Adway Girish

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Education

Indian Institute of Technology Bombay (IITB) *Mumbai, India*
Bachelor of Technology in Electrical Engineering, ***CGPA 9.60/10*** Jul. 2018 – Present

- **Honors** in Electrical Engineering and **Minor** in Mathematics
- Ranked $\mathbf{4^{th}}$ in the Department out of 65(?) students

Academic Achievements

- Recipient of an **Institute Academic Prize** for being the second best academic performer in the department *[2020-21]*
- Extended a full-time offer by Texas Instruments (India) following an **excellent internship performance** *[Summer 2021]*
- Awarded an **Undergraduate Research Award** (URA01) in recognition of a developmental effort in research for work done in Compressed Sensing Techniques in RADAR *[2020]*
- Received an **AP grade** (awarded to the top 2% of students) in EE328: Digital Communications and EE223: 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 department *[2018]*
- Secured **All-India Ranks** of **43** out of 165,000 participants in **JEE(Advanced)** and **55** out of 1,000,000 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 **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

Spatially Coupled LDPC Codes *B.Tech Project*
Guide: Prof. Kumar Appaiah, Dept. of Electrical Engg., IITB Jul. 2021 – Present

LDPC codes have shown great promise as capacity-achieving codes. A surprising result has been the significant improvement in decoding thresholds obtained by coupling individual LDPC codes together in a convolutional fashion. This improvement is what we study - in particular, we look at their performance over continuously varying fading channels.

- Performed literature review and simulations to understand why these perform better than conventional LDPC codes
- Studying the trade-off between the speed of channel variation and the codelength needed for maximum diversity
- Analysing the performance of low-complexity, reduced-latency windowed decoding

Discete Memoryless Broadcast Channels With Feedback *R&D Project*
Guide: Prof. Sibi Raj Pillai, Dept. of Electrical Engg., IITB Jul. 2021 – Present

It is well-known that the capacity of single-user discrete memoryless channels cannot be increased by causal feedback. With multiple users, this is not the case. We are studying the capacity enlargement provided by (possibly noisy) feedback (from one or both receivers) for two-user Binary Erasure and Binary Symmetric Broadcast Channels (BE-BC, BS-BC resp.).

- Derived an upper bound for erasure probabilities in the feedback that can provide any improvement in the BE-BC
- Obtained an outer bound for the capacity region achievable through stronger receiver feedback only in the BS-BC
- Looking at providing achievable code constructions to arrive at improved inner bounds

Compressed Sensing Techniques in RADAR Signal Processing *Research Project*
Guide: Prof. Vikram Gadre, Dept. of Electrical Engg., IITB Apr. 2020 – Present

RADAR signals are well-known for their application in detecting position and motion parameters of objects. Rotating or vibrating parts produce a sinusoidal variation in the frequency called the micro-Doppler, in addition to the shift produced by translation. Identifying and separating these components from the received RADAR signal is what we looked at here.

- Studied the detection of micro-Doppler parameters from RADAR signals using Inverse Radon Transform
- Devised an algorithm to express the demodulated signal in terms of Bessel functions and to use this in extracting the micro-Doppler components by filtering out appropriate elements
- Proposed an alternative approach to detect Body-Doppler parameters following the removal of micro-Doppler components using L-statistics to determine their presence

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. To do this, we first mathematically model the non-linearity, then use Digital Pre-Distortion to apply the reverse effect.

- 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 of 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

- Presented applications of the Fourier and Hilbert transforms in Signal Processing and Communication to 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

- Studied and presented Wyner's wire-tap channel to provide secrecy when the intended receiver is stronger
- Read about the use of 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

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

Other Projects

Bank Queue Simulator on Pt-51 Mar. 2021 – Apr. 2021
EE337: Microprocessors Laboratory Course Project | Prof. Rajbabu Velmurugan

- 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

- Performed 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

Thesis and Publication Review Dec. 2019 – May 2020

Guide: Prof. Vikram Gadre

- Involved in the quality improvement of the final doctoral thesis of a PhD student, on the topic of Time-Frequency Distributions, which has now been accepted and successfully defended
- Reviewed associated papers for errors and suggested corrections, leading to their successful publication
- Suggested appropriate improvements to acknowledge recommendations from independent reviewers

Mentoring and Responsibility

Institute Student Mentor Jun. 2021 – Present

for incoming undergraduates at IIT Bombay

- Part of a team of 133 senior students selected via a rigorous procedure comprising of SOP, peer reviews and interviews
- Responsible for helping students have a smooth and comfortable transition and adaptation to college life

Summer of Science mentor for Signal Processing Summer 2019

Math and Physics Club, IIT Bombay

- Guided two junior 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 musical instruments from

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 team to represent India at IOAA 2018 *[Apr. – May 2018]*
- Vijoyshi 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]*
- Hold 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]*