International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Detection of Sea Ships and Video Log Surveillance using Neural Networks

P. Sheela Rani[1], M. Reethika[2], U. Shree Preethi[3], V. Rohini[4]
[1]*Assistant Professor, Department of Information Technology, Panimalar Institute of Technology, Chennai, India*
[2,3,4]*UG Student, Department of Information Technology, Panimalar Institute of Technology, Chennai, India*

***Abstract*: In both military and civilian fields, detection of inshore and offshore ships plays an essential role in large variety of applications. So far ship detection has been dependent on supervisors who track and monitor the detection manually. The collections of images were aggregated to constitute a dataset. Every image of a ship has been annotated with the corresponding ship type label for instance cargo ship, passenger ship, war ship. The sea ship images datasets are trained and used to detect the presence of the ships in a given video frame. The system is equipped with the special feature of notifying the naval authorities when it detects the presence of a war ship. The primary intent of the system is to maintain a video log for quicker access to the surveillance videos. Adopting this video log surveillance, we can track and monitor a distinct ship with facile and with no manual effort.**

***Keywords*: neural networks, sea ships and video log surveillance**

1. Introduction

The navy avails the video surveillance which captures videos that may contain a number of divergent ships that pass by [1]. The heterogeneous mixture of sea ship may include war ship, ore carrier, bulk cargo carrier, general cargo ship, container ship, fishing boat, and passenger ship. This system provides a structure for identifying a ship's anatomy. The primary facet of this system, video log helps you to supervise the video surveillance with a log that prevents hours and hours of inspection by navy authorities. Instead, it provides a much swift access in tracking and monitoring the videos with downsized man power. The secondary intent is to proclaim the authorities about the advent or presence of warships. This proclaim gives them a caution that makes them aware of forthcoming threats. This alert gives the navy authorities ample time to make requisite preparatory measures.

A. Why detection of sea ship matters

The first most crucial step is to be aware of every ship that enters the perimeter. For instance, in civilian field the video log helps in locating the peculiar ship with ease. This is very helpful in circumstances like monitoring the time period of a passenger ship track the ship which is said to be involved in smuggling, pollutant dumping by any ships. Another instance includes the military field where it can determine whether there exists a ship that crosses border or enacts any abnormal behaviours to assures the safety of shores [3]. When the system finds itself detecting a warship, it is programmed to send an immediate alert message that comprehends a caution message.

B. Why Matlab

Being a general purpose programming language MATLAB provides many significant advantages for image processing. Complete documentation of the image processing steps is made possible and it can be easily replicated. The image processing functions of all the source codes are accessible for scrutiny and test. It makes sure that numerical precisions are maintained throughout the process of enhancement. MATLAB is more likely to hold more advanced image processing algorithms than that are available in other image processing applications.

C. Before you begin

Initializing an Environment can be done by installing software package, MATLAB. The input for the system is the real time videos from the cameras set up at inshore or offshore. The input will be further segmented into video frames and are used by the system to detect and log.

D. Neural networks

Neural networks process the input given to it in a similar way how the human brain processes. To solve a specific problem a large number of highly interconnected neurons work in parallel. This is called a network. A neural network cannot be designed to perform only a specific task. The data must be selected meticulously otherwise network might show the disability of functioning incorrectly. Unless an error occurs there is no way of knowing whether this system is at fault or not [6]. Neuron is the building block of the neural network. Here we utilize the collection of sea ship images that acts as neurons which composed to a network. These trained sets are used for pattern recognition.

E. Image preprocessing

Preprocessing of images is the primary task in dynamic object detection. Even a minute change in the pixel can lead to false detection. Due to various reasons in the background noise can be added. Because of the addition of the noise there is high probability that the pixel value will be changed hence image processing is a pre requisite task.

Fig. 1. Image preprocessing

F. Adaptive histogram equalization

Adaptive histogram equalization is a high quality contrast break through method used for both natural and medical images and other non-visual images. For certain image classes' windowing intensity has no non trivial advantages in local contrast presentation in any contrast range. While AHE has a favored position of being automatic and reproducible, and it requires the observer to only examine a single image.

