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INTELLIGENT FARM SURVEILLANCE SYSTEM FOR BIRD DETECTION

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ABSTRACT—Intelligent farm surveillance system is for viewing the remote farm. In traditional video surveillance model the basic disadvantage is manual detection of the event. Many developed and developing country are using intelligent farm surveillance system for viewing the farm remotely.In this paper there is a brief survey of different object detection techniques. Further for identifying object as a bird there is bunch of techniques for that like template matching, skeleton extraction, contour based technique, edge based technique, etc. Here after survey, best methods suitable for bird detection is selected and then efficiency of proposed scheme is measured. Proposed system is having relatively low false positive rate and false negative rate.

Index Terms: GMM, Template Matching, Haar transform.

I. INTRODUCTION

Intelligent video surveillance systems deal with the real-time monitoring of persistent and transient objects within a specific environment [1]. The primary aim of this system is to provide an automatic interpretation of scenes and to understand and predict the actions and interactions of the observed objects based on the information acquired by video camera. Intelligent word adds the intelligence to the video surveillance system. Traditional system needed the person who can view the system whole day but with the help of IVS it is possible to do these things automatically.

II. INTELLIGENT VIDEO SURVEILLANCE SYSTEM

In IVS, there are basically six components. These components are listed below.

Acquisition: This component is basically used for acquiring the images. There is a whole array of camera models to meet different monitoring needs. They are analogue and digital, and can be power-operated or not. Solar cameras are also being useful in many applications.

Transmission: The video captured by surveillance cam-eras must be sent to the recording, processing and viewing systems. This transmission can be done by cable (coaxial or fiber optic cables, stranded copper wire) or by air (infrared signals, radio transmission).

Compression: Digitized video represents a large quantity of data to be transmitted and archived. So, surveillance video must be compressed using codec, algorithms for Reducing the amount of data by deleting redundancies, by image or between footage frames, as well as details that cannot be seen by a human eye.

Processing: Video management systems process video surveillance images, such as managing different video flows, and viewing, recording, analyzing and searching recorded footage. There are four major categories of video management systems, Digital Video Recorder (DVR), Hybrid Digital Video Recorder (HDVR), Network Video Recorder (NVR), IP video surveillance software.

Archiving: The video footage archiving period varies depending on surveillance needs, ranging from a few days to a few years. There are two types of archiving devices, internal and attached.

Display: Video surveillance can be viewed on different devices. In small facilities, the video can be viewed directly on the recorder, as the image is being recorded. Images are generally viewed remotely, on a computer, or on a mobile device such as a telephone or hand held device.

Following figure shows the working of the IVS.

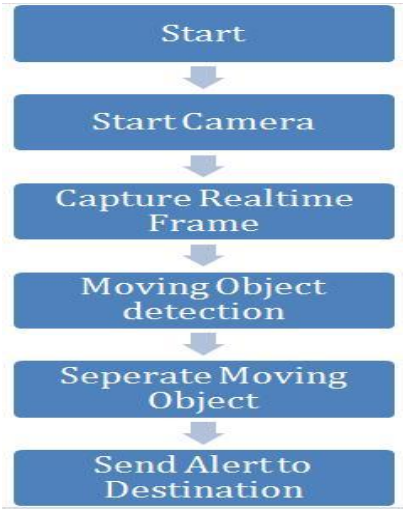

Fig. 1: Working of IVS

III. LITERATURE SURVEY

A. Moving Object detection techniques

Identifying moving objects from a video sequence is a fundamental and critical task in many computer-vision applications. A common approach is to perform background subtraction, which identifies moving objects from the portion of a video frame that differs significantly from a background model [4]. There are following challenges in developing a good background subtraction algorithm.

It must be robust against changes in illumination.

It should avoid detecting non-stationary background objects such as moving leaves, rain, snow, and shadows cast by moving objects.

Its internal background model should react quickly to changes in background such as starting and stopping of vehicles.

Thus, after doing survey of frame differencing, mean method, standard deviation and mixture of gaussian method, we have concluded that mixture of gaussian performs comparatively better than any other mechanism. As, mixture of gaussian is adaptive to changes in the background. This method works well even if there is change in background like moving leaves, falling rained.

B. Feature Extraction

In image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named features vector). There are many algorithms and techniques for feature extraction like threshold-ing, blob extraction, template matching, Hough transform, and haar transform etc.

