

# MANAS VASHISTHA

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## EDUCATION

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**Indian Institute of Technology Bombay**, *Mumbai, India*  
*Dual Degree* in Electrical Engineering with *M.Tech* in Microelectronics  
*Minor* in Center of Studies in Resources Engineering

July '17 - Present

## EXPERIENCE

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**University of Cambridge**, *Cambridge, UK*  
*Research student* under [Cecilia Mascolo](#) and, [Jagmohan Chauhan](#)  
**Incremental Learning on Resource Constrained Devices**

May '19 - Present

- Optimized various incremental learning algorithms and implemented them with machine learning classifiers
- Trained & tested these algorithms on UCI-HAR and Opportunity datasets to classify certain activities
- Compared and analysed different incremental learning classifiers to justify the variations in the accuracies
- Deploying these models on resource constrained devices by restricting the memory usage and latency
- Exploring techniques to decrease the power consumption by the model so as to make it more efficient

## PROJECTS

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**Object Detection & Classification in Satellite Images**  
*Computer Vision*

Winter '18  
*Self Project*

- Developed a Faster R-CNN model to detect objects in Satellite images & form bounding boxes
- Classified the objects detected in an image into different classes like airplanes, trees, buildings etc
- Observed the changes in the land features of a chosen locality over a certain period of time

**Automatic Text Summarizer**  
*Natural Language Processing*

Fall '18  
*Self Project*

- Implemented an interactive text summarizer which automatically produces a summary of a document
- Integrated an approximate summarization model to the original model to guarantee interactive speeds even for large text collections of multiple topic-related documents so that the user is kept engaged in the process
- Text summary is computed at every iteration by taking the document and user feedback into account. Also for each iteration the user feedback of all the previous iterations is taken into account along with document

**ChordIt — Chord Sequence Extraction from Music**  
*Machine Learning* under [Biplab Banerjee](#)

Spring '19  
*CSRE, IIT Bombay*

- Processed the audio files to retrieve  $\mathbb{R}^{12}$  dimensional [Pitch Class Profile](#) vectors.
- Achieved 95% train, 86% test accuracy with *Radial Basis Function* kernel and *SVM Classifier*
- Incorporated mini-batches method in SGD Optimizer for [Online Learning](#) on real-time data
- Used [Butterworth filter](#) for creating a band pass filter to smoothen the function for better sampling.

**Face Detection**  
*Computer Vision*

Fall '18  
*Self Project*

- Exploited [Viola Jones algorithm](#) for fast detection of a human face in a picture
- Utilised [AdaBoost](#) to improve the performance of machine learning algorithm
- Implemented the algorithm using [Haar Cascades](#) and *Integral images*
- Achieved an accuracy of 87% over the testing dataset

**Multi-Cycle (RISC) Processor**  
*Processor Design* under [Virendra Singh](#)

Spring '19  
*Electrical Engineering, IIT Bombay*

- Developed the architecture of a basic computer which follows a predefined set of instruction
- Created FSM (for implementation of the developed architecture) by assigning specific tasks to each state
- Tested the design on a new sequence of instructions by looping over all the instructions in the set
- Implemented the architecture & the testing part in VHDL and verified outputs using an instruction sequence

**Maze Solver**  
*Robotics* under [Electronics & Robotics Club](#)

Spring '18  
*IIT Bombay*

- Implemented *optimal algorithms* and techniques to obtain the *solution path* for the maze
- Analysed and mapped the maze using [Ultrasonic ranging module](#) and stored maze path data

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<sup>1</sup>Use URL [home.iitb.ac.in/~manasv](http://home.iitb.ac.in/~manasv) in case hyperlinks don't work

## Line Follower

Robotics under [Electronics & Robotics Club](#)

Spring '18  
IIT Bombay

- Assembled a sensor array using [IR Tx-Rx](#) pair to detect white line on black background
- Utilised *optimal threshold* value for sensors to calculate distance of the line from the center
- Employed [Proportional Integral Derivative](#) controller to ensure smooth motion in correct direction

## Grab Circuit

Digital Logic Design under [Subhananda Chakrabarti](#)

Spring '18  
Electrical Engineering, IIT Bombay

- Devised a quiz buzzer system ascertaining the player with the *fastest reaction time* and the *reaction time*
- Implemented and interfaced the buzzer circuit with the timer circuit using D flip-flops and latches

## Heart Rate Monitor

Analog Circuit Design under [Siddharth Tallur](#)

Fall '18  
Electrical Engineering, IIT Bombay

- Implemented reflective [Photoplethysmography](#) to measure the heart beat
- Utilised IR LED-phototransistor pair [TCRT5000](#) to detect the PPG signal
- Employed op-amp for *amplification* of signal and active filters for *noise removal*
- Analysed the heartbeat wave-form to measure *systolic & diastolic* heart-rate

## SCHOLASTIC ACHIEVEMENTS

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- Secured **All India Rank 270** in [JEE Advanced' 17](#) among 200,000 candidates
- Awarded the **AP Grade** (Top 1% out of 470 students) in Chemistry Laboratory
- Achieved 99.7 percentile in [JEE Main' 17](#) among 1.2 million candidates
- Bagged State Rank 59 in [UP State Entrance Exam' 17](#) among 142,000 candidates

## TECHNICAL SKILLS

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- **Programming Languages** - Python, C/C++, Java, MATLAB
- **Libraries** - PyTorch, DL4J, Tensorflow, scikit-learn, Tkinter, SciPy
- **Softwares** - Git, GitHub, GNU Octave, Eagle, SPICE,  $\text{\LaTeX}$ , AutoCAD, Android Studio
- **Robotics** - Arduino, Raspberry Pi, Robot Operating System

## POSITIONS OF RESPONSIBILITY

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- **Volunteer** — Abhyuday January '18  
IIT Bombay  
*Social Fest, Creating awareness about Human Rights*
  - Maintained and organized the database of lecturers, performers and visitors at IIT Bombay during the [Annual Social Fest 2018](#) as a part of a team consisting of 7 student volunteers
- **Organizer** — Techfest December '17  
IIT Bombay  
*Asia's Largest College Science & Technology Festival*
  - Planned, organized, and executed events along with a team of 20 student volunteers
  - Attended to guests and dignitaries during events, lectures, and workshops

## RELEVANT COURSES

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- **Machine Learning** - Digital Image Processing<sup>2</sup>, Machine Learning for Remote Sensing, Remote Sensing & Image Processing, CS 231n (Stanford), Machine Learning (Andrew Ng)
- **Electrical Engineering** - Probability & Random Processes<sup>2</sup>, Data Analysis & Interpretation, Network Theory, Signals & Systems, Microprocessors<sup>2</sup>, Introduction to VLSI CAD Design<sup>2</sup>
- **Mathematics & CSE** - Multivariable & Vector Calculus, Linear Algebra, Differential Equations I & II, Complex Analysis, Computer Programming & Utilisation
- **Other Courses** - Basics of Electricity & Magnetism, Quantum Physics & Application, Economics

## EXTRACURRICULAR ACTIVITIES

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- Successfully completed 1 year of training under [National Cadet Corps \(NCC\) IIT Bombay](#)
- Attended the 10 day [Annual Training Camp](#) at IIT Bombay organized by *NCC IIT Bombay* during November-December 2017 and participated in various sports and cultural events
- Participated in the *Annual Republic Day Parade* held at IIT Bombay on 26th Jan 2018

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<sup>2</sup>Courses taken in Fall 2019