

Prashant Kumar

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Research Interest

- Topological Deep Learning, Representation Learning, Point Clouds
- Generative Modelling for images
- Machine Learning on Graphs (Basic)
- Integrating Large Language models with tabular data, SQL

TECHNICAL SKILLS

- **Languages:** C++, Python
- **Skills:** Machine Learning, Deep Learning, Graph Neural Networks (Basic)
- **Tools:** PyTorch, Git(Basic), NumPy, SciPy, Scikit-learn, Pandas, SQL, Databases

Education

Examination		Institute	Year	CPI/%
Ph.D.(pursuing)	Computer Science & Engineering	IIT Delhi	2020-Present	9
M.Tech	Computer Science & Engineering	IIT Guwahati	2015-17	8.34
B.Tech	Computer Science & Engineering	AKGEC, UPTU	2008-12	77
Intermediate	Science	St. Mary's Convent Inter College, Lko	2008	92
High School	Science	St. Mary's Convent Inter College, Lko	2006	88

Publications

- **GLiDR: Topologically Regularized Graph Generative Network for Sparse LiDAR Point Clouds [pdf]**
Prashant Kumar*, Kshitij Bhat, Vedang Nadkarni, Prem Kumar Kalra
(Accepted at CVPR - 2024)
(Advisor: Prof. Prem Kumar Kalra (IIT Delhi))
- **MOVES: Movable v/s non-movable LiDAR Scene segmentation in segmentation label free settings [pdf]**
Prashant Kumar*, Onkar Susladkar, Dhruv Makwana, Prem Kumar Kalra, Anurag Mittal
(Submitted to Pattern Recognition)
(Advisor: Prof. Prem Kumar Kalra) (IIT Delhi)
- **Differentiable SLAM Helps Deep Learning-based LiDAR Perception Tasks [pdf]**
Prashant Kumar*, Dheeraj Vattikonda, Dhruv Makwana, Vedang Nadkarni, Erqun Dong, Sabyasachi Sahoo
(Published at British Machine Vision Conference (BMVC) - 2023)
- **DSLRL: Dynamic to Static Lidar Scan Reconstruction using an Adversarially Trained Autoencoder[pdf]**
Prashant Kumar*, Sabyasachi Sahoo*, Vanshil Shah, Vineetha Kondameedi, Abhinav Jain, Akshaj Verma, Chiranjib Bhattacharyya, Vinay V.
(Published at AAAI - 2021)
(Advisor: Prof. Chiranjib Bhattacharyya (IISc Bengaluru), Dr. Vinay V (Chennai Mathematical Institute))

Work Experience

- **Research Associate, IISc Bengaluru**

Apr 2019 - Sep 2020

Research Associate : Robert Bosch Centre for Cyber Physical Systems, Indian Institute of Science, Bangalore.

Worked on LiDAR point clouds and adversarial machine learning for robust SLAM in constrained settings.

- **Envestnet Yodlee**
Jul 2017 - Mar 2019
Member Technical Staff: Docker and Product API team.

RESEARCH PROJECTS

- **Automated sampling and importance weighing of positive and negatives nodes using code LLMs for Contrastive Learning on Graphs**
(Advisor: Dr. Sayan Ranu, IIT Delhi, 2024 - Ongoing)
 - Use of code LLMs for self-supervised learning on Graphs.
 - Sample positives and negatives for nodes via code LLMs using heuristics.
 - Encode positives and negatives using k-hop matrices and use closed loop feedback for LLMs.
- **User-persona identification for e-commerce using graphs**
(Advisor: Dr. Sayan Ranu, IIT Delhi, 2024 - Ongoing)
 - Unsupervised persona identification for e-commerce platforms.
 - Use of Bipartite user-product interaction (UPI) heterogeneous graphs and hyper-graphs.
 - LLMs for pretrained embeddings and label generation.
 - Hypergraphs to identify overlapping user subsets for unsupervised persona identification.
- **0-dimensional Persistent Homology(\mathcal{PH}) based topological regularization of point clouds**
(Advisor: Prof. Prem Kumar Kalra, IIT Delhi, 2023)
 - Sparse LiDAR sacrifices detail for efficiency, but still captures the overall shape of static structures.
 - We use a graph generative network, GLiDR with topological regularization.
 - GLiDR addresses sparsity by adding points along a persistent homology backbone.
 - Achieved superior performance and static augmentation across datasets using 32x sparser scans.
- **Segmentation label generation of movable and moving object without training labels**
(Advisor: Prof. Prem Kumar Kalra, IIT Delhi, 2022-23)
 - Unpredictable motion based objects are dangerous for autonomy.
 - Proposed a solution to segment such objects without needing manual labels.
 - Developed a GAN with contrastive pair discriminator to uncover static regions behind occlusions.
 - New static LiDAR structures help SLAM and also help to identifying movable objects.
- **Exploring differentiable SLAM for deep learning**
(Personal Project)
 - Investigated differentiable SLAM for end-to-end deep learning models in LiDAR applications.
 - Integrate differentiable SLAM into per-point prediction tasks using a self-supervised strategy.
 - Demonstrated improved performance on ground level estimation and generative modelling tasks.
- **Occluded static scene generation using adversarial training**
(Advisor: Prof. Chiranjib Bhattacharyya (IISc Bengaluru) and Dr. Vinay V. (CMI Chennai), 2019-20)
 - Generate an accurate perception of occluded static surroundings from dynamic LiDAR.
 - Develop a novel adversarial model using pair discriminator. Used label flipping to achieve static scans.
 - New generated static points resemble closely to original static points and help in robust navigation.
- **Estimation of Lithological Properties from Seismic Data and Well Logs**
(Advisor: Dr. Rashmi Dutta Baruah, IIT Guwahati, 2016 - 17)
 - Identify lithological properties of earth's crust using data from seismic surveys and well logs.
 - Developed a method using unsupervised pretraining to predict the existence of oil at a given location.

Achievements

- Outstanding Teaching Assistanship Award: Introduction to Computer Science.
- ACM IARCS(USD 1000) and Google Travel Grant(USD 3000) for CVPR 2024.

Mentorship Experience

- Mentored Minor project on Scene Graphs of an undergraduate student - Aadya Agarwal, IIT Delhi.
- Mentored two students - Kshitij Bhat (IIT Indore), Vedang Nadkarni (BITS Pilani) on a research project at IIT Delhi.

- Mentored two students - Dhruv Makwana (GTU Gujarat), Onkar Susladkar (VIIT Pune) on two research projects at IIT Delhi.
- Mentored a student - Vanshil Shah, at IISc Bengaluru on a research project at IISc Bengaluru.

Key Courses

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| • Optimization Methods | • Probability |
| • Multivariate Statistical Analysis | • Machine Learning |
| • Data Structures | • Deep Learning |
| • Design and Analysis of Algorithms | • Computational Geometry |
| • Discrete Mathematics | • Graph Neural Networks |
| • Linear Algebra | |

References

- Prof. Anurag Mittal
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- Prof. Prem Kumar Kalra
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Professor and Head Of Department, CSE
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- Prof. Chiranjib Bhattacharyya
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