

Shopping Cart Item Tracker

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1 Motivation & Goals

During shopping, customers often forget to buy all the necessary products and the cost of each item. However, they sometimes have to wait for a long time during check-out and cannot quickly verify all the items with the receipt. Although unmanned shopping store can resolve these issues, they have not been popularized as it needs a large number of sensors and cameras to track the motion of the customers and the products. Technical-wise, a store like Amazon Go cannot support more than 20 people shopping simultaneously, at least by 2017 [1].

Therefore, it is necessary to develop a mobile phone application to track the customer's shopping cart record in real time. The user just needs to put the phone on the shopping cart to capture every item he puts into or takes out from the shopping cart. This project will target on Android community.

2 Algorithm

Similar to fine-grain recognition [2], which recognizes multiple items on the shelf with SIFT and deep neural network with synthetic data generated from single sample per item, the model for this application will be trained with a single sample as well, except that the user needs to ensure that the front of the product will face the camera. Therefore, the complexity of the training model is greatly simplified, so the traditional image processing technique without deep neural network can be applied for correct identification.

Background subtraction technique such as [3] demonstrates promising result in the dynamic background [4], which makes the detection of newly placed or taken out item with a single sample under different illumination possible. The new item is extracted with the background mask and matched with different training sample images using the SIFT algorithm. As SIFT is sensitive to motion-blur [5], it is important to extract the new item only when it is static, but in the static mode it could be treated as background. This project will aim to implement an algorithm to resolve this issue as well.

3 Implementation

The following work will be done in this project:

1. Data collection: collect about 50 images of the front view of the product
2. Algorithm development with shopping cart video in Python Open-CV (background subtraction, object and action recognition for putting in or taking out item)
3. Android Implementation: implement the algorithm into Android mobile phone

4 Reference

- [1] Kastrenakes, Jacob (March 27, 2017). "Amazon's cashier-free store reportedly breaks if more than 20 people are in it". *The Verge*. Retrieved October 8, 2017.
- [2] Leonid Karlinsky, Joseph Shtok, Yochay Tzur, and Asaf Tzadok. Fine-grained recognition of thousands of object categories with single-example training. *In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2017
- [3] Z. Zivkovic and F. van der Heijden. Efficient adaptive density estimation per image pixel for the task of background subtraction. *Pattern Recognition Letters*, 27:773-780, 2006.
- [4] S. Brutzer, B. Hferlin, and G. Heidemann. Evaluation of background subtraction techniques for video surveillance. *In Proc. IEEE Conf. Computer Vision Pattern Recognition*, pages 1937-1944, 2011.
- [5] A. Pieropan, M. Björkman, N. Bergström, D. Kragic. Feature Descriptors for Tracking by Detection: a Benchmark. *Computer Vision and Pattern Recognition*, arXiv:1607.06178, Jul 2016