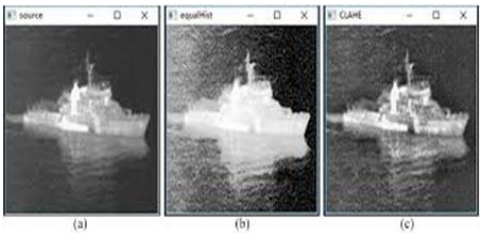

Fig. 2. Adaptive histogram equalization

In AHE.m we can find the implemented version of the adaptive histogram equalization. We use pixel by pixel approach. Scaling of the lowest values in the image make it bit look like noise. Salt and pepper noise is adapted when the image value is too low. When zooming in the image we get definite crisp lines and shapes in the full version. This depicts how pivotal different sizes of windows are.

G. Windowing

Processing the image as whole does not have the advantage of discovering minute changes in the small regions of the image. So to find the minute changes in the image, the image is divided into number of blocks and is explores. This exploration of every block in the image does not fail to find even a tiny change that might be missed if processed as a whole. The image is boxed into a number of nxn matrices. Smaller the window size the more the image is affected by changes in the neighborhood [5]. The size of the window can be seen increasing with the amount of change in our images. Each of the bands turns to be the same color as it is affected by the changes in the neighborhood. Due to small window sizes even the small areas of near consistent but random intensities will be broken apart. At last we manage to get a still random but a more uniform image. The expediency here is that we are able to view some definite structures more visually that we were not able to see before. Initially this method may not look pleasing visually as the straight histogram equalization does but it brings out different structures. This makes sense why this method is chosen as competent technique for images such as dynamic images.

H. Feature extraction

Various collections of images of divergent ships are taken and stored. These images are explored to illicit characteristics of that particular type of vessel [4]. The main four features that define a particular ship are the following: color of the vessel, texture of the body, intensity of the pixels and the energy emitted. These features also include supporting feature classes' namely gradient value of the image, Greco matrix, concurrent value, correlation, mean value, median value and Gabor value. Using the above mentioned features and sub features, the vessel is identified to be a type of particular category to which it belongs. Then we store these features as a numerical value within a matrix in the database. Then we use these illicit features to train the data using neural network.

I. Data training

The ability to generalize and respond to unexpected, unpredictable pattern paves the way for neural network to be widely used in pattern recognition [7]. While training the datasets the neurons are instructed to identify various specific patterns and whether to accept or not when it receives that pattern.

When a pattern is acquired during the stage of execution that is unassociated with an output, the neurons automatically selects the corresponding output to the pattern from the collection of patterns that it has been previously taught that is least different from the given input data. This is called generalization. This generalization is quite handy when it comes to neural networks.

2. Video segmentation

The video is taken as an input and the video is segmented into number of frames. The frames are nothing but the images from where we detect and categorize the ship. These frames are stored virtually and hence this process is memory efficient. The process of detection and categorization occurs in these frames [2]. The video is segmented into frames in order to efficiently acquire every benefit of the image difference algorithm.

A. Static scene object detection

The background is modeled and subtracted to obtain the object mask. It is designed to filter and remove noise such as salt and pepper. Adjacent pixels are grouped to obtain figure of an object. It cracks the objects frame by frame to develop trajectories.

B. Image difference algorithm

Distinguishing foreground from background plays a major

role in many applications including surveillance tracking, motion capture. The image difference algorithm uses two or more consecutive frames to draw out dynamic regions [8]. This method is comprising and prone to erroneous detection if there is a noise or illumination change due to climatic condition. To overcome that disadvantage the background subtraction technique and the frame differencing method are humongous enhancements.

1) Background subtraction technique

To find the difference between the current image and the background image, background subtraction method is used in detecting moving target.

