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Object Motion Detection and Tracking for Image Surveillance

Ms. Renuka Raut[1], Mr. Hirendra Hazare[2]

M. Tech Student, Department of CSE, Ballarpur Institute of Technology (BIT), Ballarpur[1]

Assistant Professor, Department of CSE, Ballarpur Institute of Technology (BIT), Ballarpur[2]

Abstract: Object Detection using Haar feature-based cascade classifiers is an effective object detection method, "Rapid Object Detection using a Boosted Cascade of Simple Features". It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Moving object identification and tracking motion is the base source to extract vital information regarding moving objects from sequences in continuous image-based surveillance systems. An advanced approach to motion detection for automatic image analysis has been presented in the paper. This achieves complete detection of moving object which is robust against of changes in brightness, dynamic variations in the surrounding environment and noise from the background. The proposed method is a pixel dependent and non-parametrized approach that is based on first frame to build the model. The detection of the foreground which represents the object and background which is the surrounding of the environment starts once the subsequent frame is captured. It utilizes unique tracking methodology that identifies and eliminates the ghost object from dissolving into the background of the frame. The proposed algorithm has been test implemented on several open source image by imposing single set of variables to overcome shortcomings of relevant and recently developed techniques.

Keywords: Object Tracking, Motion Detection, Background Subtraction, Normalized Cut Segmentation, Video Surveillance, etc.

I. INTRODUCTION

Identification and Tracking of object are an important factor in analysis of video in a surveillance system. It provides the extraction of the information from frames and video sequences which can be multiple processor vision applications for example, CCTV based surveillance, understanding an activity in focus, analysing flow of traffic, c1assifying and tracking an object. This exhibits that identifying and tracking an object is an important field of research in computer vision and its applications in various surveillance systems. CCTV based surveillance has become a demanding technology due to increase in terrorist threats, increase in public\private safety concerns, increase in crime rate, efficient management of public properties and various modes of transportation.

II. LITERATURE REVIEW

Author K.kadir ,M.k.Kamaraddduin,H.Nasir ,S.I.Saife ,Z.A.Bakti proposed a paper in which they describes Comparative study between LBP an HAAR Like features using opencv [1].Comparison has been made between haar features and LBP in three different databases to calculate detection speed. Haar like feature are effective for frontal face detection but ideal for arbitrary or moving positions.

AuthorLi cuimei, Qi Zhiliang , Jia Nan,Wu Jinhua Bakti proposed a paper in which they describes Haar cascade by classifier combine with additional classifiers technique for implementations[2].Viola –Jones' detector uses Adaboost, series of nodes with each node being a definite multi-tree Adaboost classifier. The key advantage of Haar cascade classifier over others is its calculation speed.

Author by Souhail Guennouni, Ali Ahaitouf, Anass Mansouri proposed a paper in which they describe two algorithms; edge orientation matching algorithm and Haar like features combined with classifiers are compared [3]. The key advantage of haar cascade classifier over Edge orientation algorithm is it's High detection accuracy.

Author Zheng jun, Hua Jizhaq, Wang proposed a paper in which they describe Color space Model and local binary pattern. Colour space Model is uses various colour models for skin detection whereas LBP used for texture extraction [4]. LBP gives simple and efficient way for face detection but takes more time than Haar cascade.

The various methods today being used for video processing are Frame differencing, Optical flow and Background subtraction. To detect the moving objects the Frame differencing method uses subtraction of successive frames. This approach is straightforward to implement and easily adaptable to dynamic environments, but it cannot always extract the complete edges of the object. Another popular technique is the optical flow method [2]. This method has two steps. First

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finding the image optical flow and then performing clustering process with the obtained optical flow characteristics. It performs accurately well in the detection process but the downside is the increased number of computations.

