Ki-Hwan Oh

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EDUCATION

03.2012 ~ 02.2018   **Sung Kyun Kwan University**, Seoul, S. Korea

09.2019 ~ Now   **University of Illinois at Chicago**, US

RESEARCH EXPERIENCE

03.2017 ~ 11.2017   **Sung Kyun Kwan Univ. Graduation Portfolio –** Seoul, S. Korea

- Research topic: Safety device for the blind based on GPS information and image processing.

- Chose to create a safety device for the blind using GPS and image processing.

- Used raspberry pi (Linux OS) as the main device, IBM Bluemix as the main cloud, and OpenCV program for image processing.

- Designed and 3D printed a suitable case for the device to be attached to the wands for the visually impaired.

- The main goal of this project is to provide safety for blind users under crosswalk circumstances.

- The project allows the family members of the user to have access to the user's current location by receiving the GPS information from the cloud network and displaying it on the map in the designed HTML.

- Through the camera, the device can check the location of the crosswalk and the current signal of the traffic light. Based on the current information, it will warn the user not to cross or guide the user while walking on the crosswalk.

- The highest grade in the class and selected as Project Advisor of the group.

09.2019 ~ 08.2020   **UIC Robotics Lab –** Chicago, IL, US

- Research topic: Synchronizing data collection time over different sensors in separate devices.

- About 25 pressure sensors and 1 IMU module are attached in each glove connected to a beaglebone black processor, 4 wireless IP cameras, and 4 additional sensors on a single tray.

09.2020 ~ 04.2021   **UIC Robotics Lab –** Chicago, IL, US

- Research topic: Physical Action Primitives for Collaborative Decision Making in Human-Human Manipulation

- Analyzing the movement of a tray where two subjects try to cooperate to accomplish a simple task without any prior communication.

- Focused on analyzing the IMU datasets to find the location, velocities, and other useful information about the tray.

- Managed to work on a methodology to classify the events that occurred during the human-human interaction regarding the analyzed datasets.

06.2021 ~ 12.2021   **UIC Surgical Innovation and Training Lab (SITL) –** Chicago, IL, US

- Research topic: Setting up the da Vinci Research Kit (dVRK).

- Helped install the full dVRK (da Vinci S model) system in the lab and managed to do basic surgery playback system using rosbag.

- Have experience in streaming the stereo live video captured from the Endoscopic Camera Manipulator (ECM) on a Virtual Reality Headset (using HTC Vive Pro Eye).

- Applied an eye tracking device (Tobii Eye Tracker) to locate the gaze position of the user by looking at the monitor displaying the live stream video from the ECM.

- Added Si version tools manually and it is expected to be updated in the dVRK community for research.

- Manually created Rviz file to simulate both Patient Side Manipulators (PSMs) and successfully registered in a motion planning program (MoveIt!), and thus it is possible to first simulate motion planning and then play the result on the actual dVRK.

01.2022 ~ Now   **UIC Surgical Innovation and Training Lab (SITL) –** Chicago, IL, US

- Research topic: A Position Based Visual Servoing (PBVS) to automate the gall bladder removal procedure.

- The main goal of the research is to automate gall bladder removal using the dVRK based on PBVS.

- Replaced the gall bladder and liver with chicken meat and skin since gallbladders are not accessible.

- First, we applied manual system calibration using fiducial markers since the data coming from the dVRK did not match the actual location of the Patient Side Manipulators (PSMs) based on the endoscope.

- Implied Detectron2, a state-of-the-art object segmentation and key point detection network developed by Facebook, with our custom dataset of pictures of the chicken's meat, skin, and PSM.

- Created a program to calculate the 3D point clouds from the stereo images of the endoscope based on the Semi-Global Block Matching (SGBM) method, and point clouds of the external RGBD camera are provided by its own SDK.

- After the images are applied to Detectron2, the corresponding 3D points for the target (boundary of the skin) and the tooltip (PSM) are captured.

- Kalman Filter is used to reducing the noise and check whether the predicted location of the tooltip matches the actual movement of the arm as feedback.

03.2023 ~ Now   **UIC Robotics Lab –** Chicago, IL, US

- Research topic: Modeling a robot that takes initiative in collaborative tasks based on the interactions from Physical Human-Human Interaction (pHHI).

- An extension to our previous research (Physical Action Primitives for Collaborative Decision Making in Human-Human Manipulation), the experiment is similar, but additional goal positions were included, and a set of actions (Hard and Soft actions) are introduced where the Hard user should lead its partner to their goal and Soft user can give up their goal during the process.

- Focused on analyzing different kinematics (force, velocity, power, etc. of each agent and interaction forces from both agents) to find similarities between the different interaction types (i.e., Hard-Soft conflicting, Soft-Soft conflicting).

- Managed to classify the first actions of Hard goal cases based on Discriminant Analysis (DA) using the average and max of the individual force, power, and velocity.

TEACHING EXPERIENCE

08.2020 ~ 12.2020 Teaching Assistant for ECE 451: Principles of Modern Control – UIC

08.2020 ~ 12.2020 Teaching Assistant for ECE 434: Multimedia Systems – UIC

01.2021 ~ 05.2021 Teaching Assistant for ECE 452: Robotics, Algorithm, and Control – UIC

08.2021 ~ 12.2021 Teaching Assistant for ECE 350: Principles of Auto Control– UIC

01.2022 ~ 05.2022 Teaching Assistant for ECE 452: Robotics, Algorithm, and Control – UIC

HONOR & AWARDS

03.2015 & 2017 **Dean's List** – Sung Kyun Kwan University, Seoul, S. Korea

SKILLS

- Proficient in C, Python, Linux, ROS, MATLAB
- Solid understanding of C++ Programming Language.
- VHDL, Verilog, and related programs
- Implementation skills for machine Learning programs (based on Tensorflow and PyTorch)
- HTML and JavaScript
- Microsoft Office (Work, Excel, PowerPoint, Access)
- 3D Printing and designing its blueprints.
- Experience in using VR Headsets and simple 3D modeling.
- Experience in using eye-tracking devices.
- Experience in research of the full da Vinci Research Kit (dVRK).

PAPERS

Z. Rysbek, K. H. Oh, B. Abbasi, M. Žefran and B. Di Eugenio, "Physical Action Primitives for Collaborative Decision Making in Human-Human Manipulation," *2021 30th IEEE International Conference on Robot & Human Interactive Communication (RO-MAN)*, 2021, pp. 1319-1325, doi: 10.1109/RO-MAN50785.2021.9515363.

Shervedani, A. M., Oh, K. H., Abbasi, B., Monaikul, N., Rysbek, Z., Di Eugenio, B., & Zefran, M., "Evaluating Multimodal Interaction of Robots Assisting Older Adults," *arXiv preprint arXiv:2212.10425* (2022).