**Sharvanee Sonawane**
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| Examination | University | Institute | Year | CPI/% |
|---|---|---|---|---|
| Graduation | IIT Bombay | IIT Bombay | 2026 | |
| Intermediate | CBSE | Delhi Public School, Nashik | 2022 | 96.20% |
| Matriculation | CBSE | Symbiosis School, Nashik | 2020 | 96.20% |

## Scholastic Achievements

- Secured **All India Rank** of **180** in **Joint Entrance Examination Main** among **900,000+** candidates *('22)*
- Achieved **99.987** percentile overall and a **100 percentile** in physics in Session 2 of JEE Main exam *('22)*
- Achieved **All India Rank 755** in **Joint Entrance Examination Advanced** among **150,000+** students *('22)*
- Granted the prestigious **KVPY fellowship** awarded by the **Government of India** by securing **All India Rank 282** in **KVPY SA** & **All India Rank 552** in **KVPY SX** examinations conducted by IISc Bangalore *('21, '22)*
- Conferred with **Certificate of Merit** in **Indian Olympiad Qualifier in Maths** awarded to state **top** 1% *('20)*

## Internship Experience

### Watermarking in Large Language Models | *Research Internship* *(May'24-July'24)*

*Instructor: Prof. Danish Pruthi, Indian Institute of Science*

- Studied **watermarking frameworks** for Language models that **embed signals** into generated text, are **algorithmically detectable** without knowledge of model parameters and ways to **attack** these watermarked models
- Investigated the **learnability** of watermarks by introducing **watermark distillation**, which trains a student model on teacher model that uses **decoding-based** watermarking to measure ease of spoofing watermarks

## Projects

### Image Compression Engine | *Course Project: Digital Image Processing* *(November'24)*

*Instructor: Prof. Ajit Rajwade*

- Built an Image Compression Engine that implements **JPEG algorithm** on input grayscale images, by performing patchwise **Discrete Cosine Transform**, **quantization** of DCT coefficients, **RunLength** and **Huffman encoding**
- Developed a **decoder** to decode the compressed **binary image**, evaluated the engine's performance by simulating different **quality factors** and plotting **RMSE**(between original and decoded image) vs **Bits Per Pixel** graph
- Performed comparison to **MATLAB's JPEG** implementation by varying quantization and Huffman table settings
- Enhanced engine functions to compress colour images by incorporating conversion from **RGB** to **YCbCr** colour space, extending algorithm to process each channel individually, **downsampling** Cb and Cr channels by a factor 2
- Implemented the research paper **Edge-Based Image Compression with Homogeneous Diffusion** that provides a lossy compression method for **cartoon-like** images exploiting information at image edges
- Applied **Marr–Hildreth** algorithm followed by **hysteresis thresholding** and stored extracted edges using JBIG
- Encoded contour pixel values along edges by applying **quantisation**, subsampling and **PAQ coding**
- Reconstructed the image from edges and contour pixels by performing **linear interpolation** to recover the pixels along the edges and used **homogeneous diffusion** to fill in the rest of the image using the **Laplace equation**

### Image Super-Resolution using Deep Neural Networks | *Seasons of Code* *(May'23-July'23)*

*Web & Coding Club, IITB*

- Developed a **Deep Convolutional Neural Network** (CNN) to convert low-quality images to **high-resolution**
- Built an **Image Classifier** in PyTorch by partitioning the **CIFAR-10** Dataset into 10 labels, applying **2D Convolution** & batch normalization layers, surpassing benchmark accuracy based on **cross entropy loss**
- Developed a **Handwritten digit recognition** model utilising CNN-based classification on the **MNIST** dataset

### Machine Learning and Artificial Intelligence | *Course Project: AI & ML* *(February'24- April'24)*

*Instructor: Prof. Swaprava Nath*

- Implemented nonparametric **Kernel density estimation** using joint likelihood to find the best estimate of variance
- Built a **regularized** and normalized **logistic regression** and a neural network model with uniform random weight initialization & **backtracking** from scratch, enhanced it to utilise **Recurrent** and convolutional neural networks
- Built a classifier for linearly inseparable data using **Support Vector Machines** and **Kernelisation**
- Performed **K-Means Clustering** on unlabelled data, engineered **Linear Discriminant analysis** for dimensionality reduction of supervised data and implemented the **Gale-Shapley** algorithm to obtain **stable matching**

### Algorithmic Trader | *Course Project: Data Structures & Algorithms* *(November'23)*

*Instructor: Prof. Ashutosh Gupta*

- Developed a **multi-threaded Autotrader** performing **real-time arbitrage detection** for high-frequency trading
- Implemented **matching algorithms** to simulate the **exchange environment** and measure trading efficiency
- Leveraged a strategy for **statistical arbitrage** detection between **correlated stocks** across different markets