C. Template Matching

Template matching is a technique in digital image pro-cessing for finding small parts of an image which match a template image. To perform template matching in matlab, we have used the concept of normalized cross co relation. In signal processing, cross-correlation is a measure of similarity of two waveforms as a function of a time-lag applied to one of them. This is also known as a sliding dot product or sliding inner-product. It is commonly used for searching a long-duration signal for shorter, known feature.For image-processing applications in which the brightness of the image and template can vary due to lighting and exposure conditions, the images can be first normalized. This is typically done at every step by subtracting the mean and dividing by the standard deviation. Here we have used feature based template matching mechanism using NCC.

IV. IMPLEMENTATION

For the implementation work, the tool selected to carry out proposed system is Matlab. As per the survey, the following

Work is carried out. The steps which should be fulfilled during implementation phase are as shown in figure 2.These steps are carried out for detecting bird from the given video.

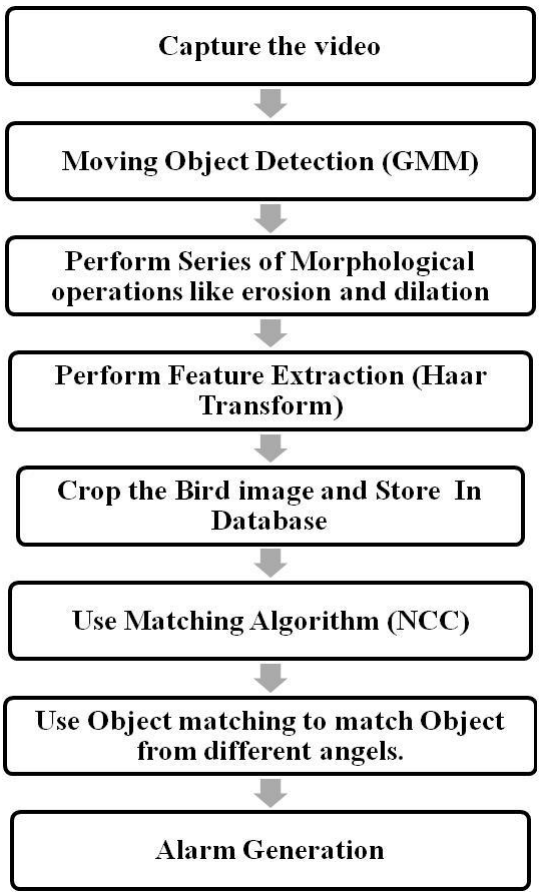

Fig. 2: Steps for implementation

A. Capture video

To capture the real time video using any webcam or IP camera, type imaqhinfo in command window to see acquisition tool information. Notice that the adaptor is Winvideo. Any webcam you connect is accessed through this adaptor. Here we are using stored video from farm surveillance system for implementation purpose.

B. Moving object detection

Here for proposed system we have used mixture of Gaussian method for background subtraction. For implementing and setting the parameter of mixture of Gaussian method we have referred [2]. The results are shown in figure 3. These parameters are set to implement mixture of Gaussian method. The results for this method is shown below.

C. Morphological operation

Morphological operations are performed to create the blob. It segregates object more sharply and returns the coordinates of detected objects. Here series of erosion and dilation are performed to obtain object's co-ordinate.

C = 3	number of Gaussian components (typically 3-5)
M = 3	number of background components
D = 2.5	positive deviation threshold
alpha = 0.01	learning rate (between 0 and 1) (from paper 0.01)
thresh = 0.25	foreground threshold (0.25 or 0.75 in paper)
sd_init = 6	initial standard deviation (for new components)
w = zeros(height,width,C)	initialize weights array
mean = zeros(height,width,C)	pixel means
sd = zeros(height,width,C)	pixel standard deviations
u_diff = zeros(height,width,C)	difference of each pixel from mean
p = alpha/(1/C)	initial p variable (used to update mean and sd)
rank = zeros(1,C)	rank of components (w/sd)

Fig. 3: Parameters for mixture of Gaussian method

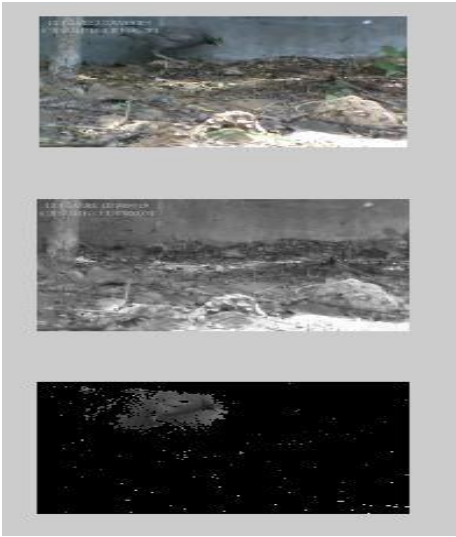

Fig. 4: Background subtraction using mixture of Gaussian

D. Feature Extraction

Here we have performed the haar transform on the bird image as shown in following figure. It returns the approximation, horizontal, vertical and diagonal values of the image.

