

AREAS OF INTEREST

Wireless Communication, Digital Signal Processing, Image Processing.

MAJOR PROJECT AND SEMINAR

- **M.Tech Project: An efficient channel estimation scheme in MIMO TDD systems** (May'19 - Present)

Guide: Prof. Kumar Appaiah, Electrical Engineering, IIT Bombay

Objective: To design an **efficient channel estimation** scheme in Time Division Duplexing (TDD) with the help of **feedback** in MIMO Communication which will reduce the effect of pilot contamination on MIMO channel estimation.

Completed work: Implemented **Multi Cell MMSE based MIMO precoding** in multiple antenna cellular systems which used non-orthogonal pilots for channel estimation.

- Analysed and implemented **covariance based channel estimation** which uses Bayesian estimation in single cell multi antenna system and observed its performance based on rate vs number of antennas.
- Implemented **Kalman estimation** for multi antenna cellular system.
- Parameterized the feedback for **postcoder** in massive **MIMO TDD** systems with multi antenna users.
- Formulated a lower bound on the achievable rate for systems with **perfect CSIT** and **partial CSIR**.

Ongoing work: Working on implementing a basic precoder which utilises the information obtained from **Kalman** estimate in **coordinated MIMO** systems.

- **M.Tech Seminar: Inter cell interference in Multi Cell MIMO systems** (Jul'18 - Nov'18)

Guide: Prof. Kumar Appaiah, Electrical Engineering, IIT Bombay

- Studied the structure and working of **MIMO systems** and impact on BER on using Non-orthogonal pilot sequences for channel estimate.
- Simulated **BER vs SNR** for MIMO systems in Interference and Interference-free scenarios to study the impact of pilot contamination on the performance of the system.

WORK EXPERIENCE

- **Systems Engineer | Infosys Technology Ltd** (Dec'15 - Jul'17)

- **Tools Used:** Oracle Peoplesoft.
- **Roles and responsibilities:** Part of the team which developed an application which automates billing for the customers of the client (Manpower group).
- Wrote code for fetching data into the module and to develop features using Oracle Peoplesoft ERM tool.
- Assisted in designing billing template in XML and in completion of Technical Document Report for the project.

KEY PROJECTS

- **Interview Management Software [Non-Academic Project]** (Feb'18 - present)

Guide: Prof. Bikash Kumar Dey, Prof. Madhu N. Belur, Electrical Engineering, IIT Bombay

- **Lead role** in building an online system that made **automatic coordination** across interview committees possible through their interface.
- The online system allowed committees to decide in **real-time** using a **cross platform web application** about interviews.
- Built various other **peripheral interfaces** to collect data at different times from students and other sources.
- This system was used **successfully** in the last **3** admission sessions.

- **Scheduling in 4G LTE** (Jan'18 - Apr'18)

Guide: Prof. Abhay Karandikar, Electrical Engineering, IIT Bombay

- Studied different scheduling schemes for **resource block allocation** to users in **LTE** systems.
- Implemented **channel aware scheduling** schemes such as Maximum Throughput, Proportional Fairness, Throughput to Average and compared all three scheduling schemes based on metrics such as **cell throughput**, **average user throughput** and **Jain Fairness index**.

