

# Yash Bhake

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## EDUCATION

### Indian Institute of Technology Bombay (IIT Bombay)

Aug 2022 – May 2026

*B.Tech. in Mechanical Engineering, Minor in AI & Data Science*

GPA: 8.73/10

- **Relevant Coursework:** Data Structures and Algorithms, Programming for Data Science, Deep Learning, Natural Language Processing, Advanced Machine Learning, Statistics & Probability, Linear Algebra, Differential Equations

## PUBLICATIONS

**Y. Bhake**, A. Anand and P. Rao, "Melodic And Metrical Elements of Expressiveness in Hindustani Vocal Music", Proc. of ISMIR 2025, Daejeon, Korea.

**Y. Bhake** and P. Rao, "Expressive Timing in Hindustani Vocal Music", Proc. of WIMAGA, ICASSP 2025, Hyderabad.

## RESEARCH & PROFESSIONAL EXPERIENCE

### Quantitative Modeling in Music Information Retrieval

May 2024 – Present

*DAPLAB, IIT Bombay (Prof. Preeti Rao)*

*Mumbai, India*

- Developed a semi-automatic syllable annotation pipeline using Whisper, VAD and a Forced Alignment model (Kaldi) for a self-curated dataset of concert recordings of stalwarts in Hindustani Classical Music.
- Applied Word2vec & text matching with **96%** accuracy to measure syllable misalignment for expression analysis.
- Modeled pitch expressiveness using Levenshtein substitution scores on quantized pitch representations.
- Generated new musical variations capturing expressive pitch by generating new contours using a genetic algorithm over the existing syllable pitch contours and expressive timing using GMM sampling on the processed data.

### Software Engineering Intern

May 2025 – Jul 2025

*Deutsche Bank*

*Pune, India*

- Delivered production-ready end-to-end user-preferences functionality, refining user experience for **18k+** users.
- Developed full-stack features using React.js, Java Spring Boot, GraphQL, and PostgreSQL, learning them on-site.
- Slashed GCP access request time by **97%** by automating the pipeline with a Python utility for **50+** developers.

## PROJECTS

### Diffusion Models with Classifier-Free Guidance | *PyTorch, MLP*

Feb 2025 – Apr 2025

- Engineered a DDPM pipeline with MLP-based noise predictors and schedulers across a 200-step diffusion process.
- Achieved **95%+** classification accuracy in controllable generation via class-conditioned sampling, integrating CFG

### Knowledge Distillation from ResNet-50 | *PyTorch, CNN*

Feb 2024 – May 2024

- Implemented knowledge distillation on CIFAR-10, training a custom CNN student model to mimic a ResNet-50.
- Achieved **15%** higher early-epoch accuracy by applying a distillation loss blending KL divergence and cross-entropy.

### Part-of-Speech Tagging with HMM-Viterbi | *PyTorch, NLTK*

Sep 2024 – Oct 2024

- Architected a stacked BiLSTM encoder + linear decoder POS tagger achieving **94%** accuracy addressing class imbalance by integrating fine-tuned fastText embeddings and a learning rate scheduler to optimize convergence.
- Developed a HMM based POS tagger on the Brown Corpus, achieving **0.90** F1 score under 5-fold cross-validation.

### Raga Clustering | *Python, Computational Musicology*

May 2025 – Jul 2025

- 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.

## TECHNICAL SKILLS

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

## POSITIONS OF RESPONSIBILITY

**Teaching Assistant (MS101)**, IIT Bombay: Conducted tutorials and graded assignments for a class of 80+ students.

**Student Mentor, SMP**, IIT Bombay: Mentoring 12 freshmen and 6 sophomores in their academic pursuits.

## EXTRACURRICULARS

Performed before an audience of **1400+** as lead vocalist in a 10-member band at IIT Bombay's flagship music event.  
Created animated educational content in science for **STEPapp**, engaging **2M+** students across **1500+** schools.  
Lead propulsion & achieved top-**20** global finish at Spaceport America Cup, world's largest rocketry competition.