Real-time object detection and post change detection using unmanned aerial vehicles

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Abstract-Object detection is the detection and classification of objects in images. In aerial scenarios, we want to detect objects on the ground and the objects are almost near to being two-dimensional. The background of the objects is also complex. This poses a challenge for the detection and classification of objects. There are numerous applications of unmanned aerial vehicles (UAV). There are often mismatches in the detected objects. Objection detection can be achieved in real-time using already existing algorithms. Change detection is difficult to be achieved in real-time along with object detection.

I. INTRODUCTION

Object detection in aerial images deals with detection of objects that we are interested in that are present on the ground. In recent times more and more aerial data is available and the applications are numerous. However, there are many challenges on working with aerial images.

The images are taken in a bird's eye view and objects have complex background with the objects having variant appearances. These factors increase the difficulty of detecting objects in aerial images. YOLO deep learning algorithm can be used to achieve real-time object detection.

The images obtained from the UAV are used to detect previously detected objects. The detected objects are stored along with a distance measure for comparing the region of interests, to detect changes.

II. LITERATURE SURVEY

[1] *Jung UK Kim* and *Jungsu Kwon* presented the one of the most important and most challenging problem in Computer Vision that is "Object Bounding Box-Critic Networks for Exclude-Robust Object Detection in Road". Learn the visual of each object and specify the object's category and its bounding.

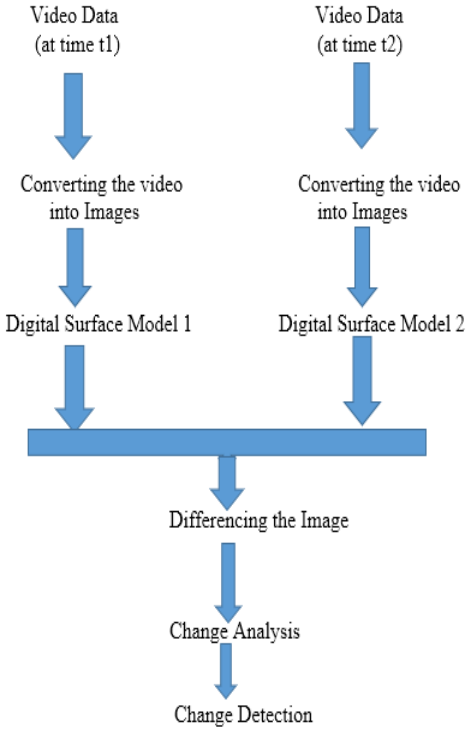

Fig1: Proposed model for change detection

[1] Detecting the vehicles on road will helpful for the drivers get to know the road condition and road traffic. But it is a most complicated because it has 'Object Exclude' problem. To overcome this problem, we can use 'Deep Conversion Neural Network (CNN)' and 'Region Proposal Network (RPN)' so in this paper publisher uses the 'Novel Object Detection Network" with multiple 'Opaque Binary DOB (OBB) "plug-in" manner it analyses the feature object exclude and resolve the problem.

Pros:

- It is fast compared to other method

- High Performance

Cons:

- Difficult to detect moving vehicles
- Large Variance of scale is difficult.

[2] *Kunimozi S* and *Gayathri G* presented the topic of "Multiple Real-Time object Identification using Single shot Multi-Box Detection" which specifies the detect and tracking moving object (vehicles) convert them into 'Real-Time video'. Several mechanisms are used to track the objects but all failed to provide accurate result. So, publisher defines the other method called 'Neural Network Method'. This method uses the "Mobile Net" technology. This technology gives better performance than the other method like 'Shallow Model'. The Mobile Net contains all the details about the architecture of SSD. The SSD has two parts i). Extract Feature Map ii). Apply convolution filters to detect objects.

