Design plan TSBB15
Group 1, Project 1

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10 februari 2016

1 Introduction

The purpose of this document is to describe the design of project 1 in TSBB15 - computer vision at the Institute of Technology at Linköping University. Initially the purpose and goal of the project will be discussed in general and thereafter the several modules of the project will be explained.

2 Project Goal

The goal of this project is to develop a tracker that can track objects in a simple sequence of images. The images that are going to be tracked are from the open source datasets *CAVIAR, pets 2001* and *changedetection.net*. The tracker should be able to identify the objects in the datasets and the accuracy of results will be evaluated in comparison to the ground truth, which is acquired from the datasets. Moreover, the tracker should be robust enough to handle the occlusion of objects, shadows, specular reflections and a changing background environment, such as that from moving trees.

3 Modules

To make development and research easier the project has been divided into several modules.

3.1 Object Detection

To be able to track a moving object in an image the first step is to find the object that is of interest.
To detect all the moving objects in an image start by compute all interest points in two on each other following images. The interest points will be found by using the Harris algorithm. These points will be compared and all the corresponding image points that has moved will be studied. These points are the ones that might be an object of interest. By making the assumption that an object have many interest points, we will look for a cluster of interest points that move in the same way. Clusters of moving interest points that move randomly can be assumed to be something uninteresting. This can be for example a moving crown of a tree, hence something that is not something to track.

Another way to find objects is to do background modeling. When using background modeling pixels that differ from the normal stateöf the background will be marked with a 1 and pixels that fit to the modeled background will be marked with 0. This means that a binary image of differences from an all background image will be made. By processing this binary image with morphological functions objects in the image can be found. When the objects are found the interest points in just those parts of the image will be found using the Harris algorithm.
Using background modeling to detect objects might be added in a later state. The implementation of modeling the background is not the first priority.
The object detection module will send the pixels of the interest points that has been found to the tracking module.

3.2 Object Tracking

From the object detection module intressed points are passed on to the object tracking. These points are evaluated if there is any movement. The tracking is also responible for clustering the movement to an object and keep track of of these objects position. The KLT tracker algorithm will be used to detect if there is any movement in the intressed points. To make the algorithm faster and more efficient predicted data from the Kalmanfilter will be used to make the search area for movement smaler.

3.3 Evaluation

The purpose of the evaluation module is to compare the results from the tracking to that of the ground truth in the images. The ground truth of the images is found in .xml files and contains information for each frame about the moving objects in the figure. There are x- and y-coordinates in the document and these can be extracted. After this, the area of the rectangle that these create will be calculated. After this, the area of the rectangle created by the tracker at the various objects will be calculated. Thereafter, the accuracy in comparison to ground truth will be calculated as the intersection of the ground truth rectangle and the result over the union of the two.

3.4 Occlusion

Occlusion is the problem of keeping track of object when they disapear or are partially hidden. For example it occurs when two objects cross path. Below is a summary of how this problem can be solved. This can be solved by using a model that simulates the motion, e.g. using a kalman filter to predict the position in the next time instance.

3.4.1 Motion model

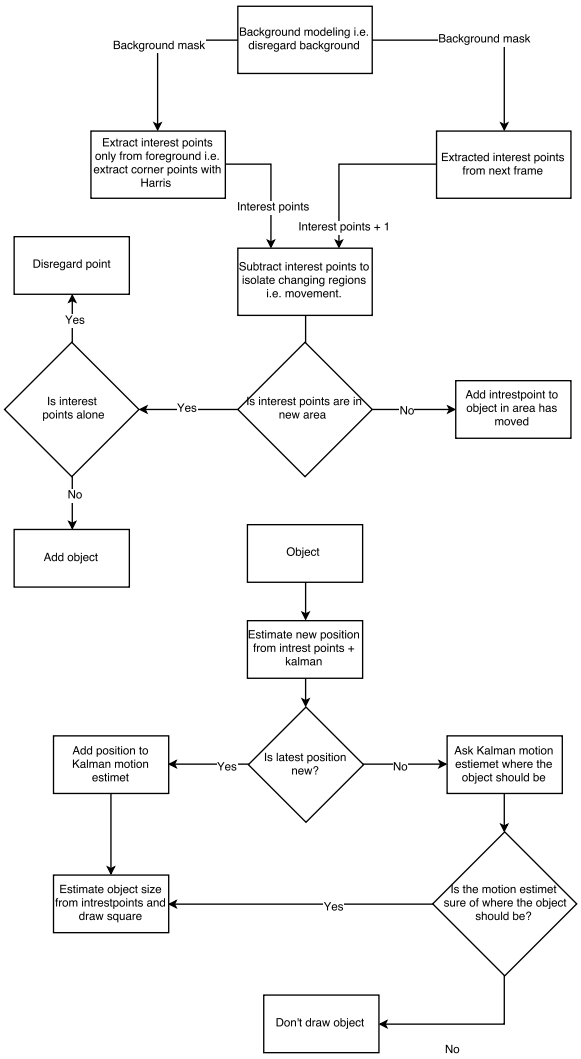
A motion model is necessary to determine where the object that is being tracked is headed. The reason for wanting to determine where an object is headed is mostly so that it is possible to find an object if it has been lost. This can help solve different occlusion problems.
If an object walks behind a wall and then returns it should be possible to create a motion model such that when it return we can say with a certainty that it is the same object. This will be solved with a Kalman filter.

3.5 Shadow- and Reflection-handling

Any object occluding a light source will give rise to shadows, moving alongside the object. In the same way, even surfaces may give rise to reflections which will move alongside the object. This may lead to the shadows or reflections being treated as a new object, or become merged with the object. This must be treated somehow. More on this in the final draft of the design plan.

4 Flowchart

Below is a flowchart for the tracker.



Figur 1: Flowchart

5 Time Plan

The time plan will be included in the final draft of the design plan.