Ameya Anjarlekar

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Education

- **Indian Institute of Technology Bombay** — Mumbai, India
  Bachelor of Technology in Electrical Engineering; ***CPI: 9.62/10*** *(2017-2021)*
- **Ratanbai Walbai Junior College** — Mumbai, India
  High School; HSC% 89.85 *(2015-2017)*
- **Indian Education Society, Chandrakant Patkar Vidyalaya** — Thane, India
  Matriculation; SSC% 94.80 *(2005-2015)*

Pursuing a **minor** in **Computer Science and Engineering**

Publications

- Generalized Fractional Ambiguity Function and Its Applications
  Peeyush Sahay, Izaz Ahamed Shaik Rasheed, Pranav Kulkarni, Shubham Anand Jain, **Ameya Anjarlekar**, P. Radhakrishna Vikram M. G. Generalized Fractional Ambiguity Function and Its Applications. Circuits Syst Signal Process 39, 4980–5019 (2020)
- Generalized Fractional Matched Filtering and its Applications
  P. Sahay, **A. Anjarlekar**, S. A. Jain, P. Radhakrishna and V. M. Gadre, "Generalized Fractional Matched Filtering and its Applications," 2020 National Conference on Communications (NCC), Kharagpur, India, 2020, pp. 1-6, doi: 10.1109/NCC48643.2020.9055991

Industrial Experience

- **Video Compression for efficient Remote Support video storage and retrieval** — Daikin Industries
  Guide: Mr. Hari Prasad, Mr. Kumata Toshiaki *(June 2020)*
  - Achieved around **70% video data compression** by developing a **Hitomi Camera**-inspired algorithm
  - Devised a video reconstruction algorithm by exploiting the spatial as well as temporal redundancy through **DCT** basis or a **learned dictionary**. The reconstructed video achieved a **PSNR** of around **24**
  - The video compression algorithm is **data independent** (when DCT used) and quality of reconstructed images is significantly improved (around 3-4 PSNR) by replacing DCT basis with learned dictionary

Research and Technical Projects

- **Sensing Matrix Design with Weighted Mutual Coherence** — IIT Bombay
  Guide: Prof. Ajit Rajwade *(August 2020 - Present)*
  - Designed sensing matrices by minimizing weighted (determined from training data) **mutual coherence**.
  - Proposed an approach to design weights to handle rotation, scaling and translation of images
  - Currently working on designing efficient sparse binary sensing matrices through weighted mutual coherence minimization. The sensing matrix is designed for use in group testing for **COVID 19**
- **Compressed Sensing with Deep Image Prior** — UC San Diego
  Guide: Prof. Piya Pal *(July 2020 - Present)*
  - Working to develop **Deep Image Prior** based compressed sensing approach for the case of limited data
  - Proposed a **rectified sparse Bayesian** based learning technique for training of the model
- **Generalized Time-Frequency Transform in Radar** — IIT Bombay
  Guide: Prof. V.M. Gadre, Dr. Peeyush Sahay(DRDO) *(April 2019 - May 2020)*
  - Proposed **Generalized Frequency Ambiguity Function** for parameter estimation of chirp signals
  - Developed **Generalized Fractional Matched Filter** by which object parameters like acceleration and velocity can be more accurately estimated using Generalized Time-Frequency Transform
  - Received **IRCC Honorarium** for excellent R&D work in Radar Signal Processing

- **Supervised Detection of Tennis Ball from Camera Stream [Doc][Code]** IIT-B Mars Rover Team
  University Rover Competition(URC 2019) *(Aug 2018 - Dec 2019)*
  - Completed the **ball detection** task required in the **autonomous** operations of the rover
  - Devised an algorithm for the task which comprises of first pre-processing the test images, then using **transfer learning** by which we re-train an already trained Alexnet model on our generated dataset
  - Each test image was pre-processed using **circular hough transform** to extract features regarding shape
- **Image Reconstruction for Parallel MRI [Doc][Code]** IIT Bombay
  Guide: Prof. V.M. Gadre *(September 2018 - June 2019)*
  - Implemented a modified version of **GRAPPA** algorithm on **Xilinx Zynq-7000 FPGA Board** for image reconstruction used in the indigenous MRI machine at IIT Bombay
  - Awarded **Undergraduate Research Award** (URA-01) by IIT Bombay for this contribution
- **DNA Sequencing Through Neural Networks** IIT Bombay
  Guide: Prof. Manoj Gopalkrishnan *(November 2018 - July 2019)*
  - Developed a novel technique to estimate the **conditional probability** distribution from samples using **Kernel Density Estimation** technique applied along with Artificial Neural Networks.
  - Applied the above model to develop a **state of the art** technique to correctly predict the micro-scale spatial information like the relative positions of bio-molecules without the need of **conventional optics**

