A SURVEY OF CAMOUFLAGE IMAGE DETECTION TECHNIQUES USING GMM ALGORITHM

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ABSTRACT

Image processing is an area of research scope where in the real time system surveillance which will increases chances for researchers to develop new modules for all the problems. There are different techniques and methods for camouflage object detection and tracking are currently present to detect specific portion or object from the Image. Detecting camouflage foreground object from its background environment is more difficult because of similarity between foreground object and background. The Conventional method cannot differentiate foreground object from background due to micro differences between them. To reduce the robustness and improve performance of camouflage object detecting system, the propose system uses GMM based background subtraction method. It also uses Gabor filter for feature extraction and distance classifier for identifying the object.

Keyword- *Image processing, GMM, feature Extraction, Gabor Filter.*

I. INTRODUCTION

For object Detection, navigation systems and surveillance systems, object detection is a first step. Object tracking has a significance in real time environment because it has several important applications such as Security and surveillance to recognize people, to provide better sense of security using visual information, In Medical therapy it is used to improve the quality of life for physical therapy patients and disabled people, In Retail space instrumentation to analyze the shopping behavior of customers to enhance building and environment design, In Video abstraction to obtain automatic annotation of videos, to generate object based summaries, In Traffic management to analyses flow, to detect accidents, Video editing is used to eliminate cumber some human operator interaction, for designing futuristic video effects. Major task of image processing is detecting moving objects. Detecting moving objects is consider as foundation of other advanced applications, such as target tracking, targets classification and target behavior understanding. In computer vision research arena visual camouflaged detection and tracking have enormous applications including surveillance, intelligence transportation etc. general extracting technique uses foreground objects to subtract the background images. Thus, basic operation need to perform is a separation process for the object from the static information present in the background. If a foreground pixel and nearby background pixels has similar color distributions ,this pixel may be mapped close to the boundary. In this case, a small obstacle may lead to a misclassification.

Various basic techniques have been defined to detect object such as background subtraction, optical flow, frame differencing. Among these, background subtraction is commonly used method due its low memory requirement, simplicity and easiness in implementation.
First phase in Background subtraction is background modeling. Kernel Density estimation ,Approximate Median,, single Gaussian, Mean filter, Gaussian mixtures are few background modeling techniques. Among these, Gaussian mixture modeling (GMM) defined by Stauffer and Grimson is most popular because of its robustness in handling

multimodal background and lighting changes. So that GMM is effective and robust to deal with the camouflage problem.

We propose a new techniques, GMM Modeling for camouflage detection. In this context camouflage is highly content-dependent, GMM is performed by considering joint background modeling. Specifically, we develop a global model for the background. Thus, we introduce a Gabor filter to extract some important features and distance classifier based on which the camouflage object are identified. GMM and Gabor filter are combine in a distance classifier to detect moving objects completely ,experiments are conducted on a number of images to demonstrate the effectiveness of our method.

II. LITERATURE SURVEY

The literature survey is the most important phase in any research. Before starting the developing process we need to study about previous papers of our domain ,which we are working. By the study, we can predict or generate the drawback and start working with the help of reference of previous papers. In this section, we briefly study the related work on Object Detection.

Yao, Li, Ling, M, "An Improved Mixture-of-Gaussians Background Model with Frame Difference and Blob Tracking in Video Stream".
Various types of research works are used as a reference for developing the proposed model which include a Gaussian model for tracking an object using background subtraction from the video stream. Depending on the differences in the frame sequences objects are detected in the model.

Simone Ferraro, Brandon Hensley, "Background subtraction uncertainty from submillimetre to millimetre wavelengths".
In this paper, Background subtraction model is used in the terms of wavelengths which is applicable in the astronomical data processing applications. This model is valuable and used in analyzing the procedure which is available in astronomical studies and that is related to the proposed model of research.

Junhua Yan, Shunfei Wang, Tianxia Xie, Yong Yang, Jiayi Wang, "Variational Bayesian learning for background subtraction based on local fusion feature".
In this literature Bayesian model for background subtraction by local fusion process is found. The fusion defines mixture of one or more sequences are frames. In this work frames are used to combine together to produce the fused image and object detection is performed by using Bayesian model.

Giorgio Gemignani; Alessandro Rozza, "A Robust Approach for the Background Subtraction Based on Multi-Layered Self- Organizing Maps".
The multi layered self organizing maps for object background subtraction is investigated in this literature ,where the layers of images are considered as multiple frames and each frame are processes independently to compute the necessary particular object from the sequence.

Yuan Xie, ShuhangGu, Yan Liu, WangmengZuo, Wensheng Zhang, Lei Zhang, "Weighted Schatten p - Norm Minimization for Image Denoising and Background Subtraction".
The literature shows the image de-noising and background extraction work using weighted schatten p norm minimization. In this research paper the observed factor is de-noising which is needed in case of processing a video hence, the objects are moving randomly tracking such objects is complex task if noise is present.

