINEERING, IIT BOMBAY

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EDUCATION

Indian Institute of Technology Bombay (IITB) *Mumbai, India*

Bachelor of Technology in Electrical Engineering (EE), ***CGPA 9.60/10*** Jul. 2018 – Present

- **Honors** in Electrical Engineering and **Minor** in Mathematics
- Ranked **5th** in the Department out of 65 students

ACADEMIC ACHIEVEMENTS

- Recipient of an **Institute Academic Prize** for being the second best academic performer in the EE department *[2020-21]*
- Extended a full-time offer by Texas Instruments (India) following an **excellent internship performance** *[Summer 2021]*
- Received an **Undergraduate Research Award** (URA01) from IITB in recognition of a developmental effort in research for work done in Radar Signal Processing *[2020]*
- Awarded an **AP grade** (given to the top 2% of students) in two courses at IITB - Digital Communications, and Data Analysis and Interpretation - for exceptional performance *[Spring 2021, Autumn 2019 resp.]*
- Granted the **Urvish Medh Memorial Prize** for being the highest-ranked student in the EE department, IITB *[2018]*
- Secured **All-India Ranks** of **43** out of 155,158 participants in **JEE(Advanced)** and **55** out of 1,259,000 in **JEE(Main)**, standing first in the state of Karnataka in both *[2018]*
- Among the top 40 and 49 students chosen for the final camp to select **the team to represent India** at **International Olympiads** on Astronomy and Astrophysics and Chemistry (IOAA and IChO respectively) *[2018]*
- Selected for the **Kishore Vaigyanik Protsahan Yojana** fellowship (in Basic Sciences, initiated and funded by the Department of Science and Technology, Government of India) by securing an **All-India Rank** of **35** *[2016]*
- Awarded the prestigious **National Talent Search** scholarship (NTS) by the National Council of Educational Research and Training (NCERT), offered to around 1000 students all over India *[2016]*

RESEARCH PROJECTS AND INTERNSHIPS

Memoryless Broadcast Channels With Feedback *R&D Project*

Guide: Prof. Sibi Raj Pillai, EE Dept., IITB Jul. 2021 – Present

The capacity of single-user discrete memoryless channels cannot be increased by causal feedback. We study the possible capacity enlargement provided by noisy feedback for two-user Broadcast Channels (BC).

- Obtained the maximum feedback erasure probability that can provide any improvement in the binary erasure BC
- Currently looking to characterize capacity of the Gaussian BC with 1-bit quantized output (QGBC) with feedback
- Studying linear feedback coding schemes to achieve capacity enlargement for the QGBC

Spatially Coupled LDPC Codes Over Fading Channels *B.Tech Project*

Guide: Prof. Kumar Appaiah, EE Dept., IITB Jul. 2021 – Nov. 2021

Spatial coupling of LDPC codes has been shown to improve error performance, with high-complexity MAP thresholds under low-complexity BP decoding. We studied their performance over correlated, continuously-varying fading channels.

- Conducted literature review to understand why performance improves over conventional LDPC codes
- Analysed the best performance possible over fading channels using interleaving, subject to a latency-constraint
- Extended the application of low-complexity, reduced-latency windowed decoding to correlated fading channels without losing out significantly on performance

Micro-Doppler Estimation in Radar Signal Processing *Research Project*

Guide: Prof. Vikram Gadre, EE Dept., IITB Apr. 2020 – Present

Radar signals are used in detecting position and motion parameters of objects. Rotating or vibrating parts produce sinusoidal variations in the frequency called the micro-Doppler (mD), in addition to shifts produced by translation.

- Studied the detection of mD parameters from Radar signals using Inverse Radon Transform and proposed an alternate algorithm to separate BD components using L-statistics
- Devised an algorithm to extract mD components by expressing the demodulated signal in terms of Bessel functions and filtering out appropriate elements
- Looking to generalize a finite-rate-of-innovation-based dual focusing approach to mD estimation

Evaluation of Baseband Behavioural Models for Power Amplifiers *Summer Internship*
Texas Instruments (India) Pvt. Ltd., Bangalore, India May 2021 – Jul. 2021

Non-linearities in power amplifiers distort the signal and generate out-of-band components by causing the spectrum to spread. Removing them is essential to efficiently use the allocated bandwidth in wireless communication applications.

- Performed literature review of Volterra series and Memory Polynomial models and identified reasonable ones to pursue
- Implemented these models on MATLAB, obtaining considerable improvement over those currently in use
- Devised a 'peeling' algorithm to make the model implementable on an FPGA, hence ready for use in a real product

Teaching and Seminars

Teaching Assistant Autumn 2020, Spring 2020, Autumn 2019 resp.
MA109: Calculus I, PH108: Electricity and Magnetism, MA105: Calculus

- Mentored batches of 45+ students by taking weekly tutorial sessions and periodic doubt-clearing sessions
- Responsible for grading exam papers and assignments, and invigilation during exams

Applications of Fourier and Hilbert Transforms in Communication Systems April 2021
MA5106: Introduction to Fourier Analysis Seminar | Prof. Sanjoy Pusti, Mathematics Dept., IITB

