



**Yash Bhake**  
**Mechanical Engineering**  
**Indian Institute of Technology Bombay**

**22B2148**  
**B.Tech.**  
**Gender: Male**  
**DOB: 25/04/2004**

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	8.73
Intermediate	CBSE	Apeejay School, Nerul	2022	95.00%
Matriculation	CBSE	Apeejay School, Nerul	2020	95.60%

Completed a Minor Degree in **Artificial Intelligence** and **Data Science** under the department of C-MInDS, IIT Bombay

#### PUBLICATIONS

- **Y. Bhake**, A. Anand and P. Rao, "Melodic And Metrical Elements of Expressiveness in Hindustani Vocal Music", Proc. of **ISMIR 2025**, Daejeon, **Korea**. For **generative modeling** in expressive classical music | Received **author grants**
- **Y. Bhake** and P. Rao, "Expressive Timing in Hindustani Vocal Music", Proc. of WIMAGA, **ICASSP 2025**, Hyderabad

#### SCHOLASTIC ACHIEVEMENTS

- Awarded with the **Undergraduate Research Award 1** for significant contribution in **MIR** and audio processing [’25]
- Secured **AIR 973** in **JEE Advanced**, **99.71** percentile in **JEE Mains**, and **99.99** percentile in **MHT-CET** exams [’22]

#### PROFESSIONAL EXPERIENCE

**Deutsche Bank | Cash and Securities Portfolio | Software Engineering Intern** [May’25 - Jul’25]

Received a **Pre-Placement Offer** and **LoR** for exceptional performance, and consistent output during the internship

- Engineered and delivered **production-ready end-to-end user-preferences functionality** refining user experience
- Developed full-stack features using **React.js**, **Java Spring Boot**, **GraphQL**, and **PostgreSQL** learning them on-site
- Slashed **GCP** elevated access request time from **1 hour** to **2 minutes** by automating the pipeline with **Python** utility

**NanoSniff Technologies Pvt. Ltd. | Design Intern** [May’24 - Jul’24]

**MEMS** fabrication and product **R&D** organization developing smart electronics through innovative **product design**

- Designed a **device prototype** for generating vapor molecules over a **combustion sensor** for detecting explosives
- **Optimized** the heating coil **orientation** and **geometry** (nested helix) maximizing heating as per the specifications

#### RESEARCH EXPERIENCE

**Quantitative Modeling in Music Information Retrieval | DAPLAB | Prof. Preeti Rao** [May’24 - Present]

Computational modeling of elements of expressiveness in Indian vocal music for generative applications and analysis

<b>Data Processing</b>	<ul style="list-style-type: none"><li>• Developed a semi-automatic <b>syllable annotation</b> pipeline using <b>Whisper</b>, <b>VAD</b> and a <b>Forced Alignment</b> model for a <b>self-curated dataset</b> of concert recordings of stalwarts in Indian Music</li><li>• Devised spectral band-energy (<b>F1 - 0.80</b>) and <math>\Delta</math><b>MFCC</b> (<b>F1 - 0.73</b>) syllable <b>onset detection</b> models</li></ul>
<b>Analysis and Generation</b>	<ul style="list-style-type: none"><li>• Applied <b>Word2vec</b> &amp; text match (<b>96% acc.</b>) to measure syllable misalignment for expression analysis</li><li>• Modeled pitch expressiveness using <b>Levenshtein</b> substitution on quantized pitch representation</li><li>• Generated <b>new variations</b> capturing expressive timing using <b>GMM sampling</b> on processed data</li></ul>

#### ACADEMIC PROJECTS

**Diffusion Models with Classifier-Free Guidance | CS 726: Advanced Machine Learning** [Feb’25 - Apr’25]

Engineered a PyTorch **DDPM** pipeline with **MLP** based noise prediction & multiple schedulers across **200-step** diffusion

- Achieved **95%+** classification accuracy in controllable generation via class-conditioned sampling by integrating **CFG**
- Developed a training-free **CFG** classifier achieving **94.6%** average accuracy, evaluated using **EMD** and **NLL** metrics

**Part of Speech Tagging with HMM-Viterbi | CS 626: Speech, NLP and the Web** [Sep’24 - Oct’24]

Developed a **HMM** based POS tagger on the Brown Corpus achieving a **0.91 F1 score** under 5-fold cross-validation

- Benchmarked against the baseline - **ChatGPT** with a **92% macro-average accuracy** on the given test sentences
- Optimised **transition** and **emission** probabilities, using Viterbi algorithm with additive smoothing for unknown words

**Knowledge Distillation from ResNet-50 | CS 419: Introduction to Machine Learning** [Feb’24 - May’24]

Implemented **knowledge distillation** on CIFAR-10, training a custom CNN student model to mimic a **ResNet-50** model

- Achieved **15%** higher early-epoch accuracy by applying a **distillation loss** blending KL divergence and cross-entropy
- Compared student models with and without **KD**, showing accuracy gains and potential for cost-efficient deployment

Implemented and benchmarked **Greedy, Top-k, Nucleus, and Temperature decoding** on **13B** params **LLaMA-2**

- Boosted the **inference throughput** with the help of **Beam search decoder** that predicts multiple tokens per step
- Evaluated and compared methods using **BLEU, ROUGE**, and **Real Time Factor** to study quality-latency trade-offs

