NINAD KHARGONKAR

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EDUCATION

University of Texas at Dallas   Richardson, TX
Doctor of Philosophy (Ph.D.) in Computer Science   *Aug. 2019 – May 2024*

University of Massachusetts, Amherst   Amherst, MA
Master of Science (M.S) in Computer Science   *Aug. 2017 – May 2019*

Indian Institute of Technology (IIT), Kanpur   Kanpur, India
Bachelor of Science (B.S) in Mathematics & Scientific Computing   *Jul. 2013 – Jun. 2017*

WORK EXPERIENCE

Research & Development Internship   Jun. 2022 – Aug. 2022
Kitware Inc   *Remote*

- Researched machine learning algorithms for approximating medial skeleton of 3D point clouds & voxels
- Implemented existing UNet based models for skeletonizing 2D images and adapted them for 3D images
- Demonstrated improved results from the proposed pipeline on 3D medical data from hippocampi and leaflet regions reducing the time for generating skeltons when compared to classical methods
- Research paper for the work was accepted to IEEE International Symposium on Biomedical Imaging (ISBI) 2023

Graduate Research Assistant   Aug. 2019 – Present
University of Texas at Dallas   *Richardson, TX*

- 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, Canada*

- 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, OpenCV, CUDA, OpenGL
Development Tools: Git/GitHub, Docker, VS Code, Vim, Tmux, LaTeX, Pandoc

PUBLICATIONS

Self-Supervised Unseen Object Instance Segmentation via Long-Term Robot Interaction. (In Submission, arXiv: 2302.03793).

Skeletal Point Representations with Geometric Deep Learning. In IEEE International Symposium on Biomedical Imaging (ISBI), 2023.

NeuralGrasps: Learning Implicit Representations for Grasps of Multiple Robotic Hands. In Conference on Robot Learning (CoRL), Proceedings of Machine Learning Research (PMLR), 2022.

Virtepex: Virtual Remote Tele-Physical Examination System. In ACM SIGCHI Conference on Designing Interactive Systems (DIS), 2022.

Generalized submodular information measures: Theoretical properties, examples, optimization algorithms, and applications. In IEEE Transactions on Information Theory Journal, 2021.

Submodular combinatorial information measures with applications in machine learning. In International Conference on Algorithmic Learning Theory (ALT), Proceedings of Machine Learning Research (PMLR), 2021.

Research Projects

Interactive Perception | *Unseen Object Segmentation*   Python, PyTorch, ROS
- 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

Object Manipulation | *Robust Grasping & Skill Transfer*   Python, PyTorch, ROS
- 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

Scan to VR | *Virtual World Reconstruction*   Python, PyTorch, Unity
- Working on the problem of efficient and robust 3D object retrieval from a RGB-D scan of indoor environment
- Implemented a pipeline to convert 3D scans to virtual Unity scenes by fetching closest matching CAD models

Submodular Information Measures | *Robust Machine Learning*   C++, Python, PyTorch
- 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
- Proposed measures have also demonstrated use case for computer vision in active learning for object detection

Virtepex | *Remote Strength Assessment*   Unity, C#
- 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

Other Experience

Professional Service: ICRA'22, IROS'22, ICMR'22, ICHI'22, IEEE VR'21, ACM MM'21, IJCAI'20 (external reviewer)

Teaching Assistant: Machine Learning, Robotics, Statistical Methods, Graphics, Natural Language Processing

Mentorship: Peer Mentor for incoming PhD students and previously member of Counselling Service at IIT Kanpur

Course Projects

Faster Inference for Chow-Liu Trees | *Machine Learning*   Python, Numpy
- 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*   C++, Python, PyTorch
- Framed subset selection from training data as an optimization problem with minimal impact on validation loss
- Utilized novelgradient approximation scheme to show utility on logistic regression and neural network models

Part of Speech Tagger for Hindi | *Natural Language Processing*   Python, NLTK, FastText
- Designed a machine learning method for a Hindi PoS tagger by leveraging word embeddings and an English tagger
- Our method showed performance gain of 12% on domain classification of Hindi docs when using inferred PoS labels

Marching Cubes based Reconstruction | *Computer Graphics*   C++, OpenGL
- Implemented a base version of marching cubes algorithm for 3D iso-surface extraction using OpenGL
- 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