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 | **Robot 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

- Proved the reliability of CNN-based visual servoing for controlling the position and orientation of SCA.
- Implemented two novel methods and a control law to enable smooth and robust 3D positioning of SCAs.
- Demonstrated robustness against various challenges, such as new targets, varying loads, and SCA diminution.
- Achieved SOTA performance with translation error less than 2cm and rotation error less than 0.25 rad.

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

- Developed a comprehensive solution utilizing Structure-from-Motion (SfM)-based reconstruction for generating point clouds of cluttered scenes.
- Created an occupancy grid to identify obstacles within the environment.
- Implemented a graph-based path-planning method for obstacle avoidance and path generation.
- Successfully applied visual servoing and control laws to close the loop and navigate the robot through challenging, cluttered environments with obstacles.

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

- Addressed accuracy challenges in the dynamic position and orientation control of SCAs.
- Developed an optical flow model to determine the relative transformation between the goal and the

current position.
- Designed a neural network mapping position to actuation values for SCA control.
- Demonstrated the method's effectiveness in autonomous berry harvesting with an error rate below 2cm.

Large-scale Agricultural Dataset for Computer Vision and Robotics
- Developing a large-scale agricultural dataset to be used for various robot learning tasks.

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 Deep Deterministic Policy Gradient (DDPG) model for tracking the path of the end effector of SCAs to a target using real-world data.
- Conducted ablation studies to identify optimal parameters for the DDPG model.
- Explored the shortcomings of DDPG through systematic experiments and compared it to other learning-based pose-estimation methods.

Learning Based Relative Pose Estimation for Visual Servoing of a Soft Robot, (March 2021 - May 2021)
- Implemented four different CNN-based architectures to learn the relative pose between two images.
- Conducted ablation studies to fine-tune the parameters of each architecture.
- Demonstrated the performance of these architectures on SCAs for reaching a target pose.
- Compared the performance on the SCA prototype and identified the best-performing model.

Conference/Journal Reviewer

- IEEE Robotics and Automation Letters (RA-L)
- International Conference on Learning Representations (ICLR)
- 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

- Member of the Engineering Graduate Student Advisory Council (EGSAC), UIUC - 2023-2024
- 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
- Diversity Advocate for a hiring committee at UIUC.