Vibhas Kumar Vats

vkvatsdss@gmail.com scholar /vibhasvats vkvats.github.io

Education

2021 – present **Ph.D. Computer Science, Indiana University** Bloomington, IN.
GPA: *4.0/4.0* | Research Interest: *Multi-View Stereo, 3D Reconstruction, Scene understanding, Deep Learning (DL), DL - Case-Based Reasoning Integration.*

2019 – 2021 **M.Sc. Data Science, Indiana University** Bloomington, IN.
GPA: *3.97/4.0* | Thesis title: *Response-Based Knowledge Distillation.* (*pdf*)

2011 – 2015 **B.Tech. Electrical Engineering, National Institute of Technology** Patna, India.
CGPA: *8.77/10.0.*

Research Publications

Journal Articles

1. 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: https://doi.org/10.1016/j.neucom.2024.128018.

Conference Proceedings

1. **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 IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, Jan. 2024, pp. 3242–3252. URL: https://vkvats.github.io/GCMVSNet-page/.
2. Z. Wilkerson, **V. K. Vats**, D. Leake, and D. J. Crandall, "Extracting indexing features for cbr from deep neural networks: A transfer learning approach," in *International Conference on Case-based Reasoning (ICCBR)*, 2024.
3. 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 *Case-Based Reasoning Research and Development*, S. Massie and S. Chakraborti, Eds., Cham: Springer Nature Switzerland, 2023, pp. 3–18.
4. **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.
5. **V. K. Vats**, S. Rai, S. De, and M. De, "Mitigating effect of communication link failure in smart meter-based load forecasting," in *Nanoelectronics, Circuits and Communication Systems*, Springer Singapore, 2020, pp. 289–300.
6. **V. K. Vats**, S. Rai, D. Bharti, and M. De, "Very short-term short-term and mid-term load forecasting for residential academic institute: A case study," in *2018 4th International Conference on Computing Communication and Automation (ICCCA)*, 2018, pp. 1–6. DOI: 10.1109/CCAA.2018.8777543.

Preprint / Under Review

1. **V. K. Vats** and D. J. Crandall, *Geometric constraints in deep learning frameworks: A survey*, 2024. arXiv: 2403.12431.
2. **V. K. Vats**, M. A. Reza, D. J. Crandall, and S.-h. Jung, *Gc-mvsnet++: Improved multi-view, multi-scale, geometrically-consistent multi-view stereo with dense 3d-regularizer*, Jun. 2024.

Work Experience

May,2024- present **Summer Intern**, GeoAI group, Oak Ridge National Laboratory, Tennessee.
- Developing a diffusion-based generative model to predict land cover and imperviousness.

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 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 the application of the Diffusion Process in 4D features

Datasets: DTU, Tanks & Temples, BlendedMVS, ETH3D

◇ **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
- Exploring methods to integrate feedback from a CBR model in training a DL model
- Exploring proxy functions of a CBR model to learn similarity-based features in a DL framework.

Dataset: AWA2, Flower102, MNIST

◇ **EngageAI Institute Project:** Exploring continuous tracking of objects in a video to enhance student engagement in a classroom
- *Dataset:* Ego4D - EgoTracks task

◇ **Roof-area Segmentation and Orientation Detection:** Designed a RANSAC algorithm to detect the orientation and plane area of the roof in 3D point clouds

2020-2021 — **Masters thesis** on Response-based Knowledge Distillation (*pdf*)
- Analyze the knowledge distillation process under varying conditions of networks
- Proposed the soft-label hypothesis to explain the behavior of distillation process
- Proposed methods for pre-training teacher models for effective knowledge distillation

2018-2019 — **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

Teaching Experience

2022-2024 — **Co-instructor, Computer Vision (CSCI-B657)**, Indiana University Bloomington
- Led deep learning discussions with Prof. David Crandall in Spring 2022, 2023, and 2024
- The discussion extensively covers seminal papers on *CNNs*, *MLPs*, and *Transformers*
- We have introduced Generative models like *GANs*, *VAEs*, and *Diffusion models* in Spring 2024.
- A complete list of papers covered in Spring'24

Skills

Languages & tools — Python, R, SQL, Docker, R-Studio, PostgreSQL, C (intermediate)

Frameworks — PyTorch (advanced), TensorFlow (advanced), Keras (advanced)

Miscellaneous Experience

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.