

# VIKASH SINGH

Cleveland, OH 44106

+1 (216) 463-5254    ✉ [vikashjohn2505@gmail.com](mailto:vikashjohn2505@gmail.com)    🌐 [vicky157.github.io](https://vicky157.github.io)  
🌐 [linkedin.com/in/vikash-singh-john](https://linkedin.com/in/vikash-singh-john)    🐙 [github.com/vicky157](https://github.com/vicky157)    🎓 [Google Scholar](#)

## Publications

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### [1] **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]

### [2] **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]

### [3] **K<sup>4</sup>: 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

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### 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
<ul style="list-style-type: none"><li>Engaged in leading-edge research on Explainable AI, particularly specializing in Counterfactual Explanation methods.</li><li>Advisor: <b>Dr. Jing Ma</b>, Assistant Professor, Department of Computer Science &amp; Engineering, CWRU</li></ul>	
IIT Mandi	Jun 2020 – Jun 2021
Analysis of Nano Particles in Environment using Deep Learning	Mandi, India
<ul style="list-style-type: none"><li>Developed a deep multi-modal architecture for accurately predicting the behavior of nanoparticles on different species using environmental data.</li><li>Advisor: <b>Dr. Tanushree Parsai</b>, Assistant Professor, IIT Madras</li></ul>	

Projects

Enhanced YOLOv4 using SMM on OneAPI in SYCL   Python3, SYCL, CNN, PyTorch	Nov 2023
<ul style="list-style-type: none"><li>Developed and integrated Enhanced YOLOv4 with SYCL-Python for advanced object detection algorithms.</li><li>Conducted performance optimization and applied ML techniques to improve real-time data processing.</li></ul>	
Human Activity Detector   Machine Learning, Python3	Nov 2023
<ul style="list-style-type: none"><li>Built models using Logistic Regression, Decision Tree, and Support Vector Classifier, achieving 96% accuracy with Logistic Regression using accelerometer and gyroscope sensor data.</li></ul>	
Landslide Warning System   Python3, Machine Learning, DNNs	Aug 2020
<ul style="list-style-type: none"><li>Designed a data-driven predictive system analyzing hillside landslide risk factors like weather, slope, and temperature.</li></ul>	

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

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| <ul style="list-style-type: none"><li>Large Language Models</li><li>Data Structures &amp; Algo.</li><li>High-Perf. Systems for</li></ul> | <ul style="list-style-type: none"><li>AI</li><li>Analysis of Algorithms</li><li>Deep Learning</li></ul> | <ul style="list-style-type: none"><li>Machine Learning</li><li>Data Science I, II, III</li><li>Computer Vision</li></ul> | <ul style="list-style-type: none"><li>Pattern Recognition</li><li>Data Privacy</li><li>Computer Security</li></ul> |
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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.