Poornash Anandan Sangeetha

(A.S. Poornash)

B.Tech, Computer Science and Engineering

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Education

- **Indian Institute of Technology, Patna** *Bihar, India*
  Bachelor of Technology in Computer Science and Engineering (2021 - 2025) *GPA:* ***9.76/10.00***
  – Ranked first **(Institute Rank 1)** among **550** students in the 2021–2025 undergraduate batch at IIT Patna.
  – Ranked first **(Department Rank 1)** among **91** students in the Computer Science and Engineering Dept. at IIT Patna.
  – Nominated for the **President's Gold Medal** for exceptional academic performance at IIT Patna.

Publications

- **ToxVidLM: A Multimodal Framework for Toxicity Detection in Code-Mixed Videos** **ACL Findings 2024**
  Authors - A.S. Poornash, Krishanu Maity*, Sriparna Saha, Pushpak Bhattacharyya*
  – Accepted at Findings of the Annual Conference of the Association for Computational Linguistics, 2024
- **Seeing Beyond Words: Multimodal Aspect-Level Complaint Detection in Ecommerce Videos** **ACM Multimedia 2024**
  Authors - A.S. Poornash, Rishikesh Devanathan*, Apoorva Singh*, Sriparna Saha*
  – Accepted at the ACM International Conference on Multimedia as an *Oral Presentation* (ACM MM, 2024)
- **A Stochastic Optimization Framework for Private and Fair Learning from Decentralized Data** **PPAI Workshop, AAAI 2025**
  Authors - Devansh Gupta, A.S. Poornash, Andrew Lowy, Meisam Razaviyayn
  – First version is accepted at the PPAI Workshop, AAAI 2025 and the second is under review at a reputed ML conference.
- **APTSumm at BioLaySumm Task 1: Biomedical Breakdown, Improving Readability by Relevancy-Based Selection** **BioNLP Workshop, ACL 2023**
  Authors - A.S. Poornash, Atharva Deshmukh, Archit Sharma, Sriparna Saha
  – Accepted at the BioNLP Workshop, Association for Computational Linguistics, 2023
- **ToxVI: A Multimodal LLM-based Framework for Generating Interventions in Toxic Code-Mixed Videos** **CIKM 2024**
  Authors - A.S. Poornash, Krishanu Maity*, Sriparna Saha, Kitsuchart Pasupa*
  – Accepted at the ACM International Conference on Information and Knowledge Management, 2024
- **HateThaiSent: Sentiment-Aided Hate Speech Detection in Thai Language** **IEEE Transactions (TCSS)**
  Authors - A.S. Poornash, Krishanu Maity*, S Bhattacharya, S Phosit, S Saha, Kitsuchart Pasupa*
  – Accepted in the IEEE Transactions on Computational Social Systems Journal, 2024 (∗ = *Equal Contribution*)

Scholastic Achievements

- **Academics:** Current **Batch Topper (Institute Rank 1)** in B.Tech 2021 batch of IIT Patna with a **GPA** of **9.76/10.00**
- **IUSSTF-Viterbi India Scholar '24:** One of only **15** selected student awardees from India to conduct research at the University of Southern California **(USC)**, by Department of Science & Technology (DST), Govt of India (Certificate)
- **MITACS GRI Research Fellowship '24:** Awarded to conduct research at University of Alberta, Canada (Award Letter)
- **DAAD-WISE Research Fellowship '24:** Awarded to conduct research at TU Darmstadt, Germany (Award Letter)
- **Amazon ML Challenge '24:** Secured **6th** position among **75,000**+ participants in an ML-based hackathon (Certificate)
- **Inter IIT Tech Meet 11.0 '23:** Bagged **1st position** among all **IITs** in an Natural Language Processing-based high-prep event DevRev - Expert Answers in a Flash: Improving Domain-Specific Question Answering. (Repository link)
- **SPARK Fellowship '23:** Selected for the prestigious summer research program of **IIT Roorkee** in my sophomore year.
- **KVPY-SX Fellow '21:** Research Fellowship awarded by DST, Govt of India, All India Rank **517** out of **160,000** students
- **JEE Advanced '21:** Secured a **99.05 percentile** score (All India Rank - **2355**) out of **250,000** candidates nationwide.
- **JEE Mains '21:** Secured a **99.79 percentile** score out of **1.1 million** candidates from across the country.

Key Courses Taken

- **Computer Science:** Optimization Techniques (AA), Discrete Mathematics (AA), Artificial Intelligence (AA), Machine Learning and Data Science (AB), Data Structures and Algorithms (AA), Database Systems (AA), Computer Architecture (AB), Operating systems (AB), Digital Systems (AA), Compiler Design (AB), Computer Networks (AA), Computer Graphics (AA)
- **Mathematics:** Linear Algebra (AA), Multivariate Calculus (AA), Probability and Random Processes (AA), Real Analysis (AA), Complex Analysis (AA), Differential Equations (AA)

Grade Key: AA – 10/10, **AB** – 9/10

Research Experience

- **SteFFLe: A Stochastic Framework for Private, Fair, and Federated Learning (Under Review)** *May. 2024 - July. 2024*
  Guide: Dr. Meisam Razaviyayn | Lab: University of Southern California, ODDS Research Group Venue | Paper | Code
  - Contributed to developing a Stochastic, Differentially Private, Fair, and Federated framework with proven inter-silo record-level differential privacy **(ISRL-DP)** guarantees. Accepted at the **PPAI Workshop** of **AAAI 2025**.
  - Proved algorithm convergence in heterogeneous data distributions across silos and for non-binary attributes.
  - Designed experiments and made privacy-utility tradeoff curves for various (ϵ, δ) privacy budgets and heterogeneity levels in federated settings, outperforming **two SOTA** approaches with a **75.47%** and **52.93%** reduction in demographic parity violations.