Course Projects:

- **Use of Residuals for Image Denoising (Guide: Prof. Ajit Rajwade)**: Implemented a denoising algorithm using the residual image. Also, studied and implemented metrics for quality of image denoising without the use of the reference image. Report can be found here
- **Blind Compressed Sensing (Guide: Prof. Ajit Rajwade)**: Reviewed various theoretical derivations of Blind Compressed Sensing and implemented the corresponding algorithm for joint estimation of dictionary and images. Report can be found here. Mathematical analysis is provided here
- **Target Parameter Estimation from Compressive Measurements (Guide: Prof. Vikram Gadre)**: Estimated parameters of a rotating target through Doppler and Micro-Doppler estimation of corresponding radar signal from its compressive measurements. Report can be found here.
- **Distortion Correction for Modulation Recognition (Guide: Prof. Sunita Saragawi)**: Implemented CNN model for the frequency estimation of signals in the **"RML2018.10a"** dataset and analyzed its performance over various Signal to Noise (**SNR**) ratios. Report can be found here. Code is provided here
- **Wine Quality Detection (Guide: Prof. Sunita Saragawi)**: Implemented regression decision tree which included both pre and post pruning for classification. Achieved **second** best error in **Kaggle** competition

Academic Responsibilities

Department Academic Mentor

- Part of a team of **35** mentors after rigorous rounds of extensive peer reviews and interview
- Mentoring **6** sophomore students by providing academic guidance and help in other non-academic issues

Teaching Assistant

- Responsible for conducting tutorial sessions and evaluations for courses **PH 108** (Electricity and Magnetism), and **MA 108** (Differential Equations I)
- Head teaching assistant for the course **MA 207** (Differential Equations II) and responsible for conducting doubt solving sessions, paper setting and evaluations

Instructor: Machine Learning Bootcamp

- Conducted sessions on Deep Learning, K-Means, EM algorithm, Bayesian Models and Decision Trees

Scholastic Achievements

- Awarded the 'Institute Technical Special Mention' for contribution to technical sphere in the institute [2020]
- Shortlisted as one of the Top **34** teams in the **Mercedes-Benz Digital Challenge**, India [2019]
- Secured an **AP** grade (awarded to less than 1% students) in course on differential equations (MA 207) [2018]
- Secured an All-India Rank **132** in **JEE - Advanced** and an All-India Rank **215** in **JEE - Main** [2017]
- Awarded fellowship by the Indian Institute of Science (IISC), Bangalore for securing an All-India Rank of **243** in **KVPY** (Kishore Vaigyanik Protsahan Yojana) out of around 80,000 students [2017]
- Among the top **500** students of the nation to be selected for the **Indian National Maths Olympiad** [2015]
- Secured the nationwide top **1**% position in **NSEP** (National Standard Examination in Physics) conducted by IAPT (Indian Association of Physics Teachers) [2016]
- Awarded **A2** certificate by Goethe-Institute for **German language** [2014]

Technical Skills & Interests

Skills: C++, Python, Matlab (Expert), Keil, VHDL, Pytorch, Keras, OpenCV, Scikit-learn, LaTeX
Interests: Signal/Image Processing, Compressed Sensing, Deep Learning, Statistics, Reinforcement Learning

Key Courses Taken

- **Probability and Statistics**: Data Analysis and Interpretation, Probability and Random Processes
- **Computer Science**: Introduction to Machine Learning, Design and Analysis of Algorithms, Data Structures and Algorithms, Digital Image Processing, Advanced Image Processing, Reinforcement Learning (edX), Theoretical Machine Learning, Introduction to Programming
- **Mathematics**: Real Analysis, Linear Algebra, Differential Equations(I and II), Complex Analysis
- **Electrical Engineering**: Signals and Systems, First Course in Optimization, Microprocessors, Wavelets, Digital Communications, Network Theory, Digital Communication, Digital Signal Processing

Extra-curricular Achievements

- Responsible for conducting fine arts competitions for Mood Indigo, annual social fest of IIT Bombay [2017]
- Completed **NCC** (National Cadet Corps) training and attended its **Annual Training Camp** [2017]
- Volunteered career counseling drive organized by Abhyuday (Social service body of IIT Bombay) [2017]