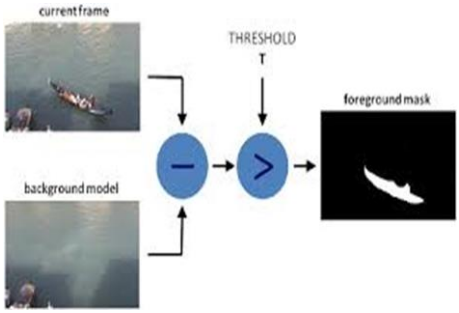

Fig. 3. Background subtraction technique

The primary idea is the first frame which is stored as the background image. Now the current image is subtracted with the pre stored background image. If the resulting different in pel is larger than the bound threshold then it defines that the pixel to pixel on the moving target or as the pixel in background. A very small value of the threshold will provide a lot of false change points and a very large value of threshold will decrease the scope of changes in movement.

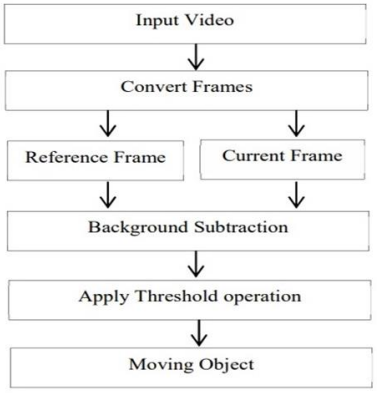

Fig. 4. Flow chart

2) Frame differencing

Frame differencing method otherwise known as image sequence difference method. This refers to a petite time interval 'th' from the two images before and after based on the pixel. This method will work when the background image is still and foreground image is moving. Depending on the speed, frame rate, global threshold and object structure this approach usage may vary. The accurate estimation of this approach wholly depends on the speed of movements in the scene. Higher thresholds are required for faster movements.

Thus we can write the background subtraction image as.

$$B(x,y,t) = I(x,y,t-1)$$
$$\Downarrow$$
$$|I(x,y,t) - I(x,y,t-1)| > Th$$

C. Motion detection

The primary goal of motion detection is to identify the object that is moving or not still. Another vision of motion detection is detecting the unusual and abnormal activity of pattern that appears in the frames. Its main function is computing the trajectories of moving objects in the frame. Many intelligent video analysis systems are dependent on the motion detection such as monitoring of traffic, real time detection of crime and indoor/outdoor security systems. Changed detection method detects objects within a scene. It tracks and object across the number of frames. It is able to focus and track more than one object that is in movement.

D. Patch model

The feature stored as the numerical value in the database is quite tedious to process. Hence these numerical values which depict the features are constituted to form a model [9]. Comparing a model to another model seems to be pretty easy task than comparing each numerical value of a feature with another. Thus, patch model effectively saves time and effort.

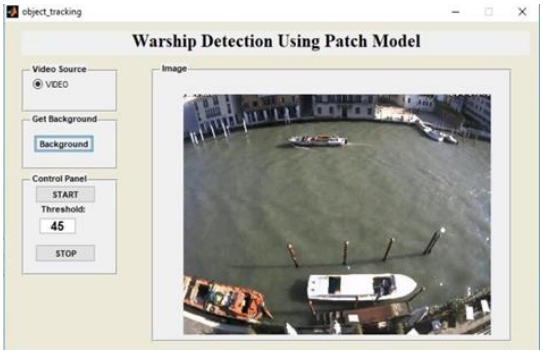

Fig. 5. Warship detection using patch model

1) Bounding boxes

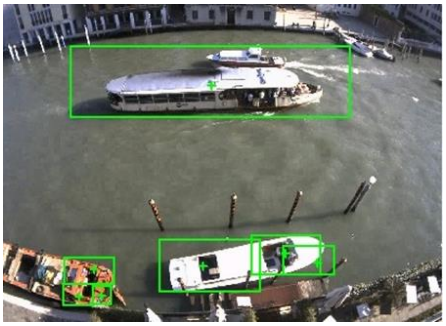

Fig. 6. Bounding boxes

Bounding boxes highlights the presence of a ship before entering the process of comparison by patch model [10]. These bounding boxes can appear more than once in a frame. This makes sense when the frame consists of two or more ships. The bounding box that covers a ship is checked against the list of certain features that label it to be a particular ship. The other bounding box that does not fall into list of features are not classified and labeled.

