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Contour Based Real Time Multiple Object Tracking

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Abstract
Contour based real time multiple object tracking is an important task in computer vision. contour based object tracking is useful in many areas such as motion based recognition, automated surveillance, human computer interaction, traffic monitoring, vehicle navigation, and medical. Detection and tracking of moving objects in video scenes is the first relevant step in the information extraction in many computer vision application.
Keywords — *contour tracking, HSV value, opencv, kernel.*

INTRODUCTION

Object tracking, in general, is a challenging problem. Object tracking is an important task within the field of computer vision. The proliferation of high-powered computers, the availability of high quality and inexpensive video cameras, and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms. There are three key steps in video analysis: detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behavior. Difficulties in tracking objects can arise due to abrupt object motion, changing appearance patterns of both the object and the scene, no rigid object structures, object-to-object and object-to-scene occlusions, and camera motion.

Tracking is usually performed in the context of higher-level applications that require the location and/or shape of the object in every frame. Typically, assumptions are made to constrain the tracking problem in the context of a particular application. There exists many Contour base Object tracking algorithms in the literature. These algorithms can be divided into three categories [1]: Point Tracking (e.g. Kalman Filter [2,3]), Kernel tracking (e.g. Mean shift [4], KLT tracker [5]), silhouette tracking (e.g. variational methods [6], condensation algorithm [7]). These algorithms mainly differ in the way they use image features and model motion, appearance and shape of the object. In development of any tracking algorithm, we need to have suitable object representation, right features for tracking and good tracking algorithm. The idea of video tracking can be used in the areas of vehicle navigation, video surveillance, automobile driver assistance, robotics, video games, biometrics and in the field of medical sciences.

During the last few years, various researches has been undergoing for the different algorithms used for the tracking the particular segment. Meanshift method, Camshift method [1], Kalman filter [3], Background Subtraction[2] methods are the different methods used for the tracking of the objects in the video scenes. Meanshift method is an iterative process, by computing the meanshift value of the current position of the object and then moves the point to its meanshift value as the new position. The camshift method used for tracking the object is the modification of the meanshift method.

The only difference is in the size of the search window. In the meanshift method, the size of thesearch window is fixed, but in the camshift method the size of the search window can be adjustedas per the movement of the object. Kalman filter can also be as the predictor-corrector method [4]. It will esssstimate the position of the object in each frame of the sequence. Kalman filter can reduce the noise in the tracking due to the illumination, the change of the light etc. Color based tracking is by taking the HSV value of the particular color tracking the value in the frames.

LITURATURE SURVAY

Ripal Patel,Chirag I Patel " Contour Based Object Tracking " International Journal of CSE and EE 4th vol, Aug 2012. Using initial contour mark the object in 1st frame and represent it using color histogram. The low frequency color in histogram are removed to minimize the noise. Color histogram is the best method to represent object for varying brightness and color conditions. Velocity, acceleration and co-ordinates of the centroid of object are used to show the current position of the object.

Petr Dokladal, Raffin Enficaud and Dejnozkova "contour based object tracking " ICASSP2004. Applications uses color to get specific output from the separ ability properties and efficient tools. Skin hue constant looks good to initialize high level process. To represent the color as digital information there exist several methods.

Cylindrical and perceptual is used to measure the color difference, Color represented by these spaces are encouraged by brightness and color of the light taken. The illuminating condition changes frequently due to motion of vehicle.

Piccardi computer vision group, "Back ground subtraction technique'' Velastin and Lo argued to use average value of last m views as the background mode but various researchers proposed that the temporal average will do better than Lo and Velastin.

One of the person proposed that average value of last m frames will provide fair background model even though last m views are subsample with respect to frame factor of 10.To increase the stability of background model use the average on last m subsample frames and p times the last calculated median value. It uses buffer with recent pixel values for computation which is the disadvantageous.

Region based algorithm track object according to variation of object. For all methods, initialization is the main problem. Feature based algorithms track objects by extracting their features and matching these features between frames. These are some features that define a vehicle (symmetry, edges, shadow, color, size) and they are looked for sequentially in the image.

METHODOLOGY

Video frames

Capture Video from Camera

Often, we have to capture live stream with camera. Open CV provides a very simple interface to this. Let's capture a video from the camera (I am using the in-built webcam of my laptop), convert it into gray scale video and display it. Just a simple task to get started.

To capture a video, you need to create a Video Capture object. Its argument can be either the device index or the name of a video file. Device index is just the number to specify which camera. Normally one camera will be connected (as in my case). After that, you can capture frame-by-frame. But at the end, don't forget to release the capture.

cap = cv2.VideoCapture(0)

Flip and Median blur

Smoothing, also called blurring, is a simple and frequently used image processing operation.

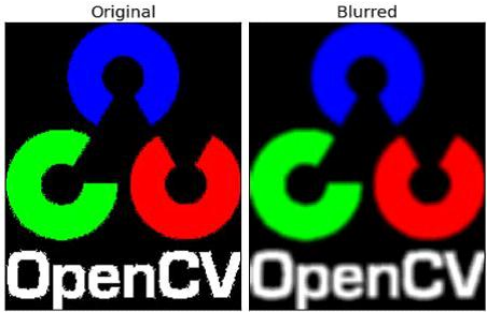
There are many reasons for smoothing. In this we will focus on smoothing in order to reduce noise. To perform a smoothing operation we will apply a filter to our image. The most common type of filters are linear, in which an output pixel's value

(i.e. g (i , j)) is determined as a weighted sum of input pixel values (i.e.g (i + k , j + l)

g(i,j)=f(i+k,j+l)h(k,l)

h (k,l) is called the *kernel*, which is nothing more than the coefficients of the filter.

median = cv2.medianBlur(img,5)



Blurred image

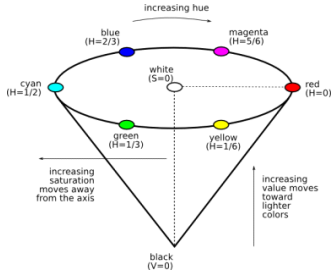
BGR to HSV image

The hue (H) of a color refers to which pure color it resembles. All tints, tones and shades of red have the same hue. Hues are described by a number that specifies the position of the corresponding pure color on the color wheel, as a fraction between 0 and 1. Value 0 refers to red; 1/6 is yellow; 1/3 is green; and so forth around the color wheel.

