Review of Approaches for Object and Movement Detection in Videos

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***Abstract*—Video Analytics is the technology that applies machine-learning algorithms to video, allowing cameras to recognize people, objects, movement, spatial events and situations automatically. Video analytics makes surveillance system more efficient, reduces stress especially in security activities. This paper provides survey about applications of video analytics such as object detection, classification of object, movement detection. This paper shows different approaches for object detection and movement detection.**

Keyword:- Adaptive Gaussian mixture modeling (AGMM), Camshift method, Cascade classifiers, Gaussian, Haar algorithm, Kalman filter, MeanShift, Video Analytics, Video Surveillance.

I. Introduction

Video surveillance system helps in detection and monitoring of different critical situations and defects happening in industries. Video surveillance is used to monitor, examine different events occur and enhance security measures. An effective surveillance can detect any anomalous events in videos [1]. Video captured through different devices need large amount of memory and large bandwidth. This will leads to network congestion. Video surveillance system can minimize these issues by discarding unwanted data and can increase the performance [2].

Video surveillance system is used only if it can capture incidents or malicious activities. Video analytics helps in finding them. Video analytics makes surveillance system more efficient, reduces stress especially in security activities. It can be used for object and motion detection, facial recog- nition, counting number of objects and so on. Development of Machine Learning (ML) helps in improvement of video analytics. Deep learning used in video analytics helps to make unstructured video into understandable by analyzing the input. This makes video analytics more efficient and faster. Artificial Intelligence (AI) - based video analytics helps in reducing human effort and also reduces time and money. Video analytics system are used in robotics, smart surveillance, medical industry, security systems [3].

Objectives of a better video analytics system are adaptability, scalability, resiliency, portability. There are a lot of challenges can be raised during building of the system such as challenges during video providers integration, analytics integration, security problems. A framework called SIGMA is introduced to solve these challenges. It is especially used video files originated in mobile phones. SIGMA is a distributed system which contains loosely components [4].

The videos that coming from the cameras have to be analyzed and have to extract information for object detection, classification etc. This is an important application of video analysis. Video analytics uses Artificial Intelligence (AI) and Deep Learning (DL). Video analytics can do object recognition, object classification or determine attributes like speed, type, color, and direction, object tracking and indexing the video so that videos can be searchable and understandable [3]. There are traditional approaches for detection of object and classification of object such as color based [5,9], Gaussian [6, 7], template matching, adaptive background, cascade classifiers [5], Haar algorithm [6]. These approaches are inaccurate, time consuming and costly [5].

Moving object detection is the aim to detect or identify the movement of different object, people in a given region. These recent years, object movement detection has got huge attention. Motion detection is used in different applications like human motion analysis, anomaly detection, traffic analy- sis, video surveillance, event detection, robot navigation, video conferencing, security [10].

The rest of the paper was organized as follows. Traditional approaches was introduced in Section II. Section III described about object detection using deep learning. Different methods used for movement detection of objects are discussed in detail in Section IV. Finally, Section V concluded the whole paper.

II. Traditional Approaches for Object Detection

First step for detecting object using cascade classifier is scanning the video frame from top-left to bottom-right corner. After identifying the features, pixel sum of all pixels inside the rectangular frame by using four corner values is calcu- lated using the algorithm. This approach is easier than pixel approach. Each frames are scanned in two passes. In first pass the frame is divided into sub-windows and is evaluated in two stages of cascade classifiers. Second pass check whether any object is eliminated or not. Classification of object is done according to the features like size, color, shape or combination of this features [5]. Blob detection [6] is used to detect regions of object using features like color, brightness. It has works

through the steps like extraction, refinement and analysis. Haar classifiers [6] sum the pixel intensities of each region and compare between the sums. Windowing technique is used for the object detection.

Background subtraction is done in Gaussian Mixture Model. Pixel-based Adaptive Gaussian mixture modeling (AGMM) algorithm is used for object detection. Mean shift (MS)- based segmentation algorithm is used to improve the object detection. It helps in solving the imperfection of AGMM [7]. A hybrid system for object detection is built with MobileNet SSD and an object tracker running Median Flow. Random objects are taken from the COCO dataset and images of chosen objects are labelled and used to train. Training process isdone by Tensor Flow. Media Flow track the object contains inbounding box [8]. There are object detection algorithm such asface detection, skin detection, color detection, shape detection, target detection. These algorithm are implemented using MAT-LAB 2017b. This helps to detect different types of object withimproved accuracy. Face detection is for detecting the human face using Viola Jones algorithm. During skin detection skin pixels are identified and Skin Detection is performed using the YCbCr Model. Target detection is used to identify object of interest by the help of background subtraction. At the time of color detection, after the image is read a thresholding process is used for conversion of Gray scale image to binary [9].

Tracking of moving object is a technology used to find or detect and analyses changes in position in a given time, identify unnatural movement of a detected object in a video. Camshift method is a hybrid method for object tracking process and Kalman filter is used for the prediction and correction. Camshift method never depend on the object type used for tracking. Kalman filter first predicts the movement [13].

III. Object Detection using Deep Learning

Moving objects are detected using TensorFlow API which is an open source platform. First step of this approach is to import the libraries needed for this process. After the successful import the pre-trained object model has to be imported. Convolutional Neural Network (CNN) is used for robust detection of object. Locations are important factor in tracking the object. CNN is used for the object tracking. The locations of objects which are identified using TensorFlow based object detection algorithms are passed to the Convolutional Neural Network based object tracking algorithm [11].

You Only Look Once (YOLO) based detection and classification approach for identify the objects in the video frames. Main objective of YOLO is this method helps in improving the computation and processing speed. During the object classification it creates bounding boxes, helps to identify the particular class of the object. YOLOv2 used graphicaluser interface for increasing the computational speed. This algorithm is implemented mainly using OpenCV library [12].

IV. Object movement detection Approaches

Detection of moving is one of the significant problems in the field of computer vision. Its applications include video semantic recognition, obstacle identification, and prediction in the area of automatic driving, vehicle tracking in traffic monitoring [14]. There are different classical approaches for moving object detection such as Background Subtraction, Frame differencing, Temporal Differencing and Optical Flow [13]. The traditional methods include the Meanshift method, the particle filter, and the optical flow tracking method, which are to predict the region proposal according to the similar image feature. A framework called HYMM contains deep learning modules for movement prediction and detection. YOLOv2 is used for identifying the location of the moving object and for movement prediction. The movement detected using traditional method is undergone with predicted one for minimizing the false positives [14]. Movement detection also can be done using filter module and morphology module. The moving region will be extracted and cropped the image. The images are passed through neural network to get bounding boxes. In the coarse-grained detection step, filtering and math-ematical morphology are also performed to reduce the adverseeffect of noises. Here the images will be filtered for eliminating noises and mathematical morphology is used to suppress the effects of noises [15].

V. Conclusion

Video analytics mainly used in surveillance system especially to capture incidents. It is done using IP cameras.Video analytics makes the work in surveillance more efficient.Video Analytics is a technology used to processes the video signal. Video analytics used in security process especially in surveillance system, identifying moving objects, identifying intruders, tracking objects, producing alarms during suspicious environment.

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