Pros:

- Helps to detect the crime in public using Public Surveillance Camera
- To prevent Terrorist attack using satellites

Cons:

- Low Resolution
- It has complex Network structure

[3] The publisher *Apoorva Raghunandan* and *Mohana* describes the "Object Detection Algorithm for Video Surveillance Application" it specifies the detection of actual objects such as humans, animals, birds etc. This algorithm uses the 'image processing' and extract the part by part portion of object. Several algorithms can used for the object detection such as: i). Face Detection: This algorithm is used to identify human face. ii). Skin Detection: This algorithm is used to check the skin of humans. Once all the features are detected the algorithm extract all the features including 'Shape and Colours'. After extracting all the features, it gives as an input for the "Video Surveillance Camera" such as CCTV etc.

Pros:

- Used in the Medical Field
- Used to give security in border

Cons:

- Algorithm only able to detect the primary colors with accuracy
- It is failed to detect the all regions of the skin.

[4] *Jaya S Kulchandani* and *Kruti J Dangarwala* has implemented a "Moving Object Detection" This follows a conventional method to detect the objects they are Background subtraction, Frame differencing, Temporal differencing and optical flow. In background subtraction method it keeps a copy of initialized model of a frame, and it takes the input as a present input then it subtracts the Present frame and the initialized frame.it subtracts the pixel values of the both the frames and gives the result. The other two methods do follow the same process but they subtract the different frames. In optical flow method it forms the clusters from the information received by field of optical flow, it forms clusters of labels that have same values.

Pros:

- Time complexity is very less.
- This can be used without the training model.

Cons:

- If the moving target and its shadow are of the same color then it is difficult to detect.
- If the intensity of illumination and reflection varies timely.

[5] *Mohammad Farag* and *Mohammed aslibai* has implemented the "Object detection and localization for grasping and positioning tasks for Selective Compliance Articulated Robotic Arm (SCARA)", this uses camera calibration methods for edge detection. This deals with the calibration of SCARA robot behaviour of the movement of its arm with the values obtained from the camera system. It takes AxB pixel as the input and uses different "Edge Detection" techniques to detect the edges. here they considered the object detection as a binary classification for the class of circular objects implemented on checker board. The SCARA is guided by the Camera vision system to draw another circular point.

Pros:

- This detects the objects of very small size.
- It has more accuracy for geometry shaped objects.

Cons:

- the elements with large objects size cannot be detected.
- Hard to implement in real life.

[6] *Dr. Ulagamuthavi, J B Janet* and *Abhinaya* has presented a paper on "Efficient objects detection model using CNN (Convolution Neural Network)". This model uses Machine Learning Techniques like Neural networks, SVM (Support Vector Machines). The Output of one layer is connected as the input for the other layer. This have any number of hidden layers including one input layer and one output layer. Textual objects are detected using the segmentation process. The model is trained after which detection happens the model saves the patterns that are formed.as this uses the dataset that is divided in to two sets of images are training set and testing set the training set is 80% and the testing set is 25%. Once the training is completed object detection takes place.

Pros:

- Textual objects are detected fast.
- After training the model it detects the targets very fast.

Cons:

- To train the model it takes more time.
- Objects other than textual are detected slowly.

[7] *Qili yeh Zhang* and *Guangjiao Zhou* has studied and presented a paper on the "Object detection for High Resolution SAR (Synthetic Aperture Radar) images and Optical images". This detects the object by forming a spatial relationship between SAR and Optical images. The coordinates of the image are obtained by forming this relation. These coordinates are extracted by forming a Gaussian image next key points are detected and then the descriptors of the object are detected. These coordinates are

matched spatially with its consecutive neighbours. These estimated values are analysed to get the result. This uses an improved version of AMM (Active Appearance Model) that is ACM (Active Contour Model).

Pros:

- The boundaries of the objects are detected for highly resolute images.

Cons:

- The intrinsic methods support the extraction of the coordinates.
- Sometimes the boundary formation is not accurate.

