Ibrahim Kaif

Indian Institute of Technology Madras (IIT Madras)
BE21B019 | Dual Degree in Biological Engineering
your-email@iitm.ac.in

Education

Pohang University of Science and Technology (POSTECH), South Korea Aug 2025 – Jun 2026
Global Young Leaders Exchange Program in Life Sciences

Indian Institute of Technology Madras, India 2021 – 2026
Dual Degree in Biological Engineering ***CGPA: 7.75/10***

Publications

LOID: Lane Occlusion Inpainting and Detection for Enhanced Autonomous Driving **MVA 2025**
Agrawal, A., Sivakumar, A. J., ***Kaif, I.****, Banerjee, C. | DOI: 10.1007/s00138-025-01744-2*

Key Achievements

- **Global Young Leaders Scholarship (2025-26):** 1 of 6 students selected globally for fully funded scholarship at POSTECH; only 2 from India in Life Sciences
- **IGVC 2023 Champions:** 1st Place (Design & Cyber Security), 3rd Overall at Intelligent Ground Vehicle Competition, Michigan (First Indian team to podium in IGVC history)
- **JEE Advanced 2021:** All India Rank 6420 (Top 2% of 200,000+ candidates)
- **Kerala Engineering Entrance 2021:** All India Rank 163 (Top 0.1% of 800,000+ candidates)

Research & Professional Experience

Research Intern | Foundation Models for Single-Cell Genomics Jan 2025 – Present
POSTECH, South Korea (Advisor: Prof. Kim)

- Developing **multimodal transformer-based foundation models** for single-cell genomics analysis, architecting encoder networks to learn unified representations from sparse, high-dimensional biological data
- Training large-scale models on **4x H100 GPUs** using PyTorch with distributed training on HPC infrastructure
- **Benchmarking foundation models** on zero-shot cell classification, designing evaluation frameworks measuring generalization and robustness across biological modalities

AI Engineer / Founding Engineer | Document Intelligence Jan 2025 – Present
WyreAI (Construction Tech Startup)

- Founded and led AI team, designing **computer vision and NLP pipelines** for construction document analysis using **Vision-Language Models (VLMs)** and multimodal transformer architectures
- Deployed pipelines integrating **OCR systems** (Tesseract, Adobe, Azure) with **Large Language Models** to extract structured data from complex construction documents
- Built comprehensive **evaluation frameworks** implementing metrics (ROC/AUC, precision, recall, F1) to assess model performance and guide architectural decisions for production AI systems
- Developed document classification systems and knowledge graphs with quality assurance protocols for production model outputs

Lane Detection with Generative Models | Research Project 2023 – Present
IIT Madras (Advisor: Prof. Lelitha Devi)

- Developing deep learning pipeline for lane detection in occluded scenarios using **Generative Adversarial Networks (GANs)** and encoder-decoder architectures for autonomous driving applications
- Created **synthetic training datasets** using image inpainting models to address data scarcity for edge cases, enabling robust model training on rare occlusion scenarios
- Designed chained generative models to inpaint occluded regions and detect lanes, achieving strong generalization across multiple real-world road datasets including Indian roads and international benchmarks
- Implemented evaluation metrics assessing perceptual quality of generated lanes and detection accuracy; work under review for publication in top-tier computer vision conference

Software Developer | NLP & Automation Jun 2024 – Sep 2024

ZeroCAC (Marketing Tech Startup)

- Built NLP ticketing system for automated customer support classification using embedding models and transformer architectures, reducing query response time by 60%
- Evaluated embedding architectures using quantitative metrics (ROC/AUC, F1-score, precision, recall), selecting optimal models for production deployment based on performance benchmarks

Selected Technical Projects

ML-Based Toxicity Prediction & Molecular Clustering Course Project

Machine Learning in Biology, IIT Madras

- Developed machine learning models (XGBoost, Decision Trees, Random Forest) to predict molecular toxicity for drug discovery, comparing architectures using cross-validation and standard evaluation metrics (accuracy, precision, recall, F1-score)
- Applied **Recursive Feature Elimination (RFE)** for feature selection, optimizing model performance on high-dimensional biological datasets with thousands of molecular features
- Utilized **UMAP** for unsupervised clustering to identify subclusters of non-toxic molecules, demonstrating dimensionality reduction techniques for biological data analysis

IGVC 2023: Autonomous Ground Vehicle Michigan, USA

Team Abhiyaan (Team Lead)

- Led team to 1st place in Design Challenge and 3rd Overall at IGVC 2023; developed ML-powered panoptic segmentation system generating 3D point clouds for real-time autonomous navigation using Stereo Cameras, LiDARs, and Radars
- Optimized Inverse Perspective Mapping (IPM) pipeline using **CUDA parallel computing**, reducing perception latency by 40% for real-time autonomous navigation in complex outdoor environments

Parallel Monte Carlo Tree Search for Optimization Personal Project

High-Performance Computing

- Implemented Monte Carlo Tree Search (MCTS) algorithm for optimization problems and parallelized computation using **OpenMP**, analyzing algorithmic structure to identify independent tasks suitable for parallel execution on multi-core systems

Technical Skills

Programming & HPC: Python, C++, CUDA, OpenMP, Linux, Docker, Kubernetes, Git/GitHub, HPC (4x H100 GPUs)

Deep Learning & Generative Models: PyTorch, TensorFlow, Scikit-learn, Transformers, GANs, Encoder-Decoder Architectures, Vision-Language Models (VLMs), Large Language Models (LLMs), Foundation Models

Computer Vision & NLP: OpenCV, OCR Systems (Tesseract, Azure, Adobe), Image Processing, Video Analysis, Embedding Models, Semantic Segmentation, Object Detection

Evaluation & Visualization: Model Benchmarking, ROC/AUC, Precision/Recall/F1, Cross-Validation, Matplotlib, Seaborn, Plotly, NumPy, Pandas

ML Concepts: Deep Reinforcement Learning (DRL) fundamentals, Optimization, Probability & Statistics, Linear Algebra

Relevant Coursework: Deep Learning for Computer Vision, Biostatistics, Analysis & Interpretation of Biological Data, Stochastic Processes, Optimization Theory

Certifications: Neural Networks and Deep Learning (Andrew Ng), Machine Learning Specialization (Andrew Ng)

Research Interests & Strengths

• **Generative Models & Evaluation:** Extensive experience with GANs, foundation models, and designing evaluation frameworks for assessing generative model quality and alignment with human perception

• **Vision-Language Models:** Practical deployment experience with VLMs for multimodal understanding and document intelligence applications

• **High-Performance Computing:** Hands-on experience training large models on multi-GPU systems (H100s), parallel computing (CUDA, OpenMP), and optimizing computational pipelines

• **Intellectual Autonomy:** Track record of leading research projects independently (published work, founding AI engineer role, research internships), demonstrating curiosity and initiative beyond coursework