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Team E: PLAID
Teammates: Michael Beck, Akshay Bhagat, Matt Lauer, Jin Zhu
ILR04
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1. Individual progress

Since the perception is running behind, our group has consensus I should help the perception team. After I implemented the communication protocol for each sub-system, I helped Matt and Jin to implement state machine for sensor selection automation. The RGB-D camera will be moved to the face of each bin and take pictures and PCD files. The sensor selection automation will help us to evaluate the image quality of every candidate sensor, but it is not part of picking scenario, so I create a different branch to manage it.

My another main task is to create a simple prototype for item classification. I used last year's caffe model trained file as current model for identifying items, so basically I can take a "simple" image and identify it. Simple image means there is only one item in the image. The ros_caffe package, ros wrapper for caffe is also used to speed up the development.

The result is shown in Figure 1. You can see there is 95% chance the item could be "Ticonderoga_12_pencils". The caffe model will list top five guesses and probabilities for target image. The test image is shown in Figure 2. I use the real pictures from sensor selection automation to simulate the real picture quality.

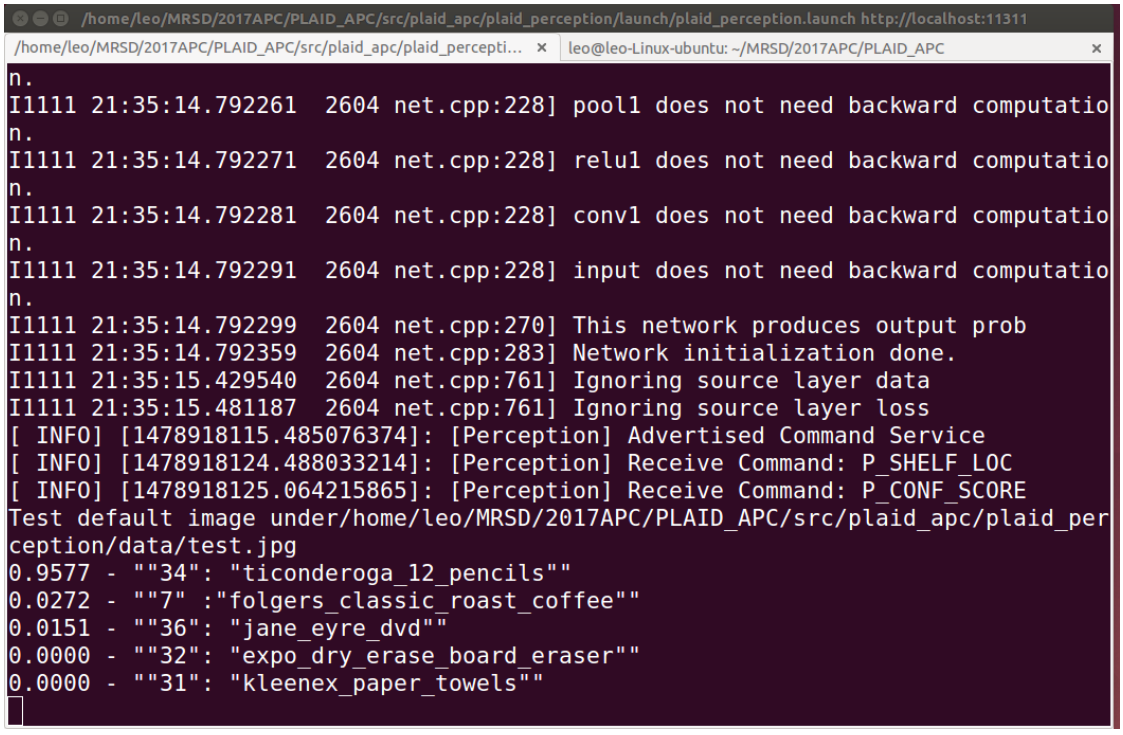

Figure 1. The classification output screen

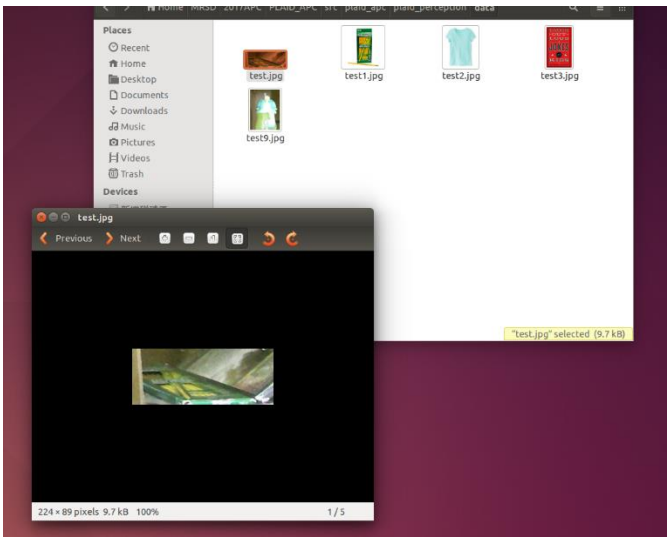

Figure 2. Test image from sensor selection automation

However, since last year's caffe model is trained by using super-pixel, the accuracy for identifying whole item is not good. It means we need to re-train caffe model to meet our requirement.

Other achievement worth mentioning is we held a code-review meeting this week. Basically we review all commits in development branch and merge them into master branch, we will follow the JAVA coding convention.

2. Challenges

New Amazon Picking Challenge rule is released recently. There are three major changes. First, we should design storage system which is shelf on our own. Second, we need to identify and pick generic items. Third, picking and stowing tasks will be mixed together if we make it to final round. Although we know the rule will be changed, we didn't expect the scope scale up so much.

For shelf design, we want to design a shelf which will avoid occlusion between objects. The RGB-D camera could take pictures from top-view. Also, for generic items classification, we need to find a way to identify item based on its shape. One of the possible solutions is that we could train CNN caffe model by using point cloud data. Since the scope for this competition goes up, we may need more man power to achieve success.

3. Teamwork

For progress review four, we focus on different domains and break down the tasks as follows:

- Michael Beck – Gripper. Finalize design for 1-DOF gripper. Mount last year's gripper as backup. Draft STL and integrate into planning scene.

- Akshay Bhagat – Perception and gripper. Helped Michael to fabricate the 1-DOF gripper.
- Matt Lauer – Arm Planning. Created abstract interface for moving arm to each bin. Integrated it with Kinect and state machine. Train E-graph for planning.
- Che-Yen Lu – Software Architecture and Perception. Created a prototype to classify objects by using last year's caffe model. Implemented state machine and communication interface for sensor selection automation.
- Jin Zu – Perception. Integrated picture taking functionality with arm planning and state machine. Helped to solve Intel realsense driver issue.

4. Future plans

To meet the goal of Fall Validation Experiment, we will try to integrate perception system first for progress review 4. We want to show the prototype of whole perception pipeline, including taking picture for each bin, segmenting object point cloud from specific bin and classification for object point cloud. As for arm planning, we will enhance the performance by training E-graph. Also, we will have 1-DOF fabricated at that time. Hopefully we could also control vacuum by Arduino before Thanks giving holiday.

For APC 2017, since the rule changes and every other sub-system depend on shelf design, we need to brainstorm first for shelf design. We will sketch out a draft design for shelf within 2 weeks.

As for sensor selection, we still want to use realsense because the working range is better than Kinect. Although we find out a stable driver version, point cloud quality is not good when point cloud is published by rostopic. We will keep in touch with students who has experience and try to solve or create rosnode on our own in winter break.