Vibhas Kumar Vats

✉ vkvatsdss@gmail.com   𝔊 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 Interests

My research involves developing and applying computer vision algorithms that understand, analyze, and organize large-scale datasets of images and video using deep learning-based techniques. My recent focus has been on creating computer vision algorithms that can generate and synthesize 3D models of visual scenes from 2D images, using techniques such as multi-view stereo, stable diffusion, and other deep learning models. I am also exploring evolution of latent representations in recursively trained generative models.

Research Publications

Journal Articles

- **V. K. Vats** and D. Crandall, "Geometric constraints in deep learning frameworks: A survey," *ACM Comput. Surv.*, Apr. 2025, Just Accepted, 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

- **V. K. Vats**, Z. Wilkerson, H. Sato, D. Leake, and D. J. Crandall, "Learning case features with proxy-guided deep neural networks," in *accepted at ICCBR*, 2025.
- **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.

Under Review

- T. Ha, **V. K. Vats**, M. A. R. Soon-heung Jung, and D. Crandall, *Hvpunet: Hybrid-voxel point-cloud unsampling network (under review - iccv)*, 2025.
- **V. K. Vats**, M. A. Reza, D. J. Crandall, and S.-h. Jung, *Blending 3d geometry and machine learning for multi-view stereopsis (under review - transaction on pattern analysis and machine intelligence)*, Nov. 2024.

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

Languages & tools	Python, R, SQL, Docker, R-Studio, PostgreSQL, C (intermediate)
Frameworks	PyTorch (advanced), TensorFlow (advanced), Keras (advanced)

Work Experience

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 *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 a model to mitigate the Communication-link failure in a smart meter-based load forecasting system using machine learning - Implemented 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 - Exploring the application of the Diffusion Process in 3D depth volume manipulation *Datasets:* DTU, Tanks & Temples, BlendedMVS, ETH3D ◇ **Latent Space Collapse in Diffusion Models:** Studying the attributes of diffusion model leading to mode-collapse on recursively trained and generated dataset *Dataset:* MNIST, Modified ImageNet
2025-present	◇ **Action Segmentation:** Developing a multi-stream active speaker detection pipeline for videos, combining synchronized audio and video frames for more accurate speaker identification. - Leveraging attention-based feature extractors to generate conditionals for diffusion models - *Dataset:* Ego4D Audio-Visual tasks
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

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.