**Face Recognition System** | *Course Project: Digital Image Processing* *(October'24)*
*Instructor: Prof. Ajit Rajwade*

- Leveraged the **Eigenfaces** technique using **PCA** on gallery images that are aligned and under same illumination
- Recorded recognition rates using squared difference between eigencoefficients for different eigenspace dimension values
- Modified the Eigenfaces technique to utilise **Singular Value Decomposition** to match results with PCA
- Extended the model for face recognition of images under **varied lighting** by creating an eigenspace without the top 3 principal components as explained by the **Lambertian model**

**Image Processing** | *Course Project: Digital Image Processing* *(August'24-September'24)*
*Instructor: Prof. Ajit Rajwade*

- Computed image dependency measures like **normalized cross-correlation**, **joint entropy** and **Quadratic Mutual Information** for a given brain MRI image and its modified versions obtained by rotation and **bilinear interpolation**
- Implemented a **Bilateral** and **Mean-shift based filter** to smoothen images corrupted with Gaussian noise
- Executed an **ideal** and **Gaussian low pass filter** and displayed frequency response in log absolute Fourier format
- Leveraged local and global **histogram equalization** to improve image **contrast** and compared their results

**Network Layer Routing** | *Course Project: Computer Networks* *(October'24)*
*Instructor: Prof. Vinay Riberio*

- Developed a network layer over an already-built Link Layer simulator by implementing **Routing Information protocol** based on distance vector between nodes allowing transfer of data packets using the shortest route
- Incorporated **Split Horizon** technique in the protocol to prevent **count-to-infinity** problem and routing loops
- Enhanced the functions to handle dead and newly added nodes through routing **advertisements** and routing table updates with protocol reverting to **broadcasting** packets when failing to converge within time constraints

**Building a Shell** | *Course Project: Operating Systems* *(January'24)*
*Instructor: Prof. Mythili Vutukuru*

- Developed a custom shell interactively accepting inputs from users to execute Linux commands with single arguments
- Extended shell capabilities for **background execution** along with **serial and parallel foreground** executions
- Implemented custom **signal handling** functions for desired communication between the shell and the processes

## Positions of Responsibility

**Department Academic Mentor** | *Student Mentor Program* *(June'24-April'25)*

- Mentoring sophomore students and assisting them in navigating the department's academic curriculum after being selected through a rigorous procedure comprising of **statement of purpose, interview, and peer reviews**

**Sports Secretary** | *Computer Science and Engineering Association* *(May'23-April'24)*

- Collaborated with CSEA Council to organize and administer all **sports tournaments** and events in the CSE department such as the **Freshers' Welcome**, **Valedictory function**, Traditional day, department trek and trip

## Courses Undertaken

| | |
|---|---|
| **Computer Science** | Data Structures and Algorithms†, Design and Analysis of Algorithms, Data Analysis and Interpretation, Software Systems Lab, Computer Programming and Utilization†, AI and ML†, Digital Image Processing, Applied Algorithms, Game Theory and Algorithmic Mechanism Design, Operating Systems†, Digital Logic Design and Computer Architecture†, Discrete Structures, Automata Theory and Logic, Principles of Data and System Security, Abstractions and Paradigms in Programming†, Computer Networks† |
| **Mathematics** | Calculus, Linear Algebra, Differential Equations, Optimization Models |

†*Course has corresponding lab*

## Technical Skills

- **Languages:** C/C++, Python, Bash, Sed, Awk, MATLAB, x86 and MIPS Assembly, VHDL
- **Libraries & Software:** NumPy, MatPlotLib, PyTorch, Pandas, SciPy, Git, LaTeX, Doxygen, Make, AutoCAD
- **Web Development:** HTML, CSS, JavaScript

## Extracurricular Activities

| | |
|---|---|
| **Tech** | • Designed and built an **Arduino-based line following bot** capable of climbing slopes with **payload dumping mechanism** as a project under the Makerspace Course at IITB *('23)*<br>• Built a **musical chord encoder** in VHDL under the Computer Architecture Course *('23)*<br>• Mentored students for the project, **Into the Realm of Neural Networks** to provide them an introduction to Convolutional Neural Nets under the **Winter in Data Science** program *('23)* |
| **Sports** | • Completed a year-long Badminton training camp and was selected to be a part of IIT Bombay **Badminton team** participating in the **Inter IIT Sports Meet 2022** held at IIT Delhi *('22)*<br>• Participated in CBSE **South Zonal Badminton Championships** held in Bangalore *('19)* |
| **Culturals** | • Secured first class in **Kathak Classical Dance examination** conducted by **Akhil Bharatiya Gandharva Mahavidyalaya** after completing **8 years long course in Kathak** *('18)* |