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*

- 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 access request time from 1 hour to 2 minutes by automating the pipeline with a Python utility.

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 resolving 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.