

Yifan Yin

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EDUCATION

JOHNS HOPKINS UNIVERSITY

Baltimore, MD

Master of Science in Robotics

May 2023 (Expected)

- **Selected Coursework:** Deep Learning; Augmented Reality; Computer Vision; Machine Perception; Image Processing and Analysis; Robot Kinematics, Dynamics and Control; Algorithms for Sensor-Based Robotics

WORK EXPERIENCE

Course Assistant - Algorithms for Sensor-Based Robotics

Aug. 2022 – Present

- Holding office hours for explaining conceptual questions regarding robot kinematics, rigid body transformations, handeye calibration, Kalman filters, particle filters, and troubleshooting for students coding assignments
- Working on the development of a ROS package for a vision-guided pick-and-place task with UR5 using MoveIt, motion planning, camera calibrations, pose estimation, robot control, for upgrading and setting up course labs

Research Assistant – Visual Perception and Robotics

Feb. 2022 – Present

Laboratory for Computational Sensing and Robotics, Johns Hopkins University

- Working on the visual perception of a micro-dissection system using ROS, camera calibrations, object detection, feature extraction, semantic segmentation, visual-servoing control and perception systems
- Designed and implemented calibration-free visual servos for robot homing and surface safe approaching to save operation time by ~37% using key-point detection, feature extraction and finite-state machines
- Developed a ROS service for the subpixel level detection and localization of the robot tooltip to improve the accuracy of hand-eye calibration by ~14% using key-point detection algorithms (Mask R-CNN)
- Designed and implemented a 2D domain randomization pipeline for data augmentation and image label refinements, capable of generating ~800 images per minute with supplied backgrounds
- Developed a 3D domain randomization to generate simulated images from different camera views using Unity 3D simulation, and perform domain adaptation to transfer those images into real domain using Cycle GAN
- Maintained data stream organization by developing a framework for integrated data management during network training, inference and evaluation

PROJECTS

Ro-robotic Ultrasound Mammography

May. 2022 – Present

Research Project

- Built an ultrasound auto-scanning robot manipulator system for the diagnosis and varification of the breast cancer with ROS, kinematics, motion planning, camera calibration, image registration, visual servoing, robot control
- Performed accurate camera calibration, ultrasound calibration and pivot calibration, which achieved an overall system accuracy of <4mm in vision-guided robot manipulations
- Designed and implemented image processing and segmentation algorithms for the localization and segmentation of the lesion areas in ultrasound images using classical and deep-learning based methods
- Developed an automatic camera calibration algorithm that demonstrated to save a calibration time of over 80%
- Implemented visual guided motion planning algorithms that are capable of finding jump-free paths in ~99% of time with ROS, rapidly-exploring random tree (RRT), stereo cameras, MoveIt, Aruco markers
- Implemented control algorithms for approaching scanning regions and performing ultrasound scanning ‘Wobble motion’ with ROS, kinematics and resolved-rate control algorithms

Trajectory Planning and Data Visualization of Injection Surgery

Oct. 2021 – Aug. 2022

Research Project

- Built a Head-Mounted Augmented Reality application for assisting lesion localization, surgical planning and trajectory visualization during facet joint injections using C# programming, Unity 3D, TCP communication; awarded the Honorary Mentioned Demo in final presentation
- Designed and built AR scenes for augmenting a virtual monitor that displays slices of the preoperative lumbar spine images (CT/MRI) in real-time as scanning the patient’s back with a registered tool
- Added intuitive user interfaces for viewing image/text records for each injection target under previous clinical visits for intraoperative reference using Microsoft Mixed Reality Toolkit (MRTK)
- Implemented a data management system for the generation, storage and extraction of clinical records using C# and object-oriented programming, capable of saving/invoking one record within 0.3ms
- Designed and implemented a TCP communication pipeline between HoloLens2 and the operation computers for efficient transfer of preoperative medical images
- Developed algorithms for the planning and visualization of injection trajectories, giving an error of smaller than 2mm

- Improved depth perception during alignment of surgical tools with planned trajectories by augmenting a window on the patient's skin that can look virtually inside the body at injection target positions

SKILLS

Programming	C/C++, C#, MATLAB, Python, PyTorch, Keras
Machine Learning	Logistic Regression, CNN, RNN, GAN, LSTM and Transformers
Computer Vision	Object Detection, 3D Reconstruction, Semantic Segmentation, Visual Servo-ing Control, Image Registration, Camera Calibration
Robotics	Robot Kinematics, Motion Planning, Handeye Calibration, Sensor Fusion, Visual Perception