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Feasibility Report

1. Idea Description:

The problem is inspired by the Amazon Fullfillment Technologies Computer Vision Team. Change detection is accomplished by processing digital photographs in order to identify differences in places or other things over time. We need to detect changes in two pictures, which is something removed or added to a bin. Getting the correct answer to this simple problem is incredibly valuable. We could use this techniques into the fields of automatic warehourse management.

Problem Outline:

Here are pair of images, our goal is to output a score between 0 and 100 that indicates whether an item was removed or added.

2. Milestone and Timeline

10/27 - 11/5, data collecting
11/5 - 11/20, design and implementation
11/20 - 11/30, testing and refining
11/30 - 12/5, report and finalzing

3. Feasibility Research

3.1. Image pre-processing

Before start the detection process, we should conduct the preprocess on source data(images) in order to assure that it satisfies certain assumptions implied by the detection method.

Generally speaking, image preprocessing includes: digitization, geometric transition, normalization, smoothing and recovering/enhancement.

For the project, we may consider several preprocess strategy, as follows:

1) Image segmentation, which includes the process of partitioning a digital image into multiple segments, in order to make the data more meaningful.

2) Grayscale threshold, which provides a transition from the original data pixels and the output pixels.

3) Grayscale histogram, which provides statistics for number of pixels in different grayscale classes. grayscale histogram helps with dividing images and setting the binary thresholds.

4) Geometric transformation, which includes both simple transition via mathematics functions, and more complicated transitions by real images data.

5) Smoothing(edge detection, gradient operator, Gaussian filtering, field average and median filtering)

3.2 Classification

For the classification, we will try on both supervised and unsupervised classification.

Supvervised -- SVM

We will try SVM for the supvervised solution. SVM has been a very good performing classifier for a while. And the advantage of SVM is that it allows data to have a very high dimensonality. Also, the soft-margin solution will reduce the requirment on the training data. Kernel functions are also very useful tools for even a non-linear hyperplane.

As for this problem, we did some research and found out that SVM has been used for sensed image to dectect change for a long time. And there is a lot of paper showing the feasibility of this classification. For example, int the paper of “Supervised change detection in VHR images using contextual information and support vector machines”, a method of dectecing the change on satellite image of landscape, using SVM, is introduced and elaborated. There are a lot of

common features between the land cover changed detection and our problem. For example, they both have high resulution images and training data of the both can change in lightness and angles.

Unsupervised

For unsupervised solution, we will try to do some manipulation directly on the features extracted from the input images, like HoG, SIFT etc. Then we will give out the results based on the difference of the metrics, e.g. the Euclidean distance or cosine similarity between the feature vectors. Finally we will give out the results based on the metrics, adding some weight from other features.

Since HoG and SIFT have been used for a lot of research as the way to extract features. They have been proved to be very efficient and powerful.