Wonjun Kim ,Youngsung Kim, "Background Subtraction Using Illumination-Invariant Structural Complexity".
Literature describes about the background subtraction using the illumination invariant function. In the illumination process the objects are considered as illusion for processing in them into the complex video environment.

Wei Liu, Hongfei Yu, Huai Yuan, Hong Zhao, XiaoweiXu , "Effective background modelling and subtraction approach for moving object detection".
The background environment detection work is performed for moving object detection. The Experimental results in both research works provides an idea of object tracking in complex environment and detection using background subtraction.

Jin-Bin Yang, Min Shi, Qing-Ming Yi, "A New Method for Motion Target Detection by Background Subtraction and Update" Physics Procedia33 (2012) 1768 – 1775, ScienceDirect.
In this paper optical flow method is used for tracking object with the Gaussian for foreground detection. There are mainly three phases of the algorithm. First phase is 'choice of different video size'. Noise removal from the frames and implementation of optical flow technique. The optical flow has the advantage that it requires less data storage , complexity is reduced as the feature vectors generated using optical flow are enough to define the motion and objects of interest, cost of processing is reduced as it requires least bandwidth to transmit .Here, the flow vectors are compared to the whole video that is being monitored.

Xie Yong, "Improved Gaussian Mixture Model in Video Motion Detection", Journal of Multimedia, Vol. 8, Nn. 5, October 2013.
Gaussian mixture model is used to for the background model, the background difference method is used to detect target. Target location features, and color features, shape features and modified Hough transform are combined for tracking the target. In this proposed algorithm, first step is to convert the video into the number of frames and by using Gaussian Mixture Modeling, the background modeling is done. The background is continuously updated and the foreground is detected by getting difference between current frame and background frame with removal of shadow.

HongxingGuo ,"Bayes classification of background and foreground image and Gaussian mixtures model for background observation" .
In this paper, proposed method is to separate foreground from Background accurately in visual surveillances application by using Bayes classification of background and foreground by using Gaussian mixture model for background observation, challenge for this approach is that it is difficult to choose a threshold to separate foreground from background because of camouflage. Camouflage problem appears when the color elements of a pixel of new foreground object are so near to the background models of an image. So they propose the video frames in sequences temporally, that reduces the variances of background models. Thus the background model is squeezed to a very narrow region and the probability of camouflage is reduced.

Table 1. Survey of Attribute Count

Writer	Survey Of Year	Purpose	Attribute Count Methods/Techniques	Count Of attribute
Huerta, D. Rowe, M. Mozerov, and J. Gonzalez	2007	Improving Background Subtraction Based on a Casuistry of Color-Motion Segmentation Problems	Preprocessing, segmentation Motion Detection.	5
P.Sengottuvelan, Amitabh Wahi, A. Shanmugam.	2008	Performance of Decamouflaging Through Exploratory Image Analysis	Decamouflaging, Image Analysis	9
YannickBenezeth, Pierre-Marc Jodoin, Bruno Emile, Helene Laurent,	2010.	Comparative study of background subtraction algorithms	Image Detection .	11
Jin-Bin Yang, Min Shi, Qing-Ming Yi	2012	A New Method for Motion Target Detection by Background Subtraction and Update",	Background Subtraction	4
Xie Yong	2013	Improved Gaussian Mixture Model in Video Motion Detection	Video Motion Detection	6
Yao, Li, Ling, M	2014	An Improved Mixture-of-Gaussians Background Model with Frame Difference and Blob Tracking in Video Stream	Mixture-of-Gaussians Model,Frame Difference, Blob Tracking.	10
Simone Ferraro, Brandon Hensley	2015.	uncertainty from submillimetre to millimeter wavelengths	Background subtraction wavelengths	**7**
Wonjun Kim; Youngsung Kim	2016	Weighted Schatten p - Norm Minimization for Image Denoising	Background subtraction, Signal Processing	11
Giorgio Gemignani; Alessandro Rozza, .	2016.	A Robust Approach for the Background Subtraction Based on Multi-Layered Self-Organizing Maps	Background Subtraction ,Transactions on Image Processing	9

III. PROPOSED SYSTEM

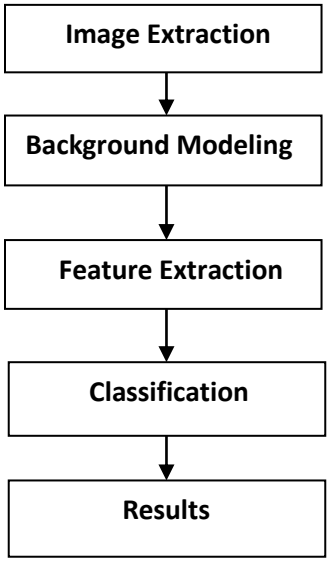


Figure 1.1.proposed system

Image Acquisition:

Camera is used to read the image and collect the data with its features.

Background modeling using GMM:
The Moving object detection is critical task in image processing. Gaussian Mixture Model (GMM) based background subtraction is most popular technique used for moving object detection due to its robustness to multimodality and lighting changes.

