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Centre for Robotics and Automation 機器人與自動化研究中心

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NEWSFEED

CityU Robotics Workshop 2016

The annual CityU Robotics Workshop was held successfully on 26 Feb 2016 at Connie Fan Multi-media Conference Room, City University of Hong Kong with the theme of "Smart Robotics: from Macro- to Micro-scaled Applications". We were privileged to invite a number of active researchers from overseas, mainland China as well as local institutions to share their expertise and recent research updates. Nearly 100 participants joined the workshop.

After the workshop, we were pleased to organize a laboratory tour to speakers and guests to give an overview of the robotics research development in CityU.

We would like to express our sincere gratitude to all our distinguished guests, session chairs and speakers. We look forward to organizing more academic activities in the near future.

APAC Innovation Summit (Robotics) 2015-16

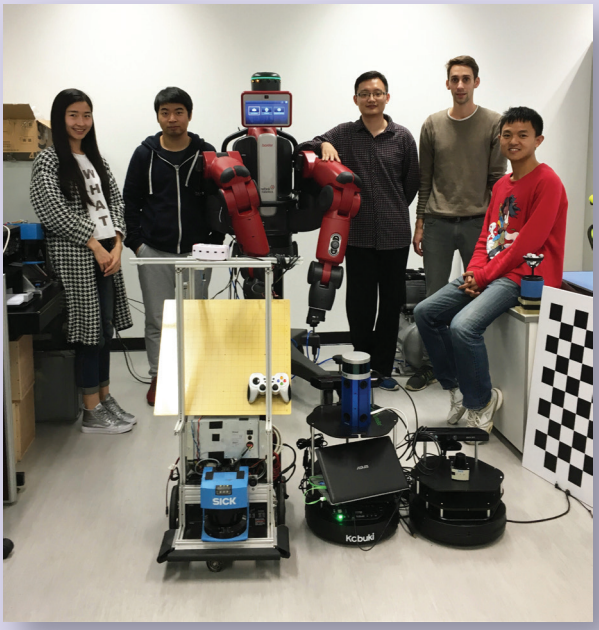
APAC Innovation Summit (Robotics) was held from 24 to 25 June 2015 at Hong Kong Science Park. Organized by Hong Kong Science and Technology Parks Corporation, the Summit aimed to provide an exchange platform on the trend of specific technology sectors and ready-for-market innovations. We were honored that Prof Wen Jung LI and Dr King WC LAI, our Core Members, were invited to deliver talks on application of robotics technology. In addition, we also had the exhibition to demonstrate our nanofabrication and IR sensor prototype during the event.

InnoDesignTech Expo 2015

The HKTDC InnoDesignTech Expo was held between 3 and 5 December 2015 at HKCEC, which provided a platform for creative and technology professionals to meet with enterprises looking to enhance their competitiveness and find business partners for the new opportunities emerging in Asia. In a seminar of the Expo, Prof Dong SUN was invited to share the manufacturing production operation in robotics and automation. The sharing inspired manufacturers to re-think of how traditional manufacturing can turn smart and trendy.

Deep Learning Based Robotics Research and Application

Dr Ming LIU

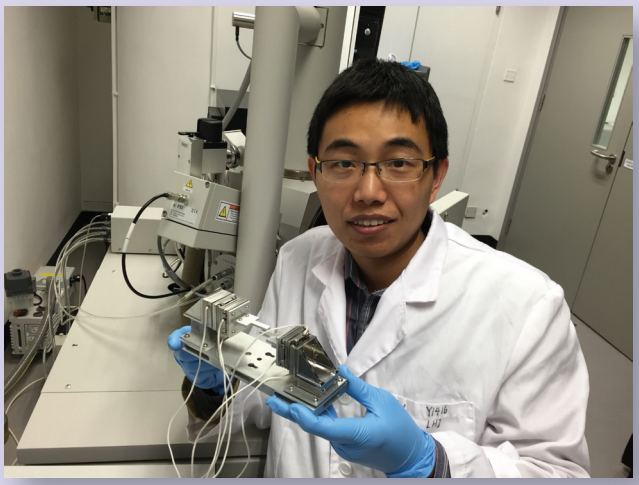


Deep learning (DL) approaches have been successfully used for many different applications, including face recognition, game strategy etc. Mobile robot communicates with the environment by sensors mounted. Taking raw sensor information as input directly, DL is also a great potential framework for robot navigation and perception. Compared with traditional man-made feature methods or human teaching methods, that can help the robot to recognize and explore the dynamic environment without any human-made logic.

Current deep learning frameworks cannot meet the demand for real-time and confidence or robotic related work. LibDeepRobot is such an appropriate library for DL-based algorithm to be applied to robotic research and application with real-time and probabilistic support. Ultimately, this library is trying to help the robot to navigate an unfamiliar environment with mapping, localization, obstacle avoidance and so on simultaneously as soon as possible but with few pre-processing procedure.

Nano Robotic Manipulation System for Scanning Electron Microscopy

Dr Yajing SHEN



Scanning electron microscopy (SEM) has been one of mostly used microscopes for object observation owing to its high resolution imaging ability (up to 1 nm). Besides, the SEM has also been considered as a promising platform for nano manipulation measurement, and manufacturing. However, at current stages, there are still many challenges for SEM system, such as the narrow imaging region, low manipulation flexibility and low controllability. To address the above challenges, our lab designed a unique nanorobotic manipulation system with a rotation degree of freedom (DOF) and proposed the relevant alignment and manipulation strategy for it. With our robot, the micro-nano sample is able to be imaged from 360°, which greatly extends the observation region of the SEM. In addition, this nano robotic system has also been applied to tackle the fundamental and practical problems in bio and material fields, including micro-nano object manipulation, nanomaterial mechanical property characterization, single cell analysis and so on. We believe the deep involvement of the nanorobotic technique in SEM will generate significant impact in the interdisciplinary areas, e.g. nano-bio-material, in the long term.

Sequential Robotic Manipulation Using Novel Intermediate Supports

Dr Jia PAN

Object reorientation performed by a robot manipulator plays an important role in industrial assembly lines. In many cases, the robot may not be able to reorient an object from its initial pose to a target pose within one round of pick-and-place. This is due to several constraints posed on the robot's movement, e.g., the robot needs to avoid colliding with its surrounding environments, and must take its joint limits and singularity into account while moving. To overcome these difficulties and extend the robot's reorientation capability, one typical solution is using a sequence of pick-and-place operations to change the object's pose incrementally. In particular, after the object is picked up by the first grasp, it would be stably placed on an intermediate support and then picked up again using another grasp. The design of the intermediate support is crucial for the flexibility and robustness of the pick-and-place regrasping. A desirable support should provide the object with many different ways of being placed on, and each placement should allow of many valid grasps.

There has been extensive work on pick-and-place regrasp since the 1980s, due to its importance for object reorientation. The majority of previous work assumed flat intermediate placement location, e.g., a horizontal ground or a tilted table. However, since the convex hull of most objects only has limited number of faces, these objects can only be stably placed on a flat surface in a few different ways. This greatly limits the number of possible placements and also the connectivity of the regrasp graph. To address this challenge, we are developing novel methods which facilitates the pick-and-place operation of a robot manipulator by using different support types, including an additional pin or an additional gripper fixed in the working cell. In this way, the object can have many more placements associated than the case when flat supports are used, which is beneficial for the robustness and efficiency of automated robotic assembly.

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