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The Detection of Objects by Analysing Image Frames

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Abstract: In the present world the volumes of unstructured data are increasing tremendously so the technologies to structure the data are booming. The unstructured data are analysed and Classified using various analytical processes. The various analytics are done on text, image and video. Though there are many ways to classify them, it is still tedious to detect and track an object. Object detection is detecting an instance of some classes which appears in the digital videos, it uses image processing and computer vision technologies. The objects are detected using the spatial resolutions and special features like space, distance, shape and classify it. The similar approach used for tracking the objects and face recognitions. The major advantage of object detection using image processing is that images are comprised of pixels and the special features can be detected. Object Detection methods will vary depends on which object we are going to analyze from the video. This paper speaks about various tools, methods which are all used for detection of objects.

Keywords: image processing, object detection, analytics, text, image, videos.

I. INTRODUCTION

In the last two decades, Object Detection [6] is gaining importance in the fields of research, medical analysis, probability optimization, artificial intelligence, mathematical probability and pattern recognition. For detecting an object, the frames are needed to be processed and analysed. Hadoop and its role in modern Image processing [17] is used to analyze a large collection of images in a distributed computing environment and also different technologies are available for work with parallel and distributed processing .In existing models Message Passing Interface (MPI) can be used to function on various parallel computing architectures. Analytics is done to interpret and discover meaningful patterns from the data source. It correlates with operational research and statistics to provide a better performance which is used in specified areas like perspective analytics, enterprise decision management, predictive analytics, cognitive analytics, store assortment, descriptive analytics, risk analytics, speech and call analytics. Analytics is mostly performed on text, image and video.

Text Analytics is analysing and determining high-quality text information from the raw unstructured text. There are several categories on text analysis as Named Entity Extraction which is acknowledging named text figures most commonly people, places, products, organizations but can be configured to the society requirements. Named entity extraction with lexalytics text analytics can identify pattern based entities. The themes and facets produces conceptual clue to the words which have multiple meanings identifying the topic of discussion. Categories are similar to themes but needs to be configured by the organization. It is useful for allocating contents into buckets that are useful and relevant to the business. Intension tracks the current behaviour and predicts the features and classifies them. Buy, sell, recommend and quit are the types of intents used. Sentiment Analysis is the most accurate, powerful and reliable features which predicts whether the text is positive, negative or neutral

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analysing the strength of the sentiment. The last category is the summarization in which the entire document will be summarized into the small passage and it is used by the humans to get the quick grasp of the long document. Image Analytics [19] used digital image processing techniques and extracts a meaningful image from the digital images. Images on the social media are increasing drastically because images have more impact over a person rather on text. Over three billon images are shared on the internet everyday and these images are needed to be classified properly. Image Analysis understands the images, identifies faces and analyse sentiment, age, gender and so on. It extracts meaningful image information from the image. Video Analytics detects and determines the spatial and temporal events by analysing videos. Video Analytics is becoming smarter by the use of Avigilon technology which leverages the idea of managing high definition videos without any loss in quality and encoding. Avigilon uses pattern based algorithms to recognise the characteristics and features of the entity thereby ignoring the entity irrelevant to the scene. Avigilon has high degree of accuracy and minimal false rate, hence can be used tro stop incidence before they happened. It integrates the top –down functionality to provide additional remote intrusion assistance.

This paper compares various tools, methods which are all used and the related work on the detection of objects. Section II is describes the core techniques that are used for detecting objects in various fields. Section III shows various papers that are existing and the works existing in the current world. The next section IV compares the latest papers based on a few parameters. Section V concludes the survey with the references in Section VI.