In the concept of a Detecting camouflaged moving foreground objects system, Friedman and Russell proposed a model for each background pixel using a mixture Then, the Gaussians is manually labeled in a heuristic manner as follows: the most darkest component has been labeled as shadow; for the remaining two components, the one which has the largest variance is labeled as object and the other one as background. This model is fixed for all the process giving lack of adaptation to changes over time. For the foreground object detection, each pixel is compared with each Gaussian and then it is classified according to its corresponding Gaussian. Stauffer and Grimson extended this idea by modeling the recent history of the color features of each pixel by a mixture of K Gaussians.

Feature Extraction:
We are going to use Gabor Filter to Extract the Image features.filters are bandpass filters which are used in image processing for feature extraction, texture analysis, and stereo disparity estimation from the image. The impulse response of these filters is created by multiplying an Gaussian envelope function with a complex oscillation. Gabor represented this elementary functions which minimize the space (time)-uncertainty product. By further extending these functions to two dimensions it is possible to create new filters which are mainly selective for orientation. In specific conditions the phase of the response of Gabor filters is approximately linear. This property

has been exploited by stereo approaches which uses the phase-difference of the left and right filter responses to estimate the disparity in the stereo images.

Classification:

For generative classification, We used the Distance classifier. GMM and Gabor filter are combine in a distance classifier to detect moving objects completely. The minimum distance to mean classifier is simplest mathematically and very efficient in computation. Here in this procedure the DN value of the training sets are plotted in a scatteromgram. The 2D scatteromgram is drawn for an example as shown in below figure. DN values of five training sets is plotted and their means are calculated. Now a unknown pixel A will be classified or be assigned to a class by a distance calculation from the mean of each class to the pixel A. That's why this algorithm is named as minimum distance to mean classifier. Thus, the pixel A will be assigned to the class whose mean value is closest to A. In this example, the unknown pixel A will be assigned to the sand class. This way the pixels of entire image are assigned to different classes. Thus for an n-Dimensional multispectral data, n-D scatter diagram is plotted; the mean of each classes are calculated and the image is classified according to the minimum distance class.

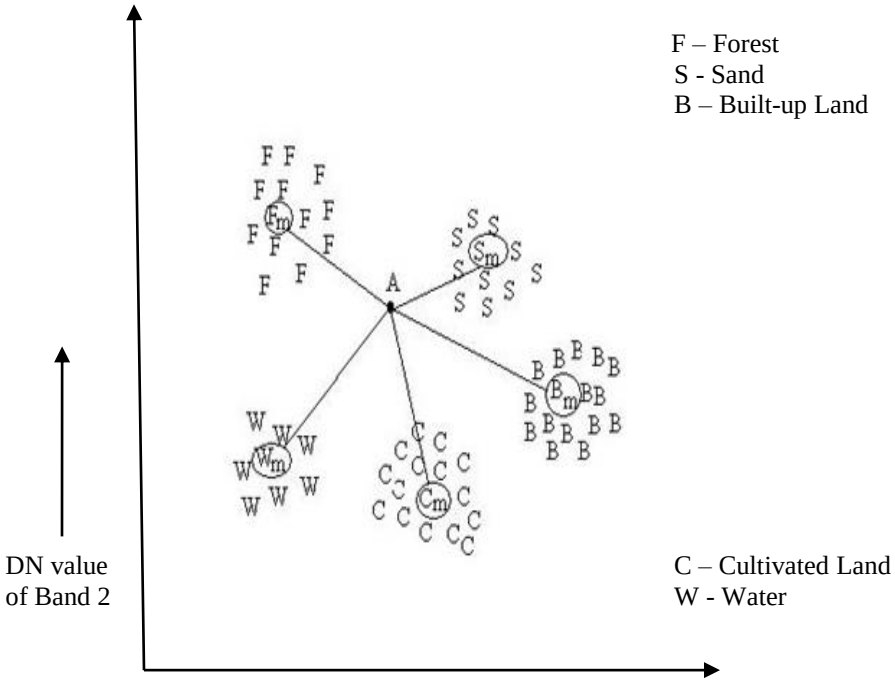
$$d_e(m_{ik}) = \sqrt{\sum_{j=1}^{nb} (m_{ij} - mk_j)^2}$$

1.Numerical Form

$$[(C_i - k)^2 (C_i - k)]^{1/2}$$

2. Matrix Form

Where,
Nb=number of bands
J=a particular band
I= a particular class
K_i=DN values of pixel at band j
C_{ij} = mean of DN values in band j for the sample for class i.
d_e (C_{ik})= Euclidean distance from the mean of a class to any unknown pixel
T=transportation



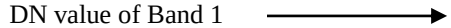


Figure 1.2.classification of object.

IV. CONCLUSION

The camouflage problem is one of the main challenging problem in moving object detection from its background environment which is discussed in this paper. In this paper GMM algorithm is used for background modeling. This algorithm is used to detect only the camouflaged parts of moving objects. We combine GMM and Gabor filter in a distance classifier for complete object detection. Our proposed method can deal with the camouflage problem well with detecting, tracking and recognizing.

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