Vibhas Kumar Vats

✉ vkvatsdss@gmail.com   𝒮 scholar   in /vibhasvats   🌐 vkvats.github.io

Education

2021 – ...	**Ph.D. Computer Science, Indiana University** Bloomington, IN.		GPA: 4.0/4.0
2019 – 2021	**M.Sc. Data Science** with thesis, **Indiana University** Bloomington, IN.		GPA: 3.97/4.0
2011 – 2015	**B.Tech. Electrical Engineering, National Institute of Technology** Patna, India.		CGPA: 8.77/10.0

Research Summary

Ph.D. candidate specializing in large-scale machine learning and generative modeling. My research bridges 3D vision, geometry-aware stereo and diffusion, and scalable neural architectures for representation learning and multimodal synthesis. Experienced in building end-to-end pipelines—from algorithm design to distributed GPU training—and publishing at ICCV, WACV, AAAI, Neurocomputing, SIGSPATIAL, ICCBR and ACM CSUR.

Selected highlights:

ICCV 2025	Hybrid-Voxel Point-Cloud Upsampling (HVPUNet)
SIGSPATIAL 2025	Diffusion-based geospatial forecasting
WACV 2024	Geometry-consistent multi-view stereo framework (GC-MVSNet)
Neurocomputing 2025	Fusion of 3d geometry and deep learning
ACM CSUR 2025	A survey on geometric constraints in deep-learning

Research Publications

Journal Articles

- **V. Vats**, M. A. Reza, D. Crandall, and S.-h. Jung, "Blending 3d geometry and machine learning for multi-view stereopsis," *Neurocomputing*, p. 131 250, 2025, ISSN: 0925-2312. 🔗 DOI: `https://doi.org/10.1016/j.neucom.2025.131250`.

- **V. K. Vats** and D. J. Crandall, "Geometric constraints in deep learning frameworks: A survey," *ACM Comput. Surv.*, vol. 57, no. 10, May 2025, ISSN: 0360-0300. 🔗 DOI: `10.1145/3729221`.

- C. Wang, M. A. Reza, **V. K. Vats**, *et al.*, "Deep learning-based 3d reconstruction from multiple images: A survey," *Neurocomputing*, p. 128 018, 2024, ISSN: 0925-2312. 🔗 DOI: `10.1016/j.neucom.2024.128018`.

Conference Proceedings

- J. Ha, **V. K. Vats**, M. A. Reza, S.-h. Jung, and D. J. Crandall, "Hvpunet: Hybrid-voxel point-cloud upsampling network," in *accepted at ICCV*, 2025.

- **V. K. Vats**, D. Varshney, B. Pandey, C. Brelsford, and P. Dias, "Geospatial diffusion for land cover imperviousness change forecasting," in *accepted at SIGSPATIAL*, 2025.

- **V. K. Vats**, Z. Wilkerson, H. Sato, D. Leake, and D. J. Crandall, "Learning case features with proxy-guided deep neural networks," in *Case-Based Reasoning Research and Development*, Cham: Springer Nature Switzerland, 2025, pp. 313–327.

- **V. K. Vats**, S. Joshi, D. J. Crandall, M. A. Reza, and S.-h. Jung, "Gc-mvsnet: Multi-view, multi-scale, geometrically-consistent multi-view stereo," in *Proceedings of the CVF WACV*, Jan. 2024. 🔗 URL: `https://shorturl.at/FUyTf`.

- **V. K. Vats**, Z. Wilkerson, D. Leake, and D. J. Crandall, "Extracting indexing features for cbr from deep neural networks: A transfer learning approach," in *ICCBR*, 2024. 🔗 URL: `https://shorturl.at/qJuwt`.

- Z. Wilkerson, **V. K. Vats**, K. Acharya, D. Leake, and D. Crandall, "Examining the impact of network architecture on extracted feature quality for cbr," in *CBR Research and Development*, Springer Nature Switzerland, 2023.

- **V. K. Vats** and D. Crandall, "Controlling the quality of distillation in response-based network compression," in *AAAI International Workshop on Practical Deep Learning in the Wild*, 2022.

Patents and Intellectual Property

- S.-H. Jung, **V. K. Vats**, D. J. Crandall, M. A. Reza, and S. Joshi, "Learning method and device for estimating depth information of image," US Patent App. 18/806,829, Feb. 2025.

