# Milind Kumar Vaddiraju

*Curriculum Vitae*

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## EDUCATION

| Program | Institution | %/CGPA | Completion |
|---|---|---|---|
| B.Tech: Electrical Engg. | Indian Institute of Technology Madras | 9.82/10 | 2020 |
| Class XII (State) | V.V.S Sardar Patel P.U. College, Bangalore | 97.6% | 2016 |
| Class X (CBSE) | Vidyaniketan Public School, Bangalore | 10/10 | 2014 |

## SCHOLASTIC ACHIEVEMENTS

- Awarded the **S. N. Bose scholarship** (**top 1.5%** in India) in 2019 to pursue a research internship in the United States.
- Selected for the **Caltech LIGO SURF Program** (1 of 4 from India) in 2019 to pursue research at Caltech.
- **Department rank 2 out of 127 students** in the Department of Electrical Engineering at the end of 8 semesters.
- Awarded the **Sri S Subramanian Prize** in 2017 by IITM for the highest CGPA among all 1$^{st}$ year students of the batch.
- Awarded the **Sarasvidya Scholarship** in 2017 for the highest CGPA among all students after the first year.
- Awarded the **O.P. Jindal Engineering and Management Scholarship** in **2017** and **2018**.
- Awarded **K.V.P.Y. fellowship** in 2014. Ranked **189** out of **1.3 Million** contenders in **JEE Advanced Examination.**

## COURSEWORK

- Digital Signal Processing
- Applied Linear Algebra for Electrical Engineers
- Probability Foundations for Electrical Engineers
- Nonlinear Optimisation: Theory and Algorithms
- Deep Learning
- Principles of Neuroscience
- Communication Systems
- Digital Communication Systems
- Introduction to Wireless and Cellular Communication
- Advanced Topics in Communications

## PROJECTS AND INTERNSHIPS

**L1 Controller Design** October 2020 - Present

*Indigenous 5G Testbed, IIT Madras*

***Advisor: Prof. Radhakrishna Ganti***

- Designing and implementing a software interface to translate inputs from L2/L3 to PHY into configurations for hardware modules. Optimising the interface to consume minimum time measured in number of clock cycles.

**5G NR Receiver Simulation** November 2019 - Present

*Indigenous 5G Testbed, IIT Madras* Abstract

***Advisor: Prof. Radhakrishna Ganti***

- Designed and implemented a bits to bits communication system according to 5G NR specifications in MATLAB.
- Evaluated the performance of multiple channel estimation and equalization algorithms in the single user, SISO case for AWGN and multipath fading channel.
- Presented the obtained results in a talk titled *"Receiver design and implementation for the Indigenous 5G Testbed"*.
- Currently simulating a receiver for multi-user MIMO in the case of a multipath fading channel. Designing transmitters and receivers for the use of SRS, CSI-RS and PRACH. Future work involves design of precoder matrices.

**Laser Beam Position Tracking for LIGO Interferometers** May 2019 - July 2019

*40 Meter Prototype Interferometer Laboratory, Caltech* Technical Report

***Advisors: Prof. Rana Adhikari and Dr. Koji Arai***

- Assisted in the installation of a Gigabit Ethernet camera at the viewport of the MC2 optic of the mode cleaner cavity of the 40m interferometer. Developed software using pypylon to interact with the installed camera.
- Evaluated the performance and suitability of image processing algorithms employing thresholding, contour detection and centroid calculation for tracking position of laser beam spot on the suspended mirror.
- Used convolutional and LSTM networks for laser beam tracking and successfully detected motion of amplitude 3mm with maximum error under 20%.
- Presented this work in a talk titled "*Laser beam position tracking for LIGO interferometers*" at Caltech.

**Source Separation** Dec 2018 - May 2019
*Speech Lab, IIT Madras* Technical Report
***Advisor: Prof. C. S. Ramalingam*** Github Repository

- Implemented multiple algorithms for Non-negative Matrix Factorization (NMF) in Python and evaluated their performance in comparison to the implementations in scikit-learn library.
- Implemented the paper *"Monaural Sound Source Separation by Nonnegative Matrix Factorization With Temporal Continuity and Sparseness Criteria"* and compared the performance of the proposed algorithm with that of plain NMF. Created a YouTube tutorial for the same.
- Experimented extensively to determine the effect of temporal continuity and sparseness terms on the SNR.
- Compared the performance of Hann, Hamming, Blackman-Harris and Chebyshev windows on the separation task.

**Music Mood Annotation** June - August 2018
*Fraunhofer IDMT* Technical Report
***Advisor: Prof. Karlheinz Brandenburg***

- Built a deep learning system for automatic tagging of music with both discrete emotional labels and dimensional valence-arousal values for music classification and retrieval from large datasets.
- Compiled a database of 80 hours of music with valence-arousal ratings equivalent to 28 emotion labels.
- Used mel spectrograms and a musically motivated frequency domain representation for the audio.
- Evaluated the performance of 3 CNN architectures for mood labeling based on MIREX 2016 submissions and obtained a classification accuracy of 70% on the high and low valence and arousal classification tasks.

**Half-duplex System Design using USRP N321** December 2019 - May 2020
*Indigenous 5G Testbed, IIT Madras* Overview
***Advisor: Prof. Radhakrishna Ganti*** Technical Report

- Set up and designed a user manual for USRP N321 at the Indigenous 5G Testbed.
- Implemented a transmitter and receiver operating at 122.88 MSPS on the USRP using GNU Radio.
- Tested functionality by transmitting and receiving 1 frame of 5G NR data using the USRP and Keysight VSA and VSG.

**MIMO Channel Estimation using PDSCH DMRS** April 2020 - June 2020
*Course Project, IIT Madras* Overview
***Advisor: Prof. Radhakrishna Ganti*** Github Repository

- Generated PDSCH DMRS symbols according to TS 38.211 using MATLAB.
- Implemented channel estimation algorithms for the single user MIMO case.
- Studied the effect of SNR on channel estimation in the case of a multipath fading channel.

## EXTRACURRICULAR ACTIVITIES

- **Head, Lectures and Demonstrations team, Evolve, Shaastra 2019** (Technical Festival, IITM)

Headed a team of 15 to organize IIT Madras' annual lecture series with a budget of over 7 Lakh INR. Organized 15 lectures including those of **Viswanathan Anand, Dr. Venkatraman Ramakrishnan and Dr. Juergen Schmidhuber**.

- **Coordinator, Lectures and Demonstrations team, Evolve, Shaastra 2018** (Technical Festival, IITM)

Organized **13 lectures** in a **team of 10** catering to a live audience of **over 3600** and over **12000** on social media. Personally coordinated lectures of **Prof. Karlheinz Brandenburg**, **Dr. Geoffrey Hinton**, and **Dr. Vilayanur Ramachandran.** Conducted Shaastra's **first TEDx style event, ShaastraX,** catering to over **400 schoolchildren** from all over Chennai.