Manish Acharya

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Research Interests

My research interests lie at the intersection of computational analysis, complexity theory, and algorithm design and optimization, with a focus on integrating artificial intelligence and machine learning techniques. I am especially driven by questions in theoretical computer science that inform and inspire practical, efficient solutions to complex computational challenges.

Education

Vanderbilt University Nashville, TN

BS in Computer Science and Mathematics, Electrical & Computer Engineering (Minor) *August 2023 – May 2027*

- **GPA:** 4.0/4.0 (Cumulative); 4.0/4.0 (Computer Science); 4.0/4.0 (Mathematics)
- **Honors:**
  - Chancellor's Scholarship (awarded to <1% for leadership, academic achievement, and diversity commitment)
  - Dean's List (all semesters)
- **Relevant Coursework:**
  - **Computer Science:** Algorithms, Data Structures, Discrete Structures, Computer Architecture
  - **Mathematics:** Probability and Statistics, Real Analysis, Linear Algebra, Multivariable Calculus

Technical Skills

Languages: Python, C/C++, Java, SQL, MATLAB, JavaScript
Frameworks: PyTorch, TensorFlow, React, Node.js, Flutter, Spring, Django
AI/ML Expertise: Machine Learning, Deep Learning, Neural Networks
Libraries & Tools: NumPy, Pandas, Scikit-Learn, Docker, Git, Unix

Research Experience

Undergraduate Research Assistant March 2024 – Present

Huang Lab, Vanderbilt University *Nashville, TN*

Advancing AI for Mathematical Reasoning and Problem Solving *November 2024 - Present*

- **Developing Mathematical AI Models:** Designing custom AI models for advanced problem-solving, including theorem proving and symbolic algebra.
- **Establishing Performance Benchmarks:** Evaluating model effectiveness for logic-based reasoning and educational applications.

Context-Aware Retrieval-Augmented Generation System *March - November 2024*

- **Engineered AUTOPATCH Framework:** Developed a system integrating Retrieval-Augmented Generation (RAG) with Control Flow Graphs (CFG), boosting code runtime efficiency by 7.3%.
- **Enhanced Code Optimization:** Designed a retrieval pipeline leveraging historical patterns to drive program restructuring and scalability improvements.

Undergraduate Research Assistant September 2023 – Present

Vanderbilt AI Negotiation Lab, Owen Graduate School of Management *Nashville, TN*

- **Developed and Optimized Platform:** Built a Django-based web platform and integrated AI negotiation model, improving performance by 30% and reducing latency by 40% using DjangoQ.
- **Contributed to Negotiation Research:** Supported advancements in negotiation research by proposing enhancements to the AI model and its applications.

Researcher October 2024 – Present

National Innovation Centre *Kathmandu, Nepal*

- **Developing Affordable Air Quality Sensors:** Designing low-cost sensors tailored for Nepali households, addressing severe air pollution caused by firewood smoke in rural areas.
- **Localizing Innovation:** Ensuring affordability and effectiveness by leveraging locally sourced components, engaging local researchers, and adopting a user-centric design for maximum impact and adoption.

Publications

Manish Acharya*, Yifan Zhang*, Yu Huang, Kevin Leach. *Optimizing Code Runtime Performance through Context-Aware Retrieval-Augmented Generation.* Accepted at the 33rd IEEE/ACM International Conference on Program Comprehension (ICPC 2025 ERA). https://arxiv.org/abs/2501.16692v2

R. Friedman, J. Cho, J. Brett, X. Zhan, N. Han, S. Kannan, Y. Ma, J. Spencer-Smith, E. Jäckel, A. Zerres, M. Hooper, K. Babbit, **Manish Acharya**, et al. *An Application of Large Language Models to Coding Negotiation Transcripts.* https://arxiv.org/abs/2407.21037

Conferences

33rd IEEE/ACM International Conference on Program Comprehension (ICPC 2025 ERA) April 2025
- Presenting: *Optimizing Code Runtime Performance through Context-Aware Retrieval-Augmented Generation.*

Teaching Experience

Undergraduate Course Assistant January 2024 – Present
MATH 2300: Multivariable Calculus, Vanderbilt University *Nashville, TN*

Industry Experience

Associate Software Developer August 2022 – March 2023
Gurzu Inc. *Lalitpur, Nepal*
- **Engineered Advanced Medical Detection Tools:** Collaborated with a team to develop breast cancer detection software, designing a custom algorithm that improved imaging accuracy by 17%.

Leadership Experience

Co-Founder March 2023 – Present
NPLCoder *Nepal*
- **Advocate for Computational Innovation:** Co-founded a non-profit to connect Nepali students with professors and universities for computational research, while providing resources and guidance.
- **Develop Structured Training Curricula:** Designing curricula and mentoring students in computer science and mathematics for international competitions (IOI, ICPC, etc.), while promoting Nepal's IOI membership.

Co-Founder January 2024 – Present
Uunchai Summer Program *Nepal*
- **Empower Underprivileged Students:** Co-founded a 6-8 week program mentoring 40-50 low-income students from remote areas of Nepal to develop projects addressing local challenges with multidisciplinary guidance.
- **Establish Internship Partnerships:** Securing partnerships with companies to offer students internship opportunities upon program completion, enhancing real-world experience.

Projects

Brain-to-Art Interface | *Python, Raspberry Pi, EEG Sensor, Spotify API* August - November 2024
- Developed a system converting EEG signals into dynamic visual art displayed on an LED matrix.
- Integrated Spotify API to generate personalized playlists based on mental state analysis.

Project Saas | *Flutter, Python, Flask, Firebase* July – September 2022
- Designed a Fourier Transform-based algorithm to analyze breathing patterns and integrated it to smartphones.

Project Yatri | *JavaScript, Node.js, React* March – May 2022
- Built a web platform providing real-time bus route and fare information for Kathmandu, Nepal.
- Designed algorithms to calculate optimal routes and nearest bus stops based on traffic conditions.

Funds & Awards

Fellowships
- 2023 SyBBURE Searle Undergraduate Research Program (Top 10 students annually) ($12,500/year)

Awards
- 2024 Top 5 Best Paper Award (Annual), SyBBURE Searle Undergraduate Research Program
- 2024 Best Innovation Award for project Brain-to-Art Interface
- 2022 Global Finalists Honorable Mention, NASA Space App Challenge
- 2022 All Nepal Rank-1, National Informatics Olympiad