[8] *Lakhan H Jadhav, Bashir Ahamad* and *F Momin* has published a paper on "Detection and identification of unattended/Removed objects in video surveillance". A video dataset is given as input captured by the CCTV cameras in 2D. Two background models are created one is for static and other is for changing with different learning rates. These background objects are subtracted to get the foreground value and then extract the "Blob" features and then classify these features. The Blob features location they are coordinates, height and width that are in pixels.an operation called split detection is performed on a single object to remove the "shadow" of the object. If the object is unattended object is found it is notified to the concerned authority.

Pros:

- Help to find the lost objects.
- Helps to monitor traffic of vehicles.

Cons:

- Has more computational complexity.
- Object detection with shadow is not good.

[9] *Sandeep Kumar, Aman bayan* and *Manvi Chawla* has presented the "Object detection and recognition in images". This involves more image pre-processing steps before giving it as the input to Neural Network. The main challenge in object detection is to identify the object and categorise it. Image pre-processing is done by passing it through the filters like skin-tone detection, input or output filter, blur filter and edge detection filters. The features extracted are fetched and stored in a separate Neural Network from which the bounding box is generated. The grid cells of the image are used to find the bounding box. The Convolutional network is chosen because it takes the weights for neuron and can take images of large size. This uses the predefined dataset that may have the information like set of Persons, Animals, Vehicles and indoor objects.

Pros:

- It gives the very accurate results once it is trained.
- This works good even if the images are blur and have low visibility.

Cons:

- The input image given has to be pre-processed before only.
- This model fails to detect the objects of very small size.

[10] *Woritchana Raku hang* and *Nawat Kamnoon* presented the paper on "Unattended and Stolen Object Detection based on Relocating existing System" it states that surveillance camera is very important in daily life because it is used in the many different places such as streets, shopping mall, colleges, public areas also in homes. But these systems are not have analyse the information for this reason ability to manually controlled system are very much important. To resolve this problem the publisher specifies two scenarios in this paper I) Unattended object ii) Stolen object These methods first import all videos and then processes on that videos. Next step is converting 'Normal image' into 'Grey scale image' finally result is display.

Pros:

- Gives high quality results
- It can use in public areas

Cons:

- Difficult to characterize object
- It is difficult to give reliable data

[11] *Shraddha Mane* and *Supriya Mangale* are two publishers describe the concept of "Moving Object Detection and Tracking using Convolutional Neural Networks". To track and detect the moving object is very much complicated task because all objects are continuously moving. To overcome this problem these two publisher describes important approach or method called 'Novel and Generalized Tensor Flow based object detection and CNN based object tracking algorithm" These algorithms can track moving object in any complex scene. 'Tensor Flow' based detection technique begin with importing all libraries then it specifies the detection graph and load the configuration from several trained model after it initializes the 'Tensor classes' then it starts to read the image once reading completes it applies the 'Tensor Flow' detection then it extract the object location the finally detect the object.

Pros:

- Used in video analysis
- Used in Military application

Cons:

- Difficult to detect the moving object direction accurately
- Difficult to detect multiple moving object simultaneously

[12]The two researchers *Uiyan Yo* and *Sanzhal* properly present important concept that is "Research the Image main object Direction Algorithm based on Deep-Learning" they research this concept because for humans it is easy to detect and recognizes the object they can easily identified by bare eye but for the computer system it is very much complicated task. So, computer devices use the 'YOLO' first 'CNN' based algorithm for detection and recognition of multiple object. 'YOLO' Algorithm takes whole image

then it divides the image into sub image called 'Grid'. If centre of image present in grid then is 'network responsibility to detect image. This mainly concentrate on main object in a scene. If method found the main object on the scene specifies the relation between main image. It also uses 'Regional Convolutional Neural Network' (RNNN) to detect multiple main object on scene.

