Yifan Yin

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EDUCATION

JOHNS HOPKINS UNIVERSITY (JHU) — Baltimore, MD
M.S.E. Robotics (Perception Systems Focus) — Aug 2021 - May 2023
CGPA: *3.75/4.00*

UNIVERSITY OF PITTSBURGH (Pitt) — Pittsburgh, PA
Bachelor of Science (Mechanical Engineering) — Aug 2019 - May 2021
CGPA: *3.95/4.00*

SICHUAN UNIVERSITY (SCU) — China
Bachelor of Engineering (Mechanical Design and Automation) — Sep 2017 - Jun 2019
CGPA: *3.91/4.00*

SKILLS

Programming	C/C++, Python, C#, SQL, Bash, Java
Frameworks	Scikit, PyTorch, OpenCV, Keras, SpaCy, TensorFlow, LangChain, Open3D
Machine Learning	SVM, CNN, RNN, GAN, ViT, Deep Q-Net; Transfer Learning, Bayesian Inference
Perception	Image Processing, Optical Flow, Object Detection, 3D Reconstruction, Segmentation, Visual Servo, Image Registration, Camera Calibration, Statistical Shape Modeling
Robotics	Robot Manipulation, Robot Operating System (ROS), Robot Kinematics, Robot Motion Planning, Handeye Calibration, Sensor Fusion, Visual Perception System

EXPERIENCE

PediaMetrix Inc. , Rockville, MD — Jul 2023 – Present
Computer Vision Internship

- Developed and implemented a machine learning based classifier for statistical prediction of types of skull abnormalities, obtained a sensitivity of 94.6% and specificity of 99.3%.
- Working on the improvement of the 3D reconstruction pipeline for cranial shape modeling with smart phone cameras by utilizing image processing, image registration, foreground estimation, instance segmentation techniques.

Johns Hopkins University, Baltimore, MD — Feb 2022 – May 2023
Research Assistant, Sponsored by Sanaria, Inc.

- Developed, integrated, and maintained software and visual perception systems for a micro-dissection robot.
- Reduced system calibration time by 87% through streamlining a fully automated calibration process.
- Streamlined the software development process for deep-learning-based robot vision, developing software tools for training, evaluation, data management, annotation refinement, and data augmentation; created 2D & 3D domain randomization tools that generate 800 new training images per minute.
- Designed and developed real-time calibration-free visual servos for robot homing and dissection surface approaching, achieving a servo accuracy of 0.14mm using multi-camera views.
- Improved hand-eye calibration accuracy by 21% through developing learning-based perception modules for subpixel-level detection and localization of the robot tooltip using key-point detection algorithms.

Teaching Assistant, of the course Algorithms for Sensor-Based Robotics — Aug 2022 – Dec 2022

- Conducted office hours to address conceptual questions regarding robot kinematics, calibration, and sensor fusion.
- Designed and implemented a ROS package for a vision-guided pick-and-place task with UR5 robot arms using MoveIt, Rviz, hand-eye calibrations, and motion planning for a new lab assignment.

RESEARCH & PUBLICATION

Task Specific Grasping with Language Models — Jul 2023 – Present

- Design and develop approaches for the generation of task specific grasping policies with large language models (LLMs) and vision language models (VLMs).
- Developed and implemented a sample-based algorithm to rapidly search and rate for antipodal points and grasping policies on a mesh based on geometries and a list of metrics.
- Leverage power of language models in a context-dependent grasping problem by building the connection between logical reasoning capabilities of LLMs and text localization capabilities of VLMs.

Uncalibrated Image-Based Visual Servoing in Robotic Manipulations Oct 2022 – May 2023

- Developed a general calibration-free visual servo approach for sending a manipulator to a given 6-DoF pose in space.
- Verified the algorithm in a mirco-scale task by fully automating an calibration process of a 3-DoF dissection manipulator, achieving sub-milimeter system accuracy.
- Extended the algorithm to a meso-scale task by constructing a screw-turning task using a UR10, achieving outstanding results with a positional error of less than 2mm and a rotational error of less than 6 degrees.
- Work presented at *the IEEE International Conference on Automation Science and Engineering (CASE).*

Co-robotic Ultrasound Mammography May 2022 – Nov 2023

- Built an ultrasound auto-scanning robot manipulator system for breast cancer diagnosis using a 6-DOF UR5 robot arm, stereo camera, force sensor, and ultrasound probe.
- Achieved an overall system accuracy of 3mm through accurate camera and ultrasound calibration.
- Developed visual perception and image processing modules to register X-ray and camera images for accurate lesion localization using segmentation, image denoising, frequency emphasis, and morphology techniques.
- Designed and implemented force feedback control modules for full X-ray guided ultrasound scanning, maintaining a constant force applied to the patient throughout the scanning process.
- Manuscript submitted to *the IEEE Robotics and Automation Letters (RA-L).*

PROJECTS

Learning-Based Surgical Instrument Tracking Mar 2023 – Aug 2023

- Adapted and customized Faster R-CNN and YOLOv8 frameworks for accurate surgical instrument tracking.
- Achieved a mean Average Precision (mAP-50) of 80%, demonstrating high accuracy and model generalizability in detecting and tracking instruments surgical videos.

UR5-ROS Spherical Image Capturing Aug 2022 – Oct 2022

- Designed and implemented a ROS package for capturing a given number of images with a manipulator on multiple layers of spherical surfaces around target objects.
- Analytically derived the rigid body transformation of the camera link with respect to the target, ensuring the camera moved on a sphere while always facing the object.

'Flappy Bird' Bot with Double Deep Q Network Aug 2022 – Nov 2022

- Designed and implemented an RL agent that can play the game 'Flappy Bird' forever.
- Constructed convolutional neural network models from scratch for game action classifications at each frame with an AUC of 0.85+ using the PyTorch framework.
- Added time-varying reward settings to the Markov Decision Process to avoid convergence of the neural networks to extreme solutions and brought a ~2000 epochs earlier convergence.
- Added an image preprocessing pipeline to ~26% decrease computational cost of training neural networks.
- Enhanced performance by ~12% using Double Deep-Q networks with Experience Replay buffers.

Trajectory Planning and Visualization for Injection Surgeries Oct 2021 – Aug 2022

- Built a Head-Mounted Augmented Reality application for lesion localization, surgical planning and trajectory visualization in injection surgeries; awarded the Honorary Mentioned Demo in final presentation.
- Designed and built AR scenes for augmenting a virtual monitor that displays slices of the preoperative images (CT/MRI) in real-time as scanning the patient's body with a registered scanning tool.
- Implemented a data management system for efficient generation, storage, and extraction of clinical records.
- Designed and implemented a TCP communication process between HoloLens2 and PC for efficient transfer of preoperative medical images.
- Developed algorithms for the planning and visualization of injection trajectories.