**Prediction and Control of Equipment Vibrations | DS 203: Programming for DS** [Nov'23 - Dec'23]

Performed **exploratory data analysis** on data procured from a data acquisition system in a chemical processing plant

- Reduced the number of predictor columns by **80%** by carrying out dimensionality reduction using **VIF** and **PCA**
- Arrived at an **R<sup>2</sup>** of **0.93** and **0.92** upon implementing **Random Forest** and **MLR** models respectively post-processing

**Time Series Forecasting for Stocks | Winter in Data Science | Analytics Club, IITB** [Sep'24 - Oct'24]

Forecasted Stock prices of **Tesla, Inc.** using Time Series analysis with **SARIMA, GARCH, VAR** and **LSTM** models

- Achieved a **RMSE** of **0.04** on Working out a **hybrid model** using an LSTM model for stock and ARIMA for error series

## TECHNICAL PROJECTS

**Spaceport America Cup | IITB Rocket Team | Design Engineer, Propulsion Subsystem** [Dec'22 - Jul'24]

World's largest rocket engineering conference & competition New Mexico, USA | **150+** Institutions | **6k+** Global participants

- Secured top-**20** finish among **156** global teams via **9,210** ft. AGL flight, lifting the team placement by **66%** YoY
- Presented our rocket to **1700+** rocketeers, judges and industry leaders including **Blue Origin** and **Virgin Galactic**
- Prototyped and fabricated **4+** iterations of a thrust vector control nozzle and a glass fiber motor casing for robustness

**iKshana: An Accessibility Product | Summer Project | ITC, IIT Bombay** [May'23 - Sep'23]

Secured the **2<sup>nd</sup>** prize among **110+** projects for successfully prototyping an accessibility product for the visually impaired

- Prototyped a **foot harness** integrated with a **navigation module** and **haptic feedback** for the **visually impaired**
- Developed an **Android app** extracting the user's location data for **long-range navigation** coupled with the device

## POSITIONS OF RESPONSIBILITY

**Institute Student Mentor & Department Academic Mentor | SMP, IIT Bombay** [Jul'25 - Present]

Selected out of **350+** students as a part of a mentorship team through an extensive process of interviews & peer reviews

- Mentoring **12** freshmen & **6** sophomores, providing counsel, ensuring academic well-being and holding help sessions
- Contributing towards ideation, management and execution of **core & research** events to improve students' exposure
- Acting as the first point of contact aiding the **communication** between the faculty, institute functionaries and students

**Cultural Summer Project Mentor | RagaVerse - Computational musicology** [Jul'25 - Aug'25]

Spearheaded a technical project on **clustering** ragas and classical songs by performing **ablative feature engineering**

- Developed robust **computational pipeline, documentation** and **open-source utilities** on GitHub for guiding students
- Taught computational musicology and **MIR** fundamentals to a group of IITB alumni, PhD scholars, and undergrads

**Teaching Assistant | MS 101: Makerspace** [Jul'23 - Dec'23]

Provided mentorship to a group of **30+** freshmen in the development of **automated tensile testing machines**

- Aided freshers in **planning, design, fabrication, assembly**, and **debugging** in their first hands-on course project

**Seasons of Code Mentor | MusGen - Music Generation using Deep Learning** [May'24 - Aug'24]

Mentored **8** students on a project on **machine learning** in **audio processing** and laid out a structured learning curve

- Pre-processed **5436 Deutsche folk songs** and converted the MIDI audio into a **one-hot-encoded** representation
- Taught students to train an **LSTM** network in **TensorFlow**, achieving a training accuracy of **87%** after data processing

## TECHNICAL SKILLS

- **Languages/Modules** : Python, C++, Java, JavaScript, MySQL, MATLAB, PyTorch, TensorFlow, NLTK, Librosa, Kaldi
- **Softwares/Tools** : Git, GitHub, GCP, Docker, Jira, Praat, Audacity, FL Studio, SOLIDWORKS, Ansys, LLMs

## EXTRA-CURRICULAR ACTIVITIES

<b>Music</b>	<ul style="list-style-type: none"> <li>• Performed before an audience of <b>1400+</b> as <b>lead vocalist</b> in a <b>10-member</b> band at Surbahaar, IITB</li> <li>• Showcased dual skills as a <b>flautist</b> and a <b>vocalist</b> in an <b>8-member</b> band at the <b>Battle of the Bands</b></li> <li>• Led a <b>Hindustani classical quintet</b> orchestrating performance structure and rehearsals, at Dharohar</li> </ul>
<b>Design</b>	<ul style="list-style-type: none"> <li>• Created animated educational content for <b>STEPapp</b>, engaging <b>2M+</b> students across <b>1500+</b> schools</li> <li>• Built a <b>portable smartphone-based microscope</b>, ranked in top <b>5</b> at <b>Annual Makerspace Conclave</b></li> </ul>
<b>Sports</b>	<ul style="list-style-type: none"> <li>• Completed a year-long training in <b>Basketball</b> under <b>National Sports Organisation</b>, IIT Bombay '23</li> </ul>
<b>Poetry</b>	<ul style="list-style-type: none"> <li>• Achieved the <b>1<sup>st</sup></b> prize in Hindi poetry writing competition organized by the Rotary Club New Bombay</li> </ul>