The saturation (S) of a color describes how white the color is. A pure red is fully saturated, with a saturation of 1; tints of red have saturations less than 1; and white has a saturation of 0.

The value (V) of a color, also called its lightness, describes how dark the color is. A value of 0 is black, with increasing lightness moving away from black.

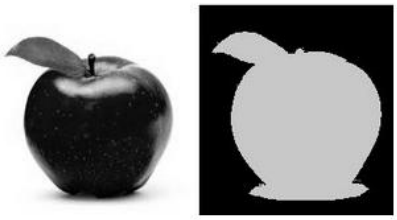
This diagram, called the single-hexcone model *of* color space, can help you visualize the meaning of the H, S, and V parameters.



Thresholding

Application example: Separate out regions of an image corresponding to objects which we want to analyze. This separation is based on the variation of intensity between the object pixels and the background pixels.

To differentiate the pixels we are interested in from the rest (which will eventually be rejected), we perform a comparison of each pixel intensity value with respect to a *threshold* (determined according to the problem to solve). Once we have separated properly the important pixels, we can set them with a determined value to identify them (i.e. we can assign them a value of 0(black), 255(white) or any value that suits your needs).



Example of thresholded image

Morphological operation

Morphological transformations are some simple operations based on the image shape. It is normally performed on binary images. It needs two inputs, one is our original image, second one is called structuring element or kernel which decides the nature of operation. Two basic morphological operators are Erosion and Dilation

Basically there are two morphological operation Erosion and Dilation.

Erosion

Dilation

Opening

Opening is just another name of erosion followed by dilation. It is useful in removing noise, as we explained above.

Here we use the function, cv2.morphologyEx()

Open image

Contour based Tracking

Contour tracing also known as border following or boundary following; contour tracing is a technique that is applied to digital images in order to extract their boundary.

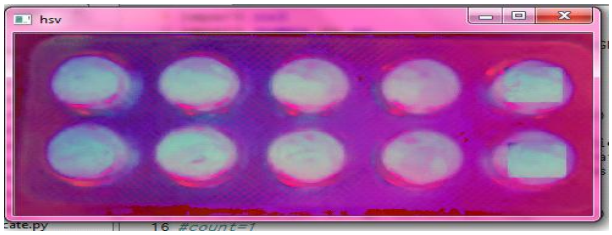
Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition. For better accuracy, use binary images. So before finding contours, apply threshold or canny edge detection. Find Contours function modifies the source image. So if you want source image even after finding contours, already store it to some other variables. In Open CV, finding contours is like finding white object from black background. So remember, object to be found should be white and background should be black.

RESULTS

Multiple object tracking example, window shows the tracking of all four colors red, blue green yellow to the real time image it varies as per illumination (brightness), as brightness changes tracking of perticlar varies.

Detailed step of this algorithm is shown, it is median blur image as like real image flip and median blur image obtained by convolving with kernal (matrix) and reduce the salt and pepper noise.

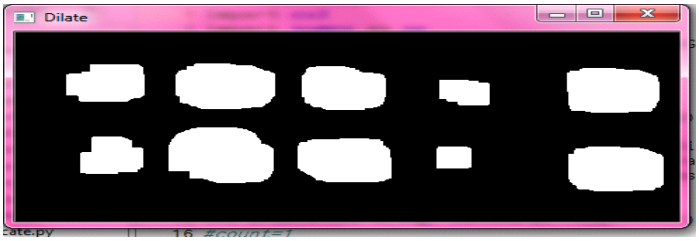
HSV image is shown below, the obtained BGR image is converting in to required HSV image to obtain the perticular colors



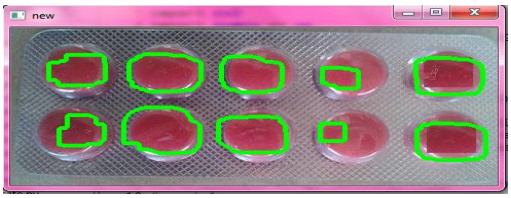
Thresholded image is shown below, In this we are obtaining binary image from colored image by setting the pixel value 0 or 1 above or below the threshold value. this step is mainly used to seperate outer region of image with an object.

Erosion image is shown below, mainly it seperate the joined object and shrinks the object, this operation is mainly used to modify the perticular region of image

Dilation image is shown below, it is enlarged image which repairs the breaks and this image is also obtained by convolving with kernal



Final contour traced image is shown below, it is exact boundary extracted image and region filling and it mainly reoves the imprfection is added during segmentation.



CONCLUTION

This we focus on the tracking of the multiple colored objects in real time. During the comparison test, the various pre-processing methods are applied to the frame pixels. The tracking of the various objects and colors are different from each other in different methods. From this discussion we can conclude that the contour based color tracking method is the best to other algorithms. This method can detect all the moving objects. Camshift, Kalman filter methods are capable of tracking only single objects.

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