Vikash Singh

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Publications

[1] **VERGE: Formal Refinement and Guidance Engine for Verifiable LLM Reasoning**
Arxiv 2026
- **Vikash Singh, Darion Cassel, Nathaniel Weir, Sam Bayless**
- [Preprint]

[2] **Trust The Typical**
ICLR 2026
- Debargha Ganguly, Sreehari Sankar, Biyao Zhang, **Vikash Singh**, Kanan Gupta, Harshini Kavuru, Alan Luo, Weicong Chen, Warren Richard Morningstar, Raghu Machiraju, Vipin Chaudhary
- [OpenReview]

[3] **Grammars of Formal Uncertainty: When to Trust LLMs in Automated Reasoning Tasks**
NeurIPS 2025
- D. Ganguly, **V. Singh**, S. Sankar, B. Zhang, X. Zhang, S. Iyengar, X. Han, A. Sharma, S. Kalyanaraman, V. Chaudhary
- [Preprint] [Code]

[4] **Mid-Think: Training-Free Intermediate-Budget Reasoning via Token-Level Triggers**
Arxiv
- Wang Yang, Debargha Ganguly, Xinpeng Li, Chaoda Song, Shouren Wang, **Vikash Singh**, Vipin Chaudhary, Xiaotian Han
- [Preprint]

[5] **Efficient Fine-Grained GPU Performance Modeling for Distributed Deep Learning of LLM**
The 32nd IEEE International Conference on High Performance Computing (HiPC), 2025
- Biyao Zhang, Mingkai Zheng, Debargha Ganguly, Xuecen Zhang, **Vikash Singh**, Vipin Chaudhary, Zhao Zhang
- [Preprint] [Code]

[6] **K^4: Online Log Anomaly Detection Via Unsupervised Typicality Learning**
The 32nd IEEE International Conference on High Performance Computing (HiPC), 2025
- **Vikash Singh**, W. Chen, Z. Rahmani, D. Ganguly, M. Hariri, V. Chaudhary
- [Preprint] [Code]

Experience

Amazon Web Services **Aug 2025 – Nov 2025**
Applied Scientist Intern *New York City, NY*
- Improved logical reasoning of LLMs using formal verification methods, including automated reasoning checks.
- Enhanced the performance of several large language models by over 40% through agentic reasoning frameworks.
- Manager: **Darion Cassel**, *Sr. Applied Scientist*, AWS

MGenio **Jun 2024 – Aug 2024**
Machine Learning Internship *Cleveland, OH*
- Led self-driven research on machine learning models and their integration on IoT platforms.
- Developed an efficient platform to manage data flow and monitor machine learning model training.
- Designed a pipeline flow and automated data preprocessing system for machine learning models to feed directly into IoT Systems.
- Manager: **Satish Ramade**, *CEO*, MGenio

DRDO, Ministry of Defence **Jan 2022 – Sep 2022**
Ml/DL Internship *Chandigarh, India*
- Developed a sophisticated approach to enhance precision in satellite imagery analysis by employing segmentation, labeling, and training methods using Variational Autoencoders (VAEs), resulting in 83% accuracy.
- Advisor: **Dr. MK Kalra**, *Scientist G, Defence Geoinformatics Research Establishment (DGRE)*, DRDO

Hatchmarine Consultants **Dec 2021 – Feb 2022**
Research Intern *Delhi, India*

- Developed machine learning models to predict river scour depth in Taiwan, informing strategic resource allocation.
- Fine-tuned predictive models using Python (Scikit-Learn) to achieve high accuracy and meet project requirements.
- Advisor: **Dr. Karan Gupta**, *Technical Director and Founder*

Case Western Reserve University **Jan 2024 – Present**
Teaching Assistant (Computational Perception) *Cleveland, OH*

- Efficiently grade assignments, ensuring accuracy and providing constructive feedback.
- Deliver engaging lectures on specialized topics, fostering student understanding and conduct effective office hours.
- Professor: **Dr. Michael Lewicki**, *Professor, Dept. of Computer Science & Engineering*, CWRU

Indian Institute of Technology Mandi **Feb 2021 – Aug 2022**
Teaching Assistant (Data Science I, II, & III) *HP, India*

- Conducted engaging lectures and facilitated Python hands-on lab sessions, enhancing students' practical skills.
- Assessed student understanding through various evaluation methods, including assignment grading and in-person viva sessions.
- Professors: **Dr. Deelip AD, Dr. Varun Dutt, Dr. Manoj Thakur**, *Professors*, IIT Mandi

Education

Case Western Reserve University **Aug 2024 – Present**
Doctor of Philosophy in Computer Science *Cleveland, OH*

Case Western Reserve University **Aug 2023 – May 2025**
Masters of Science in Computer Science (Specialisation in ML/AI) *Cleveland, OH*

Indian Institute of Technology Mandi **Jun 2019 – May 2023**
Bachelors of Technology in Civil Engineering with minor in AI & Computer Science *Mandi, India*

Research Work

Case Western Reserve University **Jan 2024 – Jul 2024**
Advancements in XAI with Specialization in Counterfactual Explanation Methods *Cleveland, OH*

- Engaged in leading-edge research on Explainable AI, particularly specializing in Counterfactual Explanation methods.
- Advisor: **Dr. Jing Ma**, *Assistant Professor, Department of Computer Science & Engineering*, CWRU

IIT Mandi **Jun 2020 – Jun 2021**
Analysis of Nano Particles in Environment using Deep Learning *Mandi, India*

- Developed a deep multi-modal architecture for accurately predicting the behavior of nanoparticles on different species using environmental data.
- Advisor: **Dr. Tanushree Parsai**, *Assistant Professor*, IIT Madras

Projects

Enhanced YOLOv4 using SMM on OneAPI in SYCL | *Python3, SYCL, CNN, PyTorch* **Nov 2023**

- Developed and integrated Enhanced YOLOv4 with SYCL-Python for advanced object detection algorithms.
- Conducted performance optimization and applied ML techniques to improve real-time data processing.

Human Activity Detector | *Machine Learning, Python3* **Nov 2023**

- Built models using Logistic Regression, Decision Tree, and Support Vector Classifier, achieving 96% accuracy with Logistic Regression using accelerometer and gyroscope sensor data.

Landslide Warning System | *Python3, Machine Learning, DNNs* **Aug 2020**

- Designed a data-driven predictive system analyzing hillside landslide risk factors like weather, slope, and temperature.

Technical Skills

Languages: Python3, C++, Java, JavaScript
Developer Tools: VS Code, Google Colab, Overleaf, High-Performance Cloud, OneAPI DevCloud
Technologies/Frameworks: TensorFlow, PyTorch, Scikit-Learn, OpenCV, Linux, GitHub

Relevant Coursework

- Large Language Models
- Data Structures & Algo.
- High-Perf. Systems for AI
- Analysis of Algorithms
- Deep Learning
- Machine Learning
- Data Science I, II, III
- Computer Vision
- Pattern Recognition
- Data Privacy
- Computer Security

Academic Achievements & Recognitions

- Awarded the **Silver Medal** and **Director's Medal** for academic excellence at IIT Mandi.
- Conducted lab sessions for the *"Training Program on Machine Learning for Ocean Acoustics"* at DRDO-NPOL, Kochi.
- Won two **gold medals** in badminton at the Inter IIT Sports Meet (2019, 2022).
- Secured first place in the **Inter IIT Tech Meet** hackathon at IIT Delhi for plant disease detection algorithm.