E. Notification of warships

The system is constructed to send the notifications whenever it claims to detect a warship or a navy ship. The notification reaches the assigned personnel of the navy department. The system searches for the presence of any warship in the video frame. If it identifies the warship it then programmed to send the alert to assigned personnel. This gives then ample time to take necessary actions.

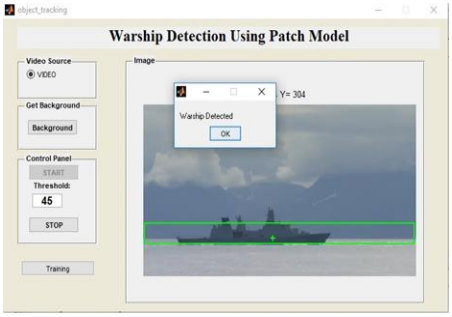

Fig. 7. Warship detection using patch model (Notification)

F. Video log surveillance

The system is not only designed to send notification but also able to log all the ship and their time sequence. This video log plays a vital role in both military and civilian fields. The video frames detect ships and starts the log file. It utilizes the system time in order to make track of the time spent by the particular ship. The video logs reduce the manual power. This allows the navy department to monitor cameras across the deployed coastline with ease.

3. Conclusion

The navy department is benefitted by use of this system which provides a quicker way of detecting and categorizing ships. It implements a crucial characteristic, the video log surveillance. The video log surveillance not only logs the ship but also keeps track of the time period the ship stays in a frame. The system also notifies the respected personnel in presence of a war ship to alert them to take necessary precautions.

References

[1] Zhenfeng Shao, Wenjing Wu, Zhongyuan Wang, Wan Du and Chengyuan Li “Sea Ships: A Large-Scale Precisely Annotated Dataset for Ship Detection” IEEE transactions on multimedia, vol. 20, no. 10, October 2018.

[2] Zhu Qiuyu, Jiang Yilong, Chen Bo “Design and implementation of video-based detection system for wharf ship” IET International Conference on Smart and Sustainable City 2013 (ICSSC 2013).

[3] Yingjian Liu, Hui Ma, Yanming Yang, Yanyan Liu “Automatic ship detection from SAR images” Proceedings 2011 IEEE International Conference on Spatial Data Mining and Geographical Knowledge Services.

[4] Xie Xiaoyang, Qizhi Xu, Hu Lei “Fast ship detection from optical satellite images based on ship distribution probability analysis” 2016 4th International Workshop on Earth Observation and Remote Sensing Applications (EORSA).

[5] Liang Zhai, Yu Li, Yi Su. Segmentation-based ship detection in harbor for SAR images2016 CIE International Conference on Radar (RADAR).

[6] R. Girshick, J. Donahue, T. Darrell, and J. Malik, “Region-based convolutional networks for accurate object detection and segmentation,” IEEE Trans. Pattern Anal. Mach. Intell., vol. 38, no. 1, pp. 142–158, Jan. 2016.

[7] C. Szegedy, S. Ioffe, V. Vanhoucke, and A. Alemi, “Inception-v4, inception-ResNet and the impact of residual connections on learning,” 2016.

[8] S. Xie, R. Girshick, P. Dollr, Z. Tu, and K. He “Aggregated residual transformations for deep neural networks,” 2016.

[9] K. He, X. Zhang, S. Ren, and J. Sun “Spatial pyramid pooling in deep convolutional networks for visual recognition” IEEE Trans. Pattern Anal. Mach. Intell., vol. 37, no. 9, pp. 1904–1916, Sep. 2015.

[10] R. Girshick, “Fast R-CNN,” in Proc. IEEE Int. Conf. Comput. Vis., pp. 1440–1448, 2015.