

## 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 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 antennas 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 implementation 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 & NON ACADEMIC PROJECT

- **Interview Management Software | Electrical Engineering Department, IITB** (*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.
  - 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.
- **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.
  - Wrote SQL queries to fetch data to 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 COURSE PROJECTS

- **Scheduling in 4G LTE** (*Jan'18 - Apr'18*)  
Guide: *Prof. Abhay Karandikar, Electrical Engineering, IIT Bombay*
  - Studied about 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 Octave** (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 using color attenuation prior and dark channel prior** (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 **p-leaders** which measure negative regularity which appear in most real time signal analysis.
  - Simulated p-leaders for several signals and were 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.
  - Spam URL classification 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 classification.

## RELEVANT COURSES

- |                               |                                  |                                 |
|-------------------------------|----------------------------------|---------------------------------|
| • 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, Bash scripting, HTML, PHP.
- Tools** : Matlab/Octave, L<sup>A</sup>T<sub>E</sub>X, Git.

## POSITIONS OF RESPONSIBILITY

- **System Administrator: PC Lab, Electrical Department, IIT Bombay** (Jul'17 - Present)
  - Building and maintaining website of EE department, maintaining TA feedback and allotment portals.
  - Provide mail service, storage space, computing facilities and network facilities to department.
  - Designed online portals and automated Interviews co-ordination in the department admission process.
- **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 & EXTRA CURRICULAR ACTIVITIES

- Completed **Machine Learning** course by **Andrew Ng** from Coursera. (2019)
- Conducted a introductory session on **Linux, vim and Git** as a part of Bridge Course which helps in smooth transition of new joinees to institute. (2019)
- Voluntered for an introductory session on **Python** which was conducted as a part of Bridge Course. (2019)
- Completed a **100 hrs** course on **Chinese** language conducted by International Relations office IIT Bombay. (2019)
- Completed Basic course in **French** Language from Vivekananda Institute of Languages, Hyderabad. (2013)
- Completed Diploma in spoken English from Vivekananda Institute of Languages, Hyderabad. (2012)
- 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)
- Voluntered for 1<sup>st</sup> **World Parliament on Spirituality** for a week as part of NSS activity. (2012)