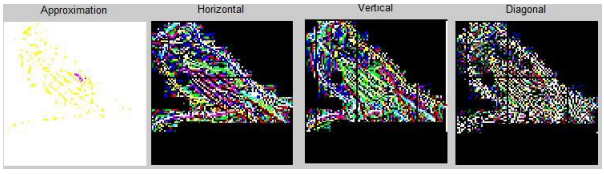

Fig. 5: Haar transform on bird image

E. Create the database

To create the database, here after performing feature extraction we have made two folders. One folder contains the target images and one folder contains the template images. Now to create the target images, we b3.avi as our testing video, and then after we have extracted images from that video. Now, these images are stored as a target images. These images should be stored in the one folder. Some of the extracted images are shown in figure. Now, to

Fig. 6: Images extracted from video

have simply extracted the video frames from testing video. For example here we have used Create template images; we have extracted the template images by performing GMM. These extracted template images are stored in one folder. Now these images are further being used for comparing the images from target folder. We are using template matching mechanism to compare the target images with template images. Some of the template images are shown in figure. Template images are used further for applying

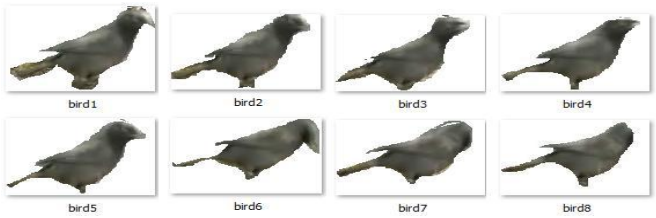

Fig. 7: Template image

Normalized cross co relation concept in finding bird from the frame. Here mainly we are finding small signal from the large signal. So target database will be used to find template images. Here if template image does not match exactly with target image then also proposed scheme is such that it detects the object. So, here even if there if only nine template images still bird can be accurately detected from more than 400 frames.

F. Template Matching

To perform template matching in matlab, we have used the concept of normalized cross co relation. In signal processing, cross-correlation is a measure of similarity of two waveforms as a function of a time-lag applied to one of them. This is also known as a sliding dot product or sliding inner-product. It is commonly used for searching a long-duration signal for a shorter, known feature. For image-processing applications in which the brightness of the image and template can vary due to lighting and exposure conditions, the images can be first normalized. This is typically done at every step by subtracting the mean and dividing by the standard deviation.

Fig. 8: Original image

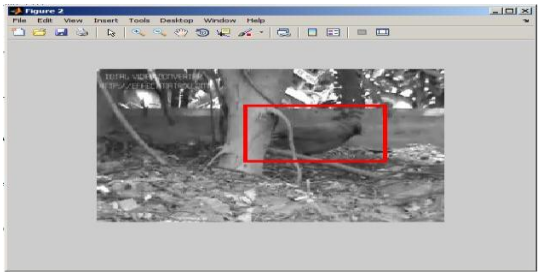

Fig. 9: Detected bird

V. Results and Analysis

Here we have manually checked the efficiency of the proposed system. This section describes the false positive rate and false negative rate of the system.

A. False Positive Rate

False positive rate indicates that it shows the rectangle on the frame even if the bird is not present. So, here to find the false positive rate for our implemented code we have taken 185 frames and from that 11 frames are showing rectangle even if there is no bird. So, false positive rate for our code is 5.94 %.
Thus the efficiency of the code=100-5.94= 94.06%.

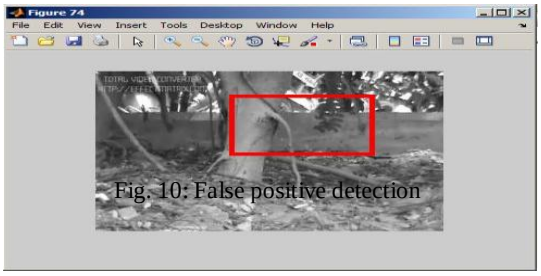

Fig. 10: False positive detection

B. False Negative Rate

False negative rate indicates that it does not show the rectangle on the frame even if the bird is present. So, here to find the false negative rate for our implemented code we have taken 420 frames and from that 22 frames are showing Rectangle even if there is no bird. So, false negative rate for our code is 5.23 %.
Thus the efficiency of the code=100-5.23= 94.77%.

