Vatsal Gupta

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Education

Indian Institute of Technology, Guwahati — Guwahati, India
Bachelor of Technology in Computer Science and Engineering, Minor in Robotics and AI — *Jul 2020 - Jul 2024*

- Cumulative GPA: **9.45**/10.00 | **3rd** in Computer Science and Engineering Department
- Selected Coursework: Machine Learning, NLP, Parallel Algorithms, Artificial Intelligence, Operating Systems, Networks, Computer Architecture, High Performance Computing, Probability, Deep Learning, Mathematical Finance

Experience

AlphaGrep Securities — Bangalore, India
Quant Researcher & Trader — *Jul 2024 - Present*

- Developed an ML-driven pipeline adaptable across multiple exchanges, introducing novel stability and profitability metrics for dynamic asset selection, and applied it to design robust trading algorithms for India and US markets.
- Architected a multi-stage NLP signal-generation pipeline leveraging SOTA transformer-based sentiment models and derived systematic strategies from the framework to improve information ratios across Crypto and US portfolios.
- Optimized the team's execution framework, achieving a 64% latency reduction through novel techniques that enhanced position-reduction smoothness and reduced slippage. (*more details omitted per IP restrictions*).

Quant Researcher & Trader Intern — *May 2023 - Jul 2023*

- Worked on creating a utility using in-house graphing tools and cloud monitoring resources to facilitate data visualization and created modules for autonomous data gathering and created indicators to analyze real-time market data efficiently.
- Designed algorithms and strategies to trade on NSE and NASDAQ involving the analysis across a range of metrics to measure the performance of different strategies and proposed alternative data sources to gauge market position.

Imperial College, London — Remote
Research Intern under Prof. Mehmet Mercangöz — *Dec 2021 - Nov. 2022*

- Implemented Auto Encoder models for anomaly detection in the Carbon Pilot Plant at Imperial College, London and compared their results to aid in reduction in carbon emissions in real world industrial scenarios.
- Established approaches and ideology for custom similarity metrics to incorporate robustness and to improve detection.

Research & Publications

MicroFM: Physics-guided Flow Matching for Isotropic Microscopy Reconstruction
Research under Prof. Min Xu, Carnegie Mellon University — Submitted to CVPR 2026

- Co-developed MicroFM, a physics-guided flow matching framework for isotropic 3D microscopy reconstruction, integrating optical priors and adversarial PSF learning to enable high-quality reconstruction without paired data.
- Built a unified benchmarking and visualization pipeline for isotropic 3D data, enabling volumetric renderings, slice-based comparisons, and metric-driven visual diagnostics across baselines (CycleGANs, NeuroClear, UTOM, SSAI-3D).
- Enhanced prior isotropic reconstruction methods by adding automated saliency thresholding and visualization overlays, improving interpretability, reconstruction stability, and model debugging during development.

NTSEBENCH: Cognitive Reasoning Benchmark for Vision Language Models
Research under Prof. Dan Roth, University of Pennsylvania — NAACL, 2025 publication[1]

- Created the NTSEBench dataset with 2,728 multiple choice questions with 4,642 images categorized into 26 different types promoting analysis of state of the art Multimodal Large Language models on the cognitive reasoning task.
- Proposed 3 strategies for evaluating performance on latest closed and open source Multi Modal Large Language Models on the visual question answering task and presented a comprehensive analysis of pitfalls along with error categorization.

Evaluating Concurrent Robustness of Language Models Across Diverse Challenge Sets
Research under Prof. Dan Roth, University of Pennsylvania — EMNLP, 2024 publication[2]

- Introduced the issue of concurrent robustness across models and highlighted the issue of reliability, trustworthiness and hence the necessity of robust techniques for improvement on the concurrent robustness problem on language models.
- Created the comprehensive Multi-Set Inoculation framework - generalizable to any natural language task - to assess and improve performance of Language Models on the concurrent robustness problem.
- Developed strategies for Multi-Set Inoculation on Pre-Trained language models(PLMs) and for SOTA Large Language models (LLMs) to improve results on the perturbed version of the INFOTABS dataset for the Tabular-NLI task.

FlowVQA: Mapping Multimodal Logic in Visual Question Answering with Flowcharts
Research under Prof. Dan Roth, University of Pennsylvania — ACL, 2024 publication[3]

- Introduced a novel benchmark to assess the capabilities, scope and limitations of Multimodal Large Language models (MLLMs) in the visual question-answering task introducing flowcharts as visual contexts for information representation.
- Created modeling strategies to compare state of the art MLLMs for tasks involving information localization, decision-making, and logical progression showcasing the necessity of the FlowVQA benchmark for advancing Multimodal QA.

[1] ntsebench.github.io [2] msin-infotabs.github.io [3] flowvqa.github.io

ChIRAAG: ChatGPT Informed Rapid and Automated Assertion Generation

Research under Prof. Chandan Karfa, IIT-Guwahati ISVLSI, 2024 publication[4]

- Introduced a novel framework for the systematic breakdown of design specifications into a standardized format for the generation of System Verilog Assertions from natural language specifications through Large Language Models (LLMs).
- Analyzed results of designs on the Open-Titan database and tracked simulator feedback showcasing that only 27% of LLM-generated assertions contained errors, highlighting their potential to reshape verification workflows.

