Anshul Singh

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Education

- **Panjab University** — Chandigarh, India
  Bachelor of Engineering in Information Technology; CGPA: 9.17/10.00 — *Sep 2021 - June 2025*

Research Experience and Internships

Research Associate at IACV Lab — **IISc Bangalore, India**
Under Prof. Soma Biswas — *Aug 2025 – Present*

- **Multimodal Fake News Detection**
  Developing fake news detection models using active learning to process multimodal data (images, text, metadata), focusing on improving detection accuracy.

Research Intern at LT Research Group — **University of Hamburg, Germany**
Under Prof. Chris Biemann and Jan Strich — *Jan 2025 – Jun 2025*

- **Multi-Hop Reasoning for Multi-tabular Data using Vision Language Models**
  Developed and evaluated Vision-Language Models for complex multi-hop reasoning over tabular image datasets. Built a benchmark to assess tabular understanding in VLMs. Applied advanced post-training techniques like GRPO, LoRA, and SFT to enhance multi-tabular visual reasoning using a custom dataset.

Visiting Research Intern at Dalhousie University — **Nova Scotia, Canada**
Under Prof. Ghader Manafiazar as MITACS Globalink Research Intern — *June 2024 – Sep 2024*

- **Machine Learning Applications for Dairy Cattle Vocal Pattern Analysis**
  Investigated ML application to analyze animal vocal patterns for predicting calving time and assessing pre/post-weaning behavior. Treated MFCC spectrograms as images, leveraging hybrid ViT-ResNet models to classify vocal patterns. Used factorial design to quantify vocal changes, achieving 83% accuracy.

Machine Learning Intern at Virtual Labs — **IIT Roorkee, India**
Under Prof. R.S. Anand and Dr. Rajeev Kumar — *June 2023 – July 2023*

- **Vibration Signal Analysis for Induction Motor Fault Detection**
  Designed a high-performance ML pipeline for fault detection in induction motors using advanced feature extraction and dimensionality reduction techniques. Developed analysis tools and visualization platforms that accelerated research, supporting three related publications.

Undergraduate Research Assistant at *Dept. of Information Technology* — **Panjab University, India**
Under Prof. Veenu Mangat — *Jan 2023 – May 2023*

- **Comparative Analysis of Classification Algorithms for Network Intrusion Detection**
  Conducted comparative analysis of ML classifiers for network intrusion detection, evaluating statistical feature selection via precision, recall, and F1 score. Also surveyed provenance-based detection methods using graph neural networks to improve accuracy.

Publications

- A. Singh, C Biemann, J Strich, "MTabVQA: Evaluating Multi-Tabular Reasoning of Language Models in Visual Space", *In Findings of EMNLP 2025.*
- P. Kumari, V. Mangat, and A. Singh, "Comparative Analysis of State-of- the-Art Attack Detection Models", 14th International Conference on Computing Communication and Networking Technologies, 2023, doi: 10.1109/ICCCNT56998.2023.10306428.

Projects

Cross-lingual Embedding Alignment for Indic Languages *Python, Pytorch, FastText, SciPy*
Project-II (PWIT 651)
Developed cross-lingual alignment pipeline using FastText with custom embeddings trained on Wikipedia dumps, achieving competitive Precision@1 scores (0.3464 vs. 0.3513 for pre-trained models). Implemented generative adversarial training for improved unsupervised alignment in low-resource language settings.

Aurelius: LLM For APIs *Python, PyTorch, Transformers, Peft, BitsandBytes*
Project-I (PWIT 552)
Developed suite of LLMs for API call generation, fine-tuned on LLaMA-7B and Mistral-7B with adapter-based techniques and quantization for efficient inference. Built highly relevant context retrieval system using ColBERT's token-level embeddings for enhanced API generation accuracy.

Metal-FL: Cross-Platform Federated Learning *Python, Kafka, gRPC, Socket.IO, Protobuf, PyTorch*
Developed decentralized federated learning architecture with Kafka and gRPC for real-time communication, utilizing Socket.IO and asynchronous programming for seamless client-server connections. Designed cross-platform model aggregation mechanism integrating weight updates from multiple heterogeneous machine nodes for distributed ML training.

Relevant Courses

• **Coursework:** Deep Learning, Machine Learning, Artificial Intelligence, Information Theory, Discrete Mathematics, Linear Algebra, Probability, Databases, Operating Systems, Data Structures.

• **Certifications:** Deep Learning Specialization (Coursera), Machine Learning by Stanford (Coursera).

Programming Skills

• **Languages**: Python, C++, Java, Javascript, Cuda, SQL, NoSQL, HTML, LaTeX

• **Technologies and Frameworks**: AWS, Kubernetes, Docker, TensorFlow, vLLM, veRL, PyTorch, DSPy, LangChain, FastAPI, Streamlit, Node.js, MongoDB, Pinecone, MySQL, PySpark, MLflow, Ray.

Teaching/Leadership Experience

- Co-founder, Director of Uniqus Edutech Solutions, startup incubated at RUSA, Panjab University.
- Executive Core Member, Content Writing Head, & Webmaster of IEEE Student Branch, Panjab University.
- ML/AI Lead at Google Developer Students Club (GDSC), Panjab University.
- Conducted an IEEE Workshop on Basics of Machine Learning for college students.
- Organizing Committee Member of IEEE National Conference of Women In Engineering held at PEC, Chandigarh 2022.

Languages

• **English:** Full Professional Proficiency **(IELTS C1)** • **Hindi:** Native/Bilingual Proficiency