- Presented applications of the Fourier and Hilbert transforms in Signal Processing and Communication to 20+ graduate students in mathematics, being the only engineering student in the class
- Demonstrated the intuition behind the transforms and a few examples of modulation and demodulation with a series of simulations on GNU Radio

Wire-tap Channels and Secrecy in Communication April 2021
EE708: Information Theory and Coding Course Project | Prof. Bikash Dey, EE Dept., IITB

- Studied and presented Wyner's wire-tap channel to provide secrecy when the intended receiver is stronger
- Read about using a shared key to communicate confidentially even with a stronger eavesdropper

Transform Domain Analysis in Electrical Engineering October 2019
EE225: Network Theory Class Term Assignment | Prof. Vikram Gadre, EE Dept., IITB

- Presented the use of Transform Domain Analysis in Signal Processing to 100+ students and faculty from TEQIP-III (Technical Education Quality Improvement Programme, Govt. of India) colleges
- Talked about the recent generalizations of Fourier Transforms such as Fractional Fourier Transforms to deal with non-stationary signals

Other Projects

Bank Queue Simulator on Pt-51 Microcontroller Mar. 2021 – Apr. 2021
EE337: Microprocessors Lab Project | Prof. Rajbabu Velmurugan, EE Dept., IITB

- Simulated the behaviour of a queue in a bank with four counters by distributing tokens to new customers as they arrive and allotting them to counters as they become free on a first-come-first-serve basis
- Interfaced a keyboard with the Pt-51 using UART to imitate the actions of the customers and tellers using keystrokes
- Displayed the token numbers being served at any moment on a 16×2 LCD module, using Timer Interrupts to notify a counter becoming free and the token number allotted to it on the screen

Audio Watermarking Sep. 2020 – Dec. 2020
EE338: Digital Signal Processing Application Assignment | Prof. Vikram Gadre, EE Dept., IITB

- Conducted literature survey of various watermarking techniques and identified echo data hiding and phase coding as effective and feasible methods to pursue

- Implemented these two schemes on MATLAB and obtained virtually error-free recovery of the embedded messages without any perceptible degradation in quality of the original audio files

Solar-Powered Street Light: Battery Management System Mar. 2021 – May 2021

EE344: Electronic Design Lab Course Project | Prof. Joseph John, EE Dept., IITB

- Implemented overcharge and undervoltage protection circuits for the LED load connected to a solar-charged battery
- Designed a PCB to make the circuit usable in a real product

Mentoring and Responsibility

Institute Student Mentor Jun. 2021 – Present

for incoming undergraduates at IIT Bombay

- Mentoring 12 first-year students, helping them have a comfortable transition and adaptation to college life
- Acting as the single point of contact for any issues they may face, in particular ensuring that they have the resources to attend online classes from home

Summer of Science Mentor for Signal Processing Summer 2019

Math and Physics Club, IIT Bombay

- Guided two students on a self-paced introduction to signal processing by helping them create an action plan, suggesting reference materials and reviewing their reports
- Curated mini-projects to provide hands-on experience - image compression using Haar wavelets, dual-tone multi-frequency generator and decoder, and identification of constituent instruments from simple music samples

Class Representative Jul. 2018 – May 2019

for the first-year batch of B.Tech in Electrical Engineering at IIT Bombay (69 students)

- Created effective communication channels to ensure that all students were kept updated on relevant issues
- Mediated discussions between faculty and the class as a whole to allow for smooth proceedings of courses

Workshops Attended

- JTG/IEEE Information Theory Society Summer School at IIT Kanpur *[Jun. 2021]*
- Final stage of selection of the team to represent India at IOAA 2018 *[Apr. – May 2018]*
- Vijyoshi Camp at Indian Institute of Science, Bangalore *[Dec. 2017]*
- Space Camp at U.S. Space and Rocket Center, Huntsville, AL, USA *[Mar. 2017]*

Relevant Coursework

- **Communication and Signal Processing:** Information Theory and Coding, Error Correcting Codes, Digital Communications, Communication Systems, Digital Signal Processing, Signals and Systems
- **Probability and Statistics:** Probability and Random Processes (Advanced and Basic), Estimation and Identification, Data Analysis and Interpretation
- **Mathematics:** Finite Fields and their Applications, Introduction to Fourier Analysis, Basic Algebra, Complex Analysis, Real Analysis, Differential Equations (Partial and Ordinary), Linear Algebra, Calculus
- **Miscellaneous:** Control Systems, Power Systems, Microprocessors, CMOS Analog Design, Digital Systems, Electronic Devices, Network Theory

Technical Skills

- **Languages:** Python, C++, Javascript, MATLAB, VHDL, HTML, LaTeX, Markdown, Spice, Embedded C
- **Software:** Keil, GNU Radio, XCircuit, Qt, Quartus, Eagle, AutoCAD, SolidWorks

Extracurriculars

- Completed an intermediate course in **Table Tennis** under the **National Sports Organization** at IIT Bombay *[2018-19]*
- Conferred the title of **Best All-Rounder** on graduation from Ryan International School, Bangalore *[2016]*
- Elected to the **Student Council** at Ryan International School as the **Deputy Education Minister** *[2014-15]*
- Completed 12 credits in practical examinations and 7 credits in theoretical examinations for **Electronic keyboard** from the **Trinity College of Music London**, a result of 6 years of musical training *[2007-13]*