Shivani Kamtikar

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Education

- **Unversity of Illinois – Urbana Champaign** — **Champaign-Urbana, IL, USA**
  Ph.D. Computer Science, Advisor - Prof. Girish Chowdhary — *May 2022 - Present*
  Relevant courses: Meta Learning, Transfer Learning - **GPA: 4.0**
- **Unversity of Illinois – Urbana Champaign** — **Champaign-Urbana, IL, USA**
  M.S. Computer Science, Advisor - Prof. Girish Chowdhary — *Sept 2020 - May 2022*
  Relevant courses: Learning-Based Robotics | Computer Vision | Robotics and Automation | Machine Learning - **GPA: 3.5**
- **Savitribai Phule Pune University, Pune, India** — **Pune, India**
  B.Tech Information Technology — *Aug 2016 - Oct 2020*

Publications

- K. Koe, S. Marri, B. Walt, **S. K. Kamtikar**, N. K. Uppalpati, G. Krishnan, G. Chowdhary, *"Model-Based Dynamic Position and Orientation Control of a Hybrid Soft Continuum Manipulator"*, in submission to IEEE Robotics and Automation Letters (RA-L).
- **S. K. Kamtikar**, S. Marri, B. T. Walt, N. K. Uppalapati, G. Krishnan, and G. Chowdhary, *"Visual servoing for pose control of soft continuum arm in a structured environment"*, IEEE Robotics and Automation Letters (RA-L), *and* IEEE International Conference on Soft Robotics – RoboSoft 2022.
- **S. K. Kamtikar**, S. Marri, B. T. Walt, N. K. Uppalapati, G. Krishnan, and G. Chowdhary, *"Towards Autonomous Berry Harvesting using Visual Servoing of Soft Continuum Arm"* - AI for Agriculture and Food Systems (AIAFS) workshop 2022.
- **S. K. Kamtikar**, E. Ji, N. K. Uppalapati, G. Krishnan, and G. Chowdhary, *"Realistic Simulation Environments to Achieve Visual Servoing on Soft Continuum Arms in Constrained Environments"* - Fourth International Workshop on Machine Learning for Cyber-Agricultural Systems (MLCAS 2022).

Relevant Experience

Graduate Research Assistant, University of Illinois – Urbana Champaign (Jan 2021 - Present)

Visual Servoing for Pose Control of Soft Continuum Arms (SCA) in a Structured Environment

- Demonstrated reliability of CNN based visual servoing to control position and orientation of SCA.
- Implemented 2 methods and a control law to perform smooth and robust 3D positioning tasks on SCA.
- Demonstrated robustness of system with new targets, lighting change, loads, and diminution of SCA.
- Achieved SOTA less than 2 cm translation error and less than 0.25 radians rotation error.

Learning-Based Manipulation of SCA in Cluttered, Unstructured and Unseen Environments

- Implemented SfM-based reconstruction methods to obtain point clouds of cluttered scenes.
- Constructed occupancy grid to determine obstacles in the scene.
- Implemented graph-based path-planning method to obtain path avoiding obstacles.
- Found waypoints, to reach the target, along the path using heuristics.
- Implemented visual servoing and control law to overcome any error gaps and close the loop.
- Demonstrating effectiveness of method in cluttered unknown environments with obstacles.

Dynamic Position and Orientation Control of a Hybrid SCA for Autonomous Berry Harvesting

- Overcame accuracy gaps in dynamic position and orientation control of SCA using visual servoing.
- Used object detection and localization to identify target berry in the environment.
- Developed a model using optical flow that determines the relative transformation between goal and current position.
- Developed a network that maps position to actuation values for control of SCA.

- Demonstrated effectiveness of method on autonomous berry harvesting task with less than 2cm error.

Large-scale Agricultural Dataset for Computer Vision and Robotics
- Developing a large-scale agricultural dataset to be used for various robot learning tasks.
- Benchmarking it against SOTA object detection, segmentation, tracking and reconstruction methods.

Academic Projects

End-to-End Goal Based Meta-Learning For Robotic Applications (Sept 2022 - Dec 2022)
- Implemented an RL-based method that combines end-to-end application feedback and meta-learning.
- Used REINFORCE method for policy update of the RL system.

Reinforcement Learning for Manipulation and Control in a Structured Environment (Sept 2021 - Dec 2021)
- Trained a DDPG for tracking the path of the end effector of SCA to target using real-world data.
- Performed various ablation studies to find the best parameters for the DDPG.
- Demonstrated the shortcomings of DDPG on the system using experiments.
- Compared the system with other learning-based pose-estimation methods and investigated the shortcomings of DDPG.

Learning Based Relative Pose Estimation for Visual Servoing of a Soft Robot, (March 2021 - May 2021)
- Implemented and trained 4 different CNN based architectures to learn relative pose between 2 images.
- Performed ablation studies to find the best parameters for each of the architectures.
- Demonstrated the performance of different architectures on SCA to reach a target from a given position.
- Compared the performance on the SCA prototype and demonstrated the best performing architecture.

Conference/Journal Reviewer
- IEEE Robotics and Automation Letters (RA-L)
- Workshop on Agricultural Robotics for a Sustainable Future, IROS

Talks and Presentations
- Demonstrated VaLeNS on Wheels at Dixon Springs Agricultural Center - 2023.
- Presented paper at the 5th IEEE-RAS International Conference on Soft Robotics – RoboSoft 2022.
- Poster presentation at the Fourth International Workshop on Machine Learning for Cyber-Agricultural Systems (MLCAS 2022).
- Workshop paper presentation at AI for Agriculture and Food Systems (AIAFS) workshop 2022.
- Research presentation at the Illinois Autonomous Farms (IAF) Workshop, UIUC - 2021.

Awards and Recognition
- Received "Best Outgoing Student Award" awarded by Savitribai Phule Pune University, Pune, India.
- Patent granted by the Indian Patent Office for final-year undergraduate project.
- Awarded a grant of 11000 USD from IBM for final-year undergraduate project.
- Awarded a full scholarship from iSURE - International Student Undergraduate Research Experience.
- Featured on the website of the University of Notre Dame.

Leadership Experience
- General Chair for CSL Student Conference 2024
- Treasurer of GradSWE (Graduate Society of Women Engineers) at UIUC - 2021-2024.
- Robotics Chair for CSL Student Conference 2023
- Appointed the Diversity Advocate for a hiring committee at UIUC.

Interests

Painting | Travelling | Reading