- **Multimodal LLMs for Toxicity Detection and Intervention in Code-Mixed Posts** *Nov. 2023 - April. 2024*
  Guide: Dr. Sriparna Saha | Lab: IIT Patna, AI-NLP-ML Group **ACL:** Paper | Code **CIKM:** Paper | Code
  - Developed ToxVidLM, a multimodal multitask framework for code-mixed video toxicity analysis, achieving **94.29**% accuracy and **94.35**% F1-scores on the toxicity classification task, accepted to **ACL Findings 2024**.
  - Designed a low-compute modality alignment technique that integrates visual and acoustic data with text using soft multimodal tokens generated with large language models' embedding matrices, improving primary task's F1 scores by approximately **6.43**%.
  - Extended this work to generate interventions for enhancing the explainability of predictions, which was accepted to **CIKM 2024**.

- **Lay Summary Generation for Biomedical Texts to Enhance Readability** *Feb. 2023 - July. 2023*
  Guide: Dr. Sriparna Saha | Lab: IIT Patna, AI-NLP-ML Group Paper | Leaderboard
  - Developed a three-step abstractive summarization framework for biomedical documents to generate lay summaries, accepted via the BioLaySum Shared Task to the **BioNLP Workshop** at **ACL 2023**.
  - Our team **APTSumm** achieved the **second-highest** readability scores (**FKGL**: 12.22, **DCRS**: 8.99) in the BioLaySum shared task.
  - Obtained strong performance in relevancy metrics (ROUGE-1: 48.32, ROUGE-2: 14.91, ROUGE-L: 45.41) using a contrastive learning-based RoBERTa re-ranking strategy, enhancing summary quality through cosine similarity matching and beam search.

- **Sentiment-Aided Hate Speech Detection in Low-Resource Languages** *April. 2023 - April. 2024*
  Guide: Dr. Kitsuchart Pasupa | King Mongkut's Institute of Technology Ladkrabang, Thailand Paper | Code
  - Developed a SOTA **lightweight** multi-task framework combining FastText and mBERT embeddings with capsule networks, advancing hate speech detection in Thai, published in the **IEEE Transactions** in Computational Social Systems **Journal** (*IF* - 4.5).
  - Achieved 89.67% accuracy and 89.79% macro-F1 score for hate speech; 80.92% accuracy and 80.97% macro-F1 score for sentiment analysis, outperforming **three SOTA** approaches by approximately **3 - 5%** with **10x** lesser parameters.

- **Median Nerve Detection and Segmentation for Carpal Tunnel Syndrome Diagnosis** *May. 2023 - July. 2023*
  Guide: Dr. Phaneendra K. Yalavarthy | Lab: IISc Bangalore, Medical Imaging Group (MIG) Presentation | Certificate
  - Worked on medical image segmentation and classification tasks for Carpal Tunnel Syndrome diagnosis using **Ultrasound** videos.
  - Experimented on a dataset of 99 patients, achieving **Dice scores** up to **73.53%** and **IoU** up to **68.4%** for MN segmentation.
  - Led development and systematic experiments with **YOLO V3** and **U-Net** models, improving segmentation accuracy notably and serving as a lightweight alternative for real-time scenarios.

Technical Skills

- **Programming Languages:** Python, MATLAB, Prolog, Lua, C, C++, Java, Kotlin, Verilog, SQL.
- **Frameworks & Libraries:** PyTorch, TensorFlow, Keras, Caffe, NumPy, Pandas, SciPy, Scikit learn, Hugging Face Transformers, Haystack, Neo4j, NLTK, spaCy, TextBlob, Gensim, TensorFlow Federated, Opacus, FederatedAI/FATE, Fairlearn, ITK, OpenCV, Scikit-Image, PIL, Napari, MONAI, Librosa.
- **Development Tools:** Git, Anaconda, Android Studio, Arduino, MySQL, Firebase, Firestore, Docker, LaTeX.
- **Web Development:** HTML, CSS, JavaScript, PHP.

Positions of Responsibility and Extra-Curricular Activities

- **NJACK Machine Learning Division (Computer Science club of IIT Patna)** *2022 - 2024*
  Lead IIT Patna
  - Organized a Machine Learning **hackathon** in collaboration with the startup Chi SquareX during the Tech fest of IIT Patna.
  - Conducted **talks** by industry professionals, researchers (alumni), **research paper reading**, and **educational sessions** regularly.

- **Hexachrome (Puzzle Club of IIT Patna)** *2022 - 2024*
  Co-Founder & Sub-Lead IIT Patna
  - **Conducted** various Speedcubing **competitions** with 2x2, 3x3, 4x4, Pyraminx, etc. Designed and released weekly Sudoku puzzles.

- **National Service Scheme (NSS), IIT Patna** *2021 - 2022*
  Volunteer (80+ hours) IIT Patna
  - Participated in **six institute cleanliness drives** and volunteered **2 hours weekly teaching math** at a nearby public primary school.