II. Core technologies:

Khushboo Khurana and Reetu Awasthi [8] proposed a concept of techniques used for single and multi object detection in images. Single object can be easily identified whereas to detect multiple objects in the image various object detectors techniques have to be used. Template matching by Hu et al is one of the techniques used for identifying small pieces of an image which matches the template image. Template images for different objects are stored earlier and when the input is given it will match the image with stored template images for object detection. Color based technique, where the color gives us strong information for object detection. It will match the images based on color histograms. Fahadss Khan, et.al.[7] uses an color as an attribute for object detection. The information will be used in already available methods like Efficient Sub window search and part-based detection framework etc. The three major basis which is important in object detection are compactness, photometric invariance and combination. Shape based feature are extensively used for object detection. It is used as a replacement technique to the local features. Recognition is based on the correspondence between advanced points for object detection in the structure of deformable shape matching. Techniques like window-sliding approach [21] which is used to determine whether an object is present or not at a location and the part-based approach [2] finds out the interest points of the image, are used in object detection. By using the above techniques only limited number of objects which has to be overcome in the feature.

While detecting the objects under various conditions unassociated difficulties may occur. Some of the difficulties are Positioning, Occlusion, Lightning etc. when the position of the object in the image gets changed it is difficult to recognise the object. To overcome this they use the template matching technique. When the input image is not properly visible then identification may difficult which is known as Occlusion. T.Gao, et al [3] proposed an idea on segment-aware object detection with Occlusion Handling. Lightning of the image plays an important role in detecting objects. Weather condition of the day also changes the lightning of the image. Shadow in the input

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image, indoor, outdoor images may also affect the lightning. The image can be rotated into different forms and the system has to overcome such difficulties. [5] proposed a system in which an automatic anatomy segmentation method is proposed which effectively combines the Active Appearance Model, Live Wire and Graph Cut (ALG) ideas to exploit their complementary strengths. It consists of three main parts: model building, initialization, and delineation. For the initialization (recognition) part, a pseudo strategy is employed and the organs are segmented slice by slice via the OAAM (Oriented Active Appearance method). The purpose of initialization is to provide rough object localization and shape constraints for a latter GC method, which will produce refined delineation. It is better to have a fast and robust method than a slow and more accurate technique for initialization.

III. Existing works:

This paper describes the general problem s regarding the object detection, tracking and identification. There are many applications for object detection, tracking and identification in the field of transport, retail shop, surveillance, physical security, transport. Multiple objects can be tracked using many methods. While tracking multiple objects, those have shown better performance. During detection global approaches have explored to overcome errors.

Grimson et al [4] developed the system that monitors the activity in a site over a long time. By using the sensors the system covers the entire site; tracker detects multiple objects in the sensor. This system first classifies the detected objects then learn common patterns for different kinds of object and then to identify unusual patterns. Common activity patterns are classified using Tracked patterns. Based on the observed data, individual tracked objects can be classified into general classes. There are two methods are used to classify objects. First approach is we cluster the tracker output using an entropy minimization algorithm by Wallace, the Numeric Iterative Hierarchical Cluster (NIHC) algorithm. Random assigning of data to cluster in a B-tree structure is the starting of this algorithm, and then it reduces the total Gaussian entropy of the tree iteratively. For each iteration, movement of sub trees by algorithm will result in the largest decreases in the sum of the entropy of the sub trees. The algorithm works on the sets of sequential images taken from different video cameras. The images are sampled five times per second and grey scaled. Based on these individual images are identify and captured the image sequentially without using the Pattern recognition techniques. To remove frequency noise in the images, that are median filtered and then window-level-filtered. This is applied to adjust the brightness, contrast and enhance the intensity ranges in the images. The non-moving background is removed to identify the moving vehicle in the captured images. The technique uses sequential framework to perform backward and forward differences between the frames. Differential operators are applied to extract the moving edges, and then apply the Sobel edge detector to the resulting image. Then the images from the results are threshold to obtain binary images and moving edge is also identified. Dilation and the Erosion are also performed to the image. The translation of all of its points with regard to the structural element and the union operation is processed are called Dilation. It is applied to the binary image to close the curves in the moving edge image dilation. The overall size is expanded in the enclosed area. Erosion is used to shrink the object.