Projects

Statistical analysis of DDoS attacks *Jul 2023 - May 2024*

Bachelor Project under Prof. Pinaki Mitra, IIT-Guwahati GitHub[5]

- Introduced novel DDoS detection methods for IoT systems, utilizing statistical techniques inspired by financial analysis.
- Methodology involved optimizing incremental algorithms for accurate, efficient DDoS detection by resampling network data and created a metric to prove statistical analysis coupled with financial insights, offers effective DDoS detection.

Systems for individual identification and medical diagnosis *Nov 2021 - Jul 2023*

Bachelor Minor Project under Prof. Satish Kumar Panda, IIT-Guwahati GitHub[5]

- Advanced earlier research on SIFT-based fingerprint recognition and iris segmentation by creating new data-refinement pipelines that strengthen individual identification capabilities on low-resource, commonly available vision hardware.
- Performed classification of breast cancer images on the BUSI dataset using vision models and developed a platform to aid medical faculty in medical diagnosis by using Gradient-weighted Class Activation Mapping (Grad-CAM) approach.

Compiler for C-like language nanoC *Mar 2023 - May 2023*

Programming Language Lab, IIT-Guwahati GitHub[5]

- Implemented a comprehensive nanoC compiler in C++, utilizing Flex for tokenization and Bison for semantic analysis.
- Executed the complete compiler pipeline for nanoC, covering Lexical Analysis, Parsing, Machine-Independent Code Generation, and Target Code Generation, integrating quad and symbol tables and auxiliary structures.

Majuli River Island - Virtual Tour *Feb 2023 - Apr 2023*

Under Prof. Samit Bhattacharya IIT-Guwahati GitHub[5]

- Developed an immersive 3D tour using the Unity framework for the Meta Oculus series for the world's largest river island -Majuli, featuring interactive navigation, AR/VR teleportation, and user control and further applied computer-vision techniques to generate super-resolution multimedia elements for an enhanced user experience.
- Awarded AS grade for leading the best project in the batch, recognized for its innovative approach to world heritage site preservation and subsequently adopted by the Department of Science and Technology, Govt. of India.

Other Projects *Jul 2022 - Nov 2022*

Operating Systems Lab, IIT-Guwahati GitHub[5]

- Mini-Shell: Developed a Linux shell in C with features supporting file I/O redirection, piping and single level redirection.
- Tar-Like Archiver: Created a shell program mimicking tar for text file archiving and unarchiving with mulitple flags.
- xv6 Implementations: Implemented kernel threading, synchronization, and hybrid scheduling within the xv6 toy OS.

Technical Skills

- **Programming Languages**: C++, C, Python, Java, SQL
- **Web/App Technologies**: HTML, CSS, Django, NodeJS
- **Frameworks**: Numpy, Pandas, Pytorch, Tensorflow, Keras, Streamlit, scikit-learn, Git, Linux, LATEX
- **MOOCs**: Stanford Online: Machine Learning, DeepLearning.AI - Deep Learning, Neural Networks and ML Projects

Achievements & Scholarships

- **CP.begin 2023:** Secured rank 3 in coding contest organised by CSEA among 100+ participants from IIT Guwahati.
- **Barclays Technology Discovery Program 2022**: Among one of the 10 students in IIT-Guwahati offered an internship.
- **Pravega 2021**: Achieved a rank of top 5 globally at the physics competition, Decoherence organised by IISc Bangalore.
- **JEE Mains and Advanced, 2020:** Secured national rank 573 amongst 1.1 million candidates appearing for IIT entrance.
- **KVPY Scholarship 2020:** Offered a scholarship for undergraduate studies securing a rank of 687 out of 40,000 candidates.
- **CBSE Board Rank 2 in State, 2018:** Awarded by former Governor of Karnataka and former Chairman of ISRO.

Community Service

- **Dadhichi Deh Samiti Foundation**: Volunteered for efforts towards promotion of eyes, organ & body donation.
- **Reap Benefit Foundation**: Contributed to environmental causes to promote planting of trees and increase awareness among local citizens for waste and water management and organizing to discuss possible solutions in rural areas.
- **National Social Service Scheme (NSS)**: Volunteered for rural areas, delivering speeches to raise educational awareness and promoted a safe environment by engaging in cleanliness drives in underpriviliged areas.

Volunteerships and Extra-Curriculars

- **AI Core Team Member, IITG**: Led the AI team to organize lectures, workshops and hackathons.
- **Coordinator, Coding Club, IITG**: Helped students get familiar with algorithms as a part of the programming module.
- **ILDP Start-Plus program** - Represented IIT-Guwahati and received recognition for one of the best AI solutions which was proposed for the 13^{th} and 14^{th} Goal of United Nations for Climate Change and Biodiversity for underwater life.
- **CSEA Mentorship Program:** Mentored 5 first year students and guided them on various fields.

[4] ieeexplore.ieee.org/document/10682649 [5] github.com/vatsal-ts