- S.-H. Jung, **V. K. Vats**, S. Shubham, M. A. Reza, C. Wang, and D. Crandall, "Method and apparatus for estimating depth information of images," US Patent App. 18/297,396, Oct. 2023.

Technical Skills

Core ML	Diffusion Models, Transformers, CNNs, 3D Reconstruction, Gaussian Splatting, Generative Modeling, Multi-View Stereo, Geometry-aware Deep Learning
Frameworks	PyTorch (advanced), TensorFlow (advanced), CUDA, OpenCV, Keras (advanced)
Languages & tools	Python, R, SQL, Docker, R-Studio, PostgreSQL, Git, HPC, Distributed Training

Work Experience

09/2025-present   **Graduate Research Intern**, GeoAI group, Oak Ridge National Laboratory (ORNL), Tennessee.
- Developing deep learning models for extracting building and road footprints as polygons from high-resolution satellite imagery
- Designing algorithms for building height estimation by integrating satellite and ground-level images
Dataset: SpaceNet, xView2, Massachusetts Roads

Summer-2024   **Summer Intern**, GeoAI group, Oak Ridge National Laboratory (ORNL), Tennessee.
- Collaborated with a multidisciplinary team of researchers to apply AI in geospatial analysis
- Developed a generative diffusion model to predict and analyze land use and land cover patterns
- Designed a multi-branch conditional normalization technique to control the diffusion model
- Implemented large-scale training on distributed GPU clusters (8×A100) for geospatial diffusion
Dataset: National Land Cover Database (NLCD)

2017-2019   **External Research Fellow**, National Institute of Technology Patna, India
`Project title`: Sustainable Smart Grid Framework for Energy Management System Incorporating Available Renewable Resources, funded by the SERB, Government of India
- Developed ML model to mitigate the Communication-link failure in load forecasting systems
- Developed an electrical load forecasting system using a weighted polynomial regression model

2015-2017   **Senior Manager**, Tata Motors Ltd. Pantnagar, India.
- Optimized maintenance schedule of Generator yard equipment using past maintenance data
- Developed SOP for building and maintenance of earthing pits

Research Experience

2021-present   **Graduate Research Assistant**, Indiana University Bloomington
◇ **3D Reconstruction, Generation and Scene Understanding:** Developed an MVS algorithm that enforces multi-view geometric consistency in the end-to-end learning process
- Exploring the integration of 3D geometric constraints in deep learning-based MVS frameworks
- Exploring structure-based attention for preserving geometric structure in feature extraction
Datasets: DTU, Tanks & Temples, BlendedMVS, ETH3D
◇ **Model Collapse in Recursively Trained Generative Models:** Investigating model collapse in recursively trained generative models using a Markov chain framework
- Developing methodologies to analyze neural resonance phenomena analogous to Alvin Lucier's experiment, within latent space representations
Dataset: MNIST, ImageNet
◇ **Gaussian Splatting for novel-view generation:** Studying the attributes of diffusion model leading to mode-collapse on recursively trained and generated dataset
Dataset: Objaverse, THuman, Tanks and Temples

2020-2025   ◇ **Deep Learning (DL) - Case-Based Reasoning (CBR) Integration:** Developed an algorithm to examine the impact of DL features on CBR models
- Developed hybrid system leveraging knowledge-engineered and network-learned features together
- Developed DL algorithms to extract latent representations suitable for CBR via proxy guided functions
Dataset: AWA2, Flower102, MNIST

2020-2021   **Masters thesis** on Response-based Knowledge Distillation (*pdf*)
- Analyzed the knowledge distillation process under varying conditions of networks
- Proposed the soft-label hypothesis to explain the behavior of the distillation process
- Developed method to pre-train teacher model for effective knowledge distillation

Teaching Experience

2022-2025   **Co-instructor/course designer, Computer Vision (CSCI-B657)**, Indiana University Bloomington
- Led deep learning discussions with Prof. David Crandall in Spring 2022, 2023, and 2024
- It extensively covers seminal papers on *CNNs, MLPs, Transformers, Generative Adversarial Networks, Variational Autoencoders*, and *Diffusion Models*.
- A complete list of papers covered in Spring'24 and Spring'25

Awards and Achievements

2025   **Nominated to Google PhD Fellowship** by Indiana University Bloomington

2022   **Associate Instructor of the Year**, Indiana University Bloomington

2017   **Outstanding Work Award** by Tata Sustainability group for distinctive work in the CSR program.

2015   **Best Graduate**, National Institute of Technology Patna, batch of 2015.