Ninad Khargonkar

Site: kninad.github.io | GitHub: kninad | Email: ninadk.utd@gmail.com | LinkedIn: linkedin.com/in/kninad

Education

2019 - 2024: **University of Texas at Dallas**, *Ph.D. in Computer Science* - Intelligent Robotics and Vision Lab

2017 - 2019: **University of Massachusetts, Amherst**, *M.S in Computer Science*

2013 - 2017: **Indian Institute of Technology (IIT) Kanpur**, *B.S. in Mathematics and Scientific Computing*

Work Experience

Research and Development Internship

Jun 2022 - Aug 2022: *Kitware Inc*

- Researched machine learning algorithms for approximating medial skeleton of point clouds & voxels
- Implemented UNet based segmentation models for skeletonizing 2D images and adapted them for 3D setting
- Demonstrated improved results via point-cloud skeletonization on data from hippocampi and leaflet regions

Graduate Research Assistant

Aug 2019 - Present: *University of Texas at Dallas*

- Researcher in Intelligent Robotics & Vision Lab, working on robot grasping, 3D vision and learning from humans
- Concurrent research on interactive perception for unseen object segmentation in cluttered environments
- Prior work on submodular information measures for machine learning problems in data selection & active learning
- Involved in mentoring students, working as a teaching assistant and taking guest lectures in selected courses

Mitacs Globalink Research Internship

May 2016 - Jul 2016: *University of Manitoba, Winnipeg*

- Studied the problem of graph sampling and extracting relevant statistics like clustering coefficient
- Implemented scale-down sampling with like Metropolis-Hastings and Jump random walks in R
- Statistical models like ERGM were used for producing model fits and simulating random networks
- Worked on second project for simulating team performance and biases in a football tournament structure

Technical Skills

Programming Languages: Python, C/C++, R

Frameworks/Libraries: PyTorch, ROS, Unity, OpenGL, CUDA, OpenCV

Development Tools: Git/GitHub, Docker, VS Code, Vim, Tmux, LaTeX, Pandoc

Research Projects

Interactive Perception | *Unseen Object Segmentation*

- Leveraging long term robot interaction with objects for real world unseen object segmentation
- Proposed self-supervised data collection method to improved real world segmentation performance
- Extended the method to utilize uncertainty in segmentation for minimizing number of interactions

Object Manipulation | *Robust Grasping & Skill Transfer*

- Learning a common representation across different robot gripper grasps for efficient skill transfer
- Proposed object contact-based metric learning constraints for effective learning in common space
- Demonstrated applications for human to robot grasp trasnfer via our encoding + retrieval pipeline

Robot Benchmarking | *Perception, Grasping & Motion Planning*

- Developed an intuitive method for replicable, real-world scenes of objects for robot benchmarking

- Implemented scene generation pipeline in simulation with focus on cluttered but graspable scenes
- Extened 10 existing methods across pose estimation, segmentation and grasping for real world experiments

Submodular Information Measures | *Robust Machine Learning*

- Proposed novel information theoretic measures for submodular set functionsin context for robust machine learning
- Theoretical properties backed up with applications on outlier aware subsets, summarization & clustering tasks
- Follow up works demonstrated computer vision applications in active learning for object detection

Virtepex | *Remote Strength Assessment*

- Design and development of a mixed reality system in Unity for Kinect-based force estimation of body movements
- Utilized Kinect to track body joints and an inverse dynamics solver to infer force/torque estimates for an user
- User studies with subject matter experts showed the benefit of using a contact-less estimation method v/s telehealth

Publications

1. RISeg: Robot Interactive Object Segmentation via Body Frame-Invariant Features (*Under Review*)
2. SceneReplica: Benchmarking Real-World Robot Manipulation by Creating Replicable Scenes. (*Under Review, ArXiV: 2306.15620*)
3. Self-Supervised Unseen Object Instance Segmentation via Long-Term Robot Interaction. *In Robotics: Science and Systems (RSS), 2023*.
4. Skeletal Point Representations with Geometric Deep Learning. *In IEEE International Symposium on Biomedical Imaging (ISBI), 2023*.
5. NeuralGrasps: Learning Implicit Representations for Grasps of Multiple Robotic Hands. *In Conference on Robot Learning (CoRL), 2022*.
6. Virtepex: Virtual Remote Tele-Physical Examination System. *In ACM SIGCHI Conference on Designing Interactive Systems (DIS), 2022*.
7. Generalized submodular information measures: Theoretical properties, examples, optimization algorithms, and applications. *In IEEE Transactions on Information Theory Journal, 2021*.
8. Submodular combinatorial information measures with applications in machine learning. *In International Conference on Algorithmic Learning Theory (ALT), 2021*.

Other Experience

Professional Service: CoRL, ICRA, IROS, IEEE VR, ACM MM, ICMR, ICHI, IJCAI (external reviewer)

Teaching Assistant: Machine Learning, Robotics, Computer Graphics, Statistics for Data Science

Mentorship: Peer mentor for new PhD students at UT-Dallas and member of Counselling Service at IIT Kanpur

Course Projects

Faster Inference for Chow-Liu Trees | *Machine Learning*

- Developed approximation algorithms for faster inference in Chow-Liu tree probabilistic graphical model
- Tried out sub-quadratic variants for minimum weight spanning tree computation & compared with optimal setting

Data Subset Selection | *Optimization Algorithms*

- Framed subset selection from training data as an optimization problem with minimal impact on validation loss
- Utilized gradient approximation scheme to show utility on logistic regression and neural network models

Marching Cubes based Reconstruction | *Computer Graphics*

- Implemented a base version of marching cubes algorithm for 3D iso-surface extraction using OpenGL and C++
- Improved initial results via better representation for vertex normal by averaging over faces for a vertex

Academic Achievements

- Recipient of Inspire scholarship awarded by Indian Govt. for academic performance at IIT Kanpur.
- Awarded the Mitacs Globalink scholarship for fully funded summer research internship in Canada.
- Secured a percentile score of 97.7 in JEE (Advanced)-2013 and a percentile score of 99.8 in JEE (Main)-2013 national engineering entrance examinations.