- **Simulation of Cellular System in MATLAB** (Jan'18 - Apr'18)
Guide: Prof. Abhay Karandikar, Electrical Engineering, IIT Bombay
 - Computed **SIR**, **blocking probability** for different cluster sizes and **sectoring**.
 - Analyzed **handover** process and **ping-pong** rate for different user mobilities and hysteresis values.
 - Analyzed BER performance for **space** and **time diversity** in a slow flat fading Rayleigh channel.
 - Analyzed BER performance for a single-cell and multi-cell scenario in a **CDMA** cellular system.
- **Image Dehazing** (Jul'18 - Nov'18)
Guide: Prof. Amit Sethi, Electrical Engineering, IIT Bombay
 - Implemented **Color Attenuation Prior** and **Dark Channel Prior** techniques to estimate the depth map.
 - Implemented **Guided Filter** to reconstruct the Haze-free image using Hazy Image and its depth map.
- **Basic Image Editor tool in Python** (Jul'18 - Nov'18)
Guide: Prof. Amit Sethi, Electrical Engineering, IIT Bombay
 - Built a **GUI tool using PyQt** to implement Histogram equalisation, Gamma correction, Log transformation, Horizontal and Vertical edge detection using Sobel operators, blurring and sharpening with a mechanism to control the extent of blurring and sharpening respectively.
 - Implemented **Image Deblurring** using Inverse filter, Truncated inverse filter, Weiner filter, Constrained least square filter and analysed the performance with help of metrics PSNR and SSIM.
- **Wavelet based leaders and P-leaders in Multi Fractal Analysis** (Jul'18 - Nov'18)
Guide: Prof. Vikram M Gadre, Electrical Engineering, IIT Bombay
 - Studied about **p-exponents** and multi-resolution quantity called **p-leaders** which measure negative regularity which appear in most real time signal analysis.
 - Simulated p-leaders for several signals and was able to prove their convergence with **DWT based Wavelet leaders** as **p** becomes large.
- **Spam URL classification using Machine Learning** (Jan'19 - Apr'19)
Guide: Prof. Gaurav S kasbekar, Electrical Engineering, IIT Bombay
 - Studied 3 among the Top-10 vulnerabilities of **OWASP** Standard mainly **XML external entity** attack, **SQL injection**, **cross site scripting** with practical implementation and proposed solutions.
 - Classification of URLs using Machine Learning Techniques like **Logistic Regression**, **Naive Bayes**, **Support Vector Machine**, **One-vs-Rest**.
 - An increase of more than **2 percent** in accuracy was obtained by replacing logistic regression by One-vs-Rest.

RELEVANT COURSES

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| • DSP and its Applications | • Wireless Mobile Communications | • Optimisation |
| • Statistical Signal Analysis | • Wavelets | • Network Security |
| • Applied Linear Algebra | • Image Processing | • Information Theory and Coding |

TECHNICAL SKILLS

- Languages** : C, C++, Python, HTML, PHP, JQuery, Bash scripting.
- Tools** : MATLAB, L^AT_EX, Git.

POSITIONS OF RESPONSIBILITY

- **System Administrator: PC Lab, Electrical Department, IIT Bombay** (Jul'17 - Present)
 - Building and maintaining the website of EE department, maintaining TA feedback and allotment portals.
 - Providing mail service, storage space, computing facilities and network facilities to the department.
 - Handled the Department M.Tech and PhD Admission process; Helped in generation of admit cards, coordinating the answer sheet corrections.
- **Web Nominee: Post Graduate Academic Council, IIT Bombay** (Jul'18 - Jun'19)
 - Designed new web portal for PGAC which is used by all the Post Graduate students of the institute.

CO-CURRICULAR ACTIVITIES

- Completed **Machine Learning** course by **Andrew Ng** from Coursera. (2019)
- Conducted an introductory session on **Linux, Vim and Git** as a part of Bridge Course which helps in smooth transition of new joiners to institute. (2019)
- Volunteered for an introductory session on **Python** which was conducted as a part of Bridge Course. (2019)
- Completed a **100 hrs** course on the **Chinese** language conducted by IR office, IIT Bombay. (2019)
- An active member of **National Service Scheme (NSS)** for 2 years and attended a camp conducted in a village to perform social activities like conducting medical camps, cleaning and painting common facilities like village panchayat, temple etc. (2013)
- Completed basic course in the **French** language from Vivekananda Institute of Languages, Hyderabad. (2012)
- Volunteered for 1st **World Parliament on Spirituality** for a week as part of NSS activity. (2012)
- Completed Diploma in spoken English from Vivekananda Institute of Languages, Hyderabad. (2012)