Interactive perception is a significant and unique characteristic of embodied agents. An agent can discover plenty of knowledge through active interaction with its surrounding environment. Recently, deep learning structures introduced new possibilities to interactive perception in robotics. The advantage of deep learning is in acquiring self-organizing features from gathered data; however, it is computationally impractical to implement in real-time interaction applications. Moreover, it can be difficult to attach a physical interpretation. An alternative suggested framework in such cases is integrated perception-action.

In this dissertation, we propose two integrated interactive perception-action algorithms in control manner for automatic grasping with real-time tactile sensing. While visual processing is necessary for gross reaching movements, it can slow down the grasping process if it is the only sensing modality utilized. To overcome this issue, humans primarily utilize tactile perception once the hand is in contact with the object. Inspired by this, we first present similar ability for a robot by formulating the required grasping steps. In this phase, we introduce a deep learning approach to predict the bias information before extracting the tactile sensing out of robot joint torque data during interaction with the object surface.

Next, we improve the algorithm to achieve finger closure constraint via suggesting a human-like behavior for the robot to interactively identify the object. During this process, the robot adjusts the hand through an interactive exploration of surface normal vector. As the robot finds the surface normal vector, it then tries to find the object edges to have a graspable final rendezvous with the object. Such achievement is very important in case the first algorithm fails to find the object edges for rectangular objects before fully grasping the object. We implement the proposed approaches on a robot agent to demonstrate the performance of interactive perception-action strategies to accomplish this task in an automatic manner.

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The public is welcome to attend.