III. PROPOSED SYSTEM

The integral part of this research paper is a face detection method using the OpenCV library. The OpenCV was launched in 1999 by Gary Bradsky at Intel. The first problem appeared later in the year 2000. In fact, OpenCV stands for Open Source Computer Vision Library. Although it is written in optimized C/C++, it has interfaces to Python and Java as well as C++. OpenCV has an active user base around the world, and its use is growing due to the growing number of computer vision applications. Object (Face) recognition has important considerations and is one of the most promising applications in image analysis. Object detection can take into account the main part of the facial recognition operation. Computing resource based on the part of the image, the intensity of which is concentrated on the face. Object detection methods in images are complex due to changes in the face, such as posture, expression, position and orientation, skin colour, presence of glasses or facial hair, differences in camera gain, lighting conditions and image resolution, the face detection method is divided into four categories and these categories are as follows:

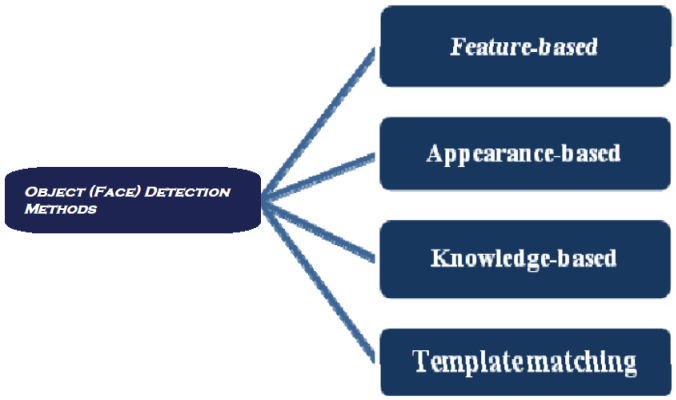

Fig: Types of Object (Face) Detection Methods

In this research, we used the appearance-based method. The appearance-based method relies on several face images used for delegate training to identify face models. An appearance-based approach is superior to other types of performance. In general, appearance-based techniques rely on statistical analysis and machine learning techniques to find relevant features of facial images. This method is also used to extract facial features. Identification or facial recognition: it basically compares the input facial image with all facial images from a dataset with the aim to find the user that matches that face. It is basically a 1xN comparison.

IV. PROJECT DESIGN

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features". It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Haar-Cascade Detection in OpenCV
OpenCV comes with a trainer as well as detector. If you want to train your own classifier for any object like car, planes etc. you can use OpenCV to create one. Here we will deal with detection. OpenCV already contains many pre-trained classifiers for face, eyes, smiles, etc. Those XML files are stored in the opencv/data/haarcascades/ folder. Let's create a face and eye detector with OpenCV.

OpenCV
Currently OpenCV supports a wide variety of programming languages like C++, Python, Java etc and is available on different platforms including Windows, Linux, OS X, Android, iOS etc. Also, interfaces based on CUDA and OpenCL are also under active development for high-speed GPU operations. OpenCV-Python is the Python API of OpenCV. It combines the best qualities of OpenCV C++ API and Python language.

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OpenCV-Python

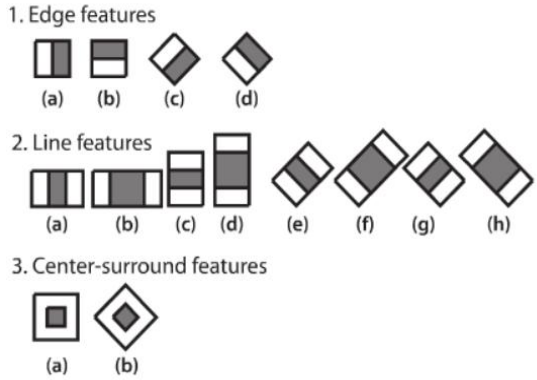
Python is a general-purpose programming language started by Guido van Rossum, which became very popular in short time mainly because of its simplicity and code readability. It enables the programmer to express his ideas in fewer lines of code without reducing any readability.

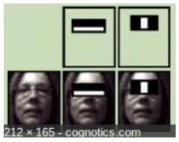
Compared to other languages like C/C++, Python is slower. But another important feature of Python is that it can be easily extended with C/C++. This feature helps us to write computationally intensive codes in C/C++ and create a Python wrapper for it so that we can use these wrappers as Python modules. This gives us two advantages: first, our code is as fast as original C/C++ code and second, it is very easy to code in Python. This is how OpenCV-Python works, it is a Python wrapper around original C++ implementation.