A system which is used to estimate traffic speed using a sequence of images from an uncelibrated camera was developed by Daniel.J, et al [1].They forcefully believe that there is no need for exact calibration to estimate the speed of the vehicle. The images have some geometric relationship which is used to reduce the problem occurred to the One Dimensional (1-D) geometry. To isolate the moving edges, track vehicles between frames, Frame difference techniques were used. The basic steps for estimating the speed from the uncalibrated

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images taken the sequential images from the camera, the scale factor in feet per pixel is dynamically estimated, track all the vehicles between images, using the interframe delay estimate the speed and distance travelled.

The work on the paper Object Detection combining Recognition and segmentation by Liming Wang et al [9] tells about top-down recognition and bottom-up image segmentation .The two main steps involved are: Hypothesis generation step and verification step. In top-down process, they design improve context feature which will be used for object deformation and removing noises. Then in the verification process, first identify the set of feasible segmentations which are stable with top-down hypotheses. First the matching and voting of an input image will takes place with codebook buildings and entries. Object prototype can be understood by constructing a codebook of local features. Then important processes hypothesis and image segmentation will be carried out and further proceed with the verification step. Finally the detection details will be displayed as output. The paper proposes a new method known as False Positive Pruning (FFP) to prune out many wrong thesis from top-down recognition. The goal of thesis generation is to predict probable object locations and also the figure-ground segmentation for individual thesis.

The system proposed by Michael and Fabian Bastian [10] is used to detect and tracks a large number of dynamically moving persons in complex scenes. They do not use any additional knowledge. Tracking and detection is done using single and moving uncalibrated camera. Particle filter of an object can be estimated by the tracking algorithm. Probability density function is estimated by the State transition density. For each person that is detected a separate particle filter is initialized. To decide the detector that guide the tracker is used by the Data association. They used the greedy Data association. This algorithm can handle the false positive detection.

The system proposed by Pheng Ann and Heng Qian Chen [13] locates an object effectively in complex condition with camera motion, clutter and Partial occlusion etc. The diffusion snake is used to evolve the object contour to improve the tracking precision. Kalman filter is used to evaluate and predict the Initial target position and the Bhattacharyya coefficient, respectively in the 1ST object localization stage. It is used to identify whether the region intersects the object region or not. If the coefficient is very small then the target region does not intersect the object region so we need to relocate the coefficient. The active contour is evolved on the basis of an object feature images generated with the color information in the initial object region; in case of contour evaluation stage. We can check that the object counter evolves in the right way by comparing the similarities that occurred in the target region. This method having the disadvantages are: It is time consuming and it cannot effectively track the object.

The object recognition by Y.Ramadevi et al [16] speaks about segmentation and edge detection techniques. Segmentation [12] deals with partition an image into separate understandable regions. Various edge detection methods such as sobel, Roberts, Canny are used by them for segment the images. Expectation-Maximization (EM) algorithms and Genetic algorithms were used to study the interaction between the segmented regions and the object to be identified. Usually image noise will be removed using preprocessing of image. Segmentation will vary based on measurements such as colour, texture so on. They partition the images based on changes in the intensity near the edges known as edge-based segmentation. The three major steps involved in edge segmentation are a) Filtering b) Enhancement c) Detection. Image segmentation using EM algorithm consists of two steps: E-step, the missing data are estimated. Whereas in M-step, the likelyhood function is maximized based on assuming that missing data are identified. Segmentation using OTSU is based on selecting threshold automatically. Using Genetic algorithm the major processes are selection, crossover and mutation. Implementation was done by converting colour

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to gray scale images then segmenting into regions and recognized.