Pros: -

- It is simple method to detect main object direction
- It specifies the relations of the objects

Cons: -

- Difficult to distinguish complex images
- It does not have remedy for inaccurate image

[13] *Pengcheng Fang* and *Yijie Shi* has presented the topic of "Small Object Detection Using Context Information Fusion in Faster R-CNN" which is aimed at improving the accuracy and recall rate of small object detection using the Faster R-CNN. Here the candidate window is sampled up number of times and concatenated with the CNN layers to get 2048 dimensions which is then used for classification and posture recognition. The image is divided into 8 small-windows and checks if it crosses the feature map boundary

Pros:

- Bounding box regression error is not required
- Better performance is achieved by baseline model than context irrigation method

Cons:

- No change in the recall rate of the image by fusion method
- Accuracy decreases with 2 times increase of context information

[14] *Jae Min Cho and Kye Kyung Kim* has introduced the method of "Precise Object Detection Using Local Feature for Robot Manipulator" for recognising objects in manufacturing industry. Candidate line compute the four vertices for the analysis of shape in the precise object region. The local and hierarchical features can be used for precise object detection. We detect objects through "Fast Hough Transform" Initially the Edge information detected by Gaussian method the image is cropped and then the DoG and Adaptive Binarization images are combined and Hough Transform is applied for rectangle estimation and then the feature extraction is made and correction is applied and finally the object is detected.

Pros:

- This method is 96.875% accurate
- This method can detect the small components of industries without fail.

Cons:

- Some errors occur due to vanished feature in the rectangle.
- More accurate algorithms can be developed

[15] *Nam Trung Pham* and *Karianto Leman* has introduced the method of "Two-Stage Unattended Object Detection Method with Proposals" mainly for the visual surveillance systems where it is necessary to detect the suspicious objects. In this method we track the static objects and also avoid occlusions. False alarms are reduced by short-term background model and miss rate of unattended images is decreased by long-term background model. This use 3 background models and then collaborate with person detection algorithm. Initially all people are detected. Track-let association technique is applied to track moving objects

Pros:

- The first stage can find major candidates of static objects.
- It has very low false alarm rate and hence it is more flexible and suitable for large scale deployment

Cons:

- Identifying the background model for second stage is the major challenge in this method
- It is challenging to handle false alarm miss detection rate,

[16] *Haoyu Ren* and *Ze-Nian Li* has proposed a method of "Object Detection Using Edge Histogram of Oriented Gradient" which tells us about the new feature extraction method to take the structural information which tells the local shape and also the appearance. This method gives us the shape parameters by arranging the block along the edge. After that the local structural parameters are used instead of traditional gradient histogram which is the new feature extraction technique

Pros:

- This method works on both single scale and multi-scale test sets without effecting the accuracy
- Training accuracy and the speed of the boosted classifier is are better in Edge HOG
- The speed of the Edge HOG is Two times more when compared to the traditional HOG

Cons:

- The objects may completely vary with the minute changes in the illumination and other parameters
- The algorithm may be improved to get better accuracy

[17] *Haoze Sun* and *Tianqing Chang* has presented a novel on "Gradually Global Pruning for Object Detection Network" for object detection using redundant features. Here we calculate the summation of absolute weights and the pruning is reduced and the finetuning has to be performed to improve the accuracy. We remove different

unnecessary weights by pruning where the threshold value is fixed and later the accuracy will be restored by finetuning. We evaluate the importance of individual filters globally across all the network layers by calculating the sum of its absolute weights. Then, we propose a progressive sparsity control function to gradually reduce the proportion of pruning in the implementation process. Finally, we finetune the pruned network to restore its accuracy. To avoid over pruning we have to reduce the amount of pruning with the decrease in number of neurons.

Pros:

- Amount of calculation involved here is very less
- Calculation of the response from each layer is not required for the reduction process
- Performance is better with the detection accuracy of 71.2%
- Global pruning has strong adaptability and easy implementation.

Cons:

- Global pruning cannot be directly applied to
- When there are multiple layers the symmetric derivation of the pruning is not possible

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