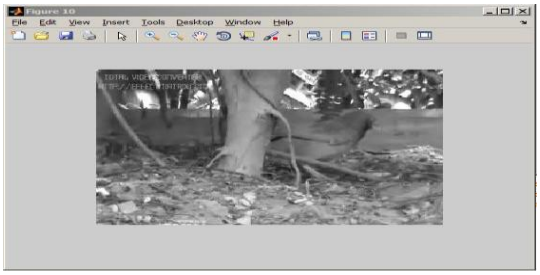

Fig. 11: False negative detection

VI. CONCLUSION

Intelligent farm surveillance system refers to the video level processing techniques for identification of specific objects, in recorded videos of the farm. In our work, we have assumed video, to be a series of images and have extended the concept to identify birds from videos of the farm. Different image processing techniques have been surveyed and implemented to recognize birds in video more efficiently. Background sub-traction methods like frame differencing, mixture of Gaussian and sum of absolute differences were implemented and tested on the video. Out of them mixture of Gaussian method worked comparatively better. Different feature extraction methods were surveyed and as a result, Haar transform was used for fast feature extraction from the video. After performing feature extraction, database is generated for target and template images. At last the template matching mechanism is used for detecting bird from the video. To implement template matching, normalized cross correlation technique is used. On detection of the bird an alarm is generated as a feedback. We have observed that the above methods work well for bird detection. Hence, the false positive rate for bird detection is 5.94 %; while false negative rate for bird detection is 5.23%.The proposed technique has 94% efficiency for bird detection.

VII. FUTURE WORK

Here as matching algorithm we have used NCC (Normalized cross co relation), in future any machine learning technique like SVM or neural network can be used.

REFERENCES

[1] Technological and Commercial Intelligence Report,Aude-Emmanuelle Fleurant ,CRIM, Technople Defence and Security,April 8, 2009,"Intel-ligent Video Surveillance: Promises and Challenges"

[2] T. Bouwmans, F. El Baf, B. Vachon,"Background Modeling using Mixture of Gaussians for Foreground Detection - A Survey",Laboratoire MIA, University de La Rochelle, Avenue M. Crpeau, 17000 La Rochelle, France

[3] Cheung S, Kamath C. Robust background subtraction with foreground validation for Urban Traffic Video. J Appl Signal Proc, Special Issue on Advances in Intelligent Vision Systems: Methods and Applications (EURASIP 2005), New York, USA, 2005; 14: 2330-2340.

[4] Piccardi M. Background subtraction techniques: A review. Proc of the Int Conf on Systems, Man and Cybernetics (SMC 2004), The Hague, The Netherlands, October 2004; 3199-3104.
[5] Elhabian S, El-Sayed K, Ahmed S. Moving object detection in spatial domain using background removal techniques - State-of-Art. Recent Pat on Comput Sci 2008; 1(1): 32-54.
[6] Xiao-yan Zhang, Xiao-juan Wu, Xin Zhou, Xiao-gang Wang, Yuan-yuan Zhang School of Information Science and Engineering, Shandong University Jinan 250100, P. R. China, "Automatic Detection and Tracking of Maneuverable Birds in Videos"
[7] Dee, H. M., Velastin, S. A. How close are we to solving the problem of automated visual surveillance? A review of real-world surveillance, scientific progress and evaluative mechanisms. Machine Vision and Ap-plications, 19 (5-6). Septembre 2008. pp. 329-343.
[8] Foresti, G. L., Micheloni, C., Snidaro, L. Remagnino, P., Ellis, T. Active Video-Based Surveillance System: The low-level image and video processing techniques needed for implementation . IEEE Signal Processing Magazine, 22 (2) March 2005. pp. 25-37.
[9] Hampapur, A., Brown, L., Connel, J., Ekin, A., Haas, N., Lu, M., Merkl H., Pankanti, S., ASenior, A., Shu, C.-F., Tian, Y. L., "Smart Video Surveillance : Exploring the concept of multiscale spatiotemporal tracking ", IEEE Signal Processing Magazine, 22 (2) March 2005. pp. 38-51.
[10] Hearing, N., Venetianer, P. L., Lipton, A. " The evolution of video surveillance: an overview. Machine Vision and Applications", 19 (5-6) September 2008 : pp. 279-290.