And the support of Numpy makes the task easier. Numpy is a highly optimized library for numerical operations. It gives a MATLAB-style syntax. All the OpenCV array structures are converted to-and-from Numpy arrays. So whatever operations you can do in Numpy, you can combine it with OpenCV, which increases number of weapons in your arsenal. Besides that, several other libraries like SciPy, Matplotlib which supports Numpy can be used with this. So OpenCV-Python is an appropriate tool for fast prototyping of computer vision problems.

Haar features

OpenCV's algorithm is currently using the following Haar-like features which are the input to the basic classifiers:





Cascade of Classifiers

"Instead of applying all the 6000 features on a window, group the features into different stages of classifiers and apply one-by-one. If a window fails the first stage, discard it. We don't consider remaining features on it. If it passes, apply the second stage of features and continue the process. The window which passes all stages is a face region."

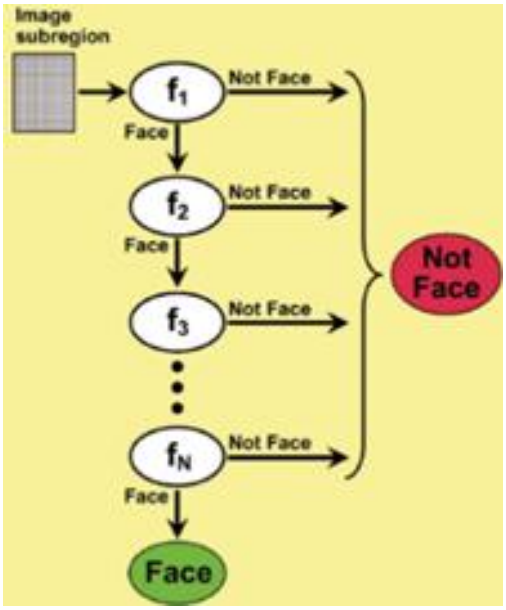


Fig: Stages of Face Region

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Opencv's Pre-Trained Classifiers
OpenCV already contains many pre-trained classifiers for face, eyes, smile etc.

We use v2.CascadeClassifier.detectMultiScale() to find faces or eyes The parameters are:
image : Matrix of the type CV_8U containing an image where objects are detected.
scaleFactor : Parameter specifying how much the image size is reduced at each image scale.

Fig: Scale Pyramid

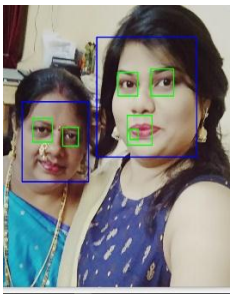
This scale factor is used to create scale pyramid as shown in the picture. Suppose, the scale factor is 1.03, it means we're using a small step for resizing, i.e. reduce size by 3 %, we increase the chance of a matching size with the model for detection is found, while it's expensive.
minNeighbors : Parameter specifying how many neighbors each candidate rectangle should have to retain it. This parameter will affect the quality of the detected faces: higher value results in less detections but with higher quality. We're using 5 in the code.
flags : Parameter with the same meaning for an old cascade as in the function cvHaarDetectObjects. It is not used for a new cascade.
minSize : Minimum possible object size. Objects smaller than that are ignored.
maxSize : Maximum possible object size. Objects larger than that are ignored.
If faces are found, it returns the positions of detected faces.

V. EXPERIMENTAL RESULTS

Snapshot

1. Object Detection with one person

2. Object Detection with two persons



3. Object Detection with many persons

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VI. FUTURE SCOPE

In this research, we introduced the topic of human faces and dealt with the factors that affect face detection operation. We discussed the solution that improves the face segmentation precisely. Here using OpenCV as it can large training data, if want to get better results, we can collect a large number of face images and nose images, and train them which can improve the accuracy of the face location.

VII. CONCLUSION

Object (Face) detection technique using OpenCV is developed in Python's programming language in Anaconda software platform (or IDLE) running on Windows 10 operating system, is created using Numpy, functions, Matplotlib and OpenCV libraries. This application detects the faces and gives the information about the student whether she/he is present in the classroom and also gives the faces of all those who try do mischievous behaviour or tries to break the rule in classroom.

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