Vision based working object detection by Kalpesh R et al [6] mainly focuses on video surveillance for identifying the people and velocity. They uses image difference algorithm for tracking and identification. Their implementation system is single moving object detection using fixed webcam placed in buildings which will monitor the overall region. Blob matching tracking algorithm which is based on matching information without use of descriptions of models. Concepts like template matching and frame differencing are used for single object tracking system. To automate the tracking operation they employ pan-tilt arrangement which will adjust to tracking algorithm. The system performs various steps as follows: the first is taking video from vision system and then subtract it from the reference image then set the threshold level and apply the Gaussian filter for elimination of noise the next step is to find the centroid and identify the variation between centroid and reference point and find velocity and acceleration of an moving object.

The video detection and the tracking approaches developed by the Rogerio Feris et al [15] is used to detect and track vehicles under the partial occulation. It is also used to detect the multiple vehicles under different weather. Poisson image reconstruction is used to handle the partial occlusion. The images are identified first then calculate the intensity gradient and the changes are made to it by adding zeros along with the border pixel. Then the image is reconstructed. Indexing based methods are used to search a tracked vehicle. There retrieve the vehicle using fine grained attributes. The consume huge amount of time because of using sequential methods, this is the main disadvantage. It can be overcome by using Parallelism.

Color Based Object Detection by Manpreet Kaur [11] deals with red color parameter. Real-time moving object detection and color recognization is a basic step in multiple vision systems. The fundamental impartial of applying color based detection for both still images and real time images is because of using matlabGUI to detect things based on red color. The object detection process starts with image acquisition then defining the color to be detect .Find the connected components using morphing operations then find centroid of an object. And they implemented by using matlab for foreground image extraction then subtracting the background reference from it to identify the pixel value differences. The video will be converted to binary form then based on number of one's the nature will be analysed. If motion is identified then the remaining frames will also be analysed. Zero occurs the motion has been stopped. Final recognization will be displayed as an output.

Raquib Buksh et al [14] proposed a system that controls and handles output states of an arduino and the movements of a iROBOTCREATE using Matlab algorithms and colour detection techniques. The webcams are used for capturing images that takes snaps continuously in a predefined time intervals depending upon the processing speed. Arduino is an electrobnic opensource prototyping platform is used as a programmable interface. The board and the serial ports are selected from the tools and the code is written and uploaded to the microcontroller. The iROBOT is a robot developed based on the Roomba platform is used for analog and digital input outputs. The commands for the robot are specified and sent through the Bluetooth Adapter Module which enables the robot to be accessed remotely with a pc hosted web server. The methodology consists of two parts as follows. The first is the movement detection in which the image acquisition is a tedious process. Several snaps are taken by connecting multiple imaging devices and Bounding Box algorithm is used. The algorithm fetches the images from the image acquisition toolbox and performs the image grabbing function within a loop. Then the subtracting function is calculated from the required colour index. Then the image is filtered

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and Regionprops is calculated to list the components of the image. The second is the iROBOT interfacing which is done using Bluetooth Adapter Manager. The Bluetooth setup is completed and the program in the arduino gets executed where the x-axis is used for the left and right movement and y-axis for up and down movement. The implementation proved that intermediate angles were able to be rotated more accurately using the box algorithm.

Prof Dhananjay M. Dakhane and others [20] proposed on idea about Image Conversion Using Map reduce in computing environment. Normal methods are not efficient for handling multimedia data comes from various social networks. To overcome this they are using hadoop and map reduce in cloud environment for image conversion. HDFS is used for high fault-tolerance which can able to accommodate a huge number of very large files on cluster systems. Map reduce can handle proper communication, scheduling for processing huge data sets. The first step in the process is image selection. Only images which are in proper format type will be taken for further processing. And the process continues with the selection extension where the conversion criteria will be given as per our need. Then the multiple images are converted into parallel for processing and HIPI will be used for filtering the set of images. Images which are converted will now stored in the cloud to cut down storage problems. Business Applications, Satellite images, Social media and photographs are some of the applications were this idea is executed.

Timofei Epanchintsev and Andrey Sozykin, [19] developed a modified MapReduce Image Processing framework which is an extension of MIPr framework that allows the access of Opencv for Distributed image processing in the hadoop cluster. The proposed framework is an open architecture that uses MATclass containers in OpenCV and creates a Mat Writable Image suitable as a value in Map Reduce Programs which preserves the original image file names in contrast with the traditional approach. The images are read from the HDFS into the memory using OpenCV File Input Formats and the Map Reduce program is executed on the image cluster. The Image Processing is done with the MIPr and OpenCV java binding which utilizes the standard Mapper and Reducer classes. The performance testing of the system revealed the near-linear scalabity for large clusters but it was poor for single node cluster due to Hadoop overhead.

Application of Deep Learning in Object Detection by Xinyi Zhou, Wei Gong et al [22] uses deep learning technique for the better recognition based on neural networks. Deep learning has two stages as follows: the first is the dataset which is the important fuel of deep learning. It depicts the accuracy and the network architecture of the system. The system uses Image Net as an image library which has more than 14million images classified under more than 20,000 categories. PascalVOC (Pattern Analysis, Statistical modeling and Computational Learning Visual Object Classes) is used for pattern recognition, computational learning and modeling and COCO (Common Objects in Context) makes a big progress in segmentation and has become the standard dataset. The second is the neural network. The system uses faster R-CNN (Region and Convolution Neural Network) which focuses on the shortcomings of both R-CNN and SPP-net. Faster R-CNN reduces the running time for detecting objects based on region analysis but the accuracy depends on the clarity of the image captured.

IV. Comparison:

The survey was done by recent research papers and the comparisons based on techniques, performance, accuracy of output and the results of comparison is as follows:

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Techniques	Input works on	Performance	Accuracy	Tool/ Platform
Top down model recognition and Bottom up Image segmentation[6]	Based on shape context features.	It achieves high recall and precisions rate.	Objects position can be detected and also gives figure ground segmentation mask	MAT Lab
Image difference Technique and velocity estimation[9]	Images taken from static cameras and compare with the reference image then difference algorithm will be applied.	Velocity, accelaration of an Moving object can be identifies with good performance	Output images are efficient.	MAT Lab
Diffusion and object contour[13]	Images generated with colour information	It works on complex condition but is time consuming.	It cant effectively track an object.	
Segmentation Edge detection[16]	Processed images in which segmentation is based on image features.	it performs various steps of EM and generic algorithms	It works better even on blur or improper images.	MAT Lab
Template matching, Shape based[8]	Image is converted into intensity gradient form.	It works on crowded environment. Storage can be minimized by using Parallelism.	It works on Partial occlusion effectively.	MAT Lab
Colour Detection Techniques[14]	Snaps obtained continuously from Webcams	Image grabbing and subtracting function is done in a loop. Hence slow.	Even intermediate angles can be obtained accurately.	Roomba Platform.
Modified MapReduce Image Processing[17]	Image clusters using MAT class container	Consumes more time as the files are read and written back into memory.	Works well on large clusters but poor in single node cluster.	Hadoop

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Map Reduce techniques[20]	Large volumes of data from cloud environment.	Only specific formats files can be accessed.	Efficient in handling multimedia data from social networks.	Hadoop
Neural networks [22]	Datasets and neural networks	It is the fastest technique due to use of R-CNN	Accuracy depends on clarity of image.	Deep learning

The above table describes various features and methods used for detecting objects from image frames by analysing the frames using image processing. The recent systems are using neural networks which work the fastest and yield accurate results.

V. Conclusion

The advancements in conventional networks, object detection, segmentation and recognition are drastically increasing turing the researches towards the strong development of the techniques and applications. As per the survey made on the above papers, the convolution neural networks are gaining scope and are being the fastest in recognizing the object. But if the input frames are not clear, the accuracy of regional recognition fails down. Hence our future work will focus on tracking videos from the cloud environment, processing them using hadoop and MATlab tools then identifying object. Huge volumes of data can be easily processed using Hadoop Image Processing Interface and analytics can be done only on the matched frames with the reference of the object that needs to be identified.

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