Animal Human Intrusion Detection Sysytem In Agricultural Land Using W-COHOG

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Abstract- *Animal detection are useful for many real life applications. Animal detection methods are useful on research related identification of targeted animal and also prevented wild life animal intrusion in residential area. Computer Vision is applied in agriculture field for food grading, disease identification of the plants and agro-farms security. Huge crop damage is caused by the wild animal attacks on the agriculture farms. Farmers in India face serious threats from pests, natural calamities &damage by animals resulting in lower yields Traditional methods followed by farmers are not that effective and it is not feasible to hire guards to keep an eye on crops and prevent wild animals. Since safety of both human and animal is equally vital. So, animal detection system is necessary in farm areas. In this paper, we proposed an algorithm to detect wild animals in a given image. WCoHOG is a Histogram oriented gradients based feature vector with better accuracy. It is an extension of Co-occurrence Histograms of Oriented Gradients (CoHOG). In this paper LIBLINEAR classifier is used in order to get better accuracy for high dimensional data. Experimental results prove that W-CoHOG performs better than existing state of the art methods.*

I. INTRODUCTION

In recent years wild animals are special challenge for the farmers throughout the world, Animals like wild boars, elephant, tiger and monkeys etc..... cause serious damage to crops by animals running over the field and trampling over the crops. It causes the financial problem to the farmers. It is not possible for human beings to monitor animal movements continuously throughout the day. So there is a need for specialized detection of animals particularly which enter the paddy fields and farm land of human beings. Animal attacks in Assam are a common story nowadays. Due to the unavailability of any detection system these attacks kill villagers and also destroy their crops. Due to lack of proper safety measures, these villagers are left helpless to their fate. Therefore a proper detection system could help save their lives and also to the preservation of crops. Also the crops of villagers are destroyed due to frequent interference of animals. The crops and paddy fields cannot be always fenced. So the possibility of crops being eaten away by cows and goats are very much present. This could result in huge wastage of crops produced by the farmers. To make the best use of mobile communication technology, the objectives of this paper therefore utilizes global system for mobile communication (GSM) and provide short message service (SMS). Image matching is a key component in almost any image processing method. Also the image matching is important in many applications such as navigation, guidance, automatic surveillance and in various types of mapping process.

II. EXISTING SYSTEM

The project is used to protect the farmland from animals by using Raspberry pi. Animals like wild boars, elephants, monkeys etc…cause serious damage to crops. This project utilizes the RFID (Radio Frequency Identification Device) module and GSM (Global System Mobile) modem for this purpose. The techniques that already being used is ineffective, in this article we are presenting a practical procedure toward them off, by creating a system which studies the behavior of the animal, detects the animal and produce the different sound that irritates the animal and also alerts the authorized person by sending a message. The animal can be detected by the RFID injector (for animals), the LF tag which inject on the animal skin. After the detection the intimation is sent. More hardwares has been used in the existing methodologies it leads more cost and it may cause damage to the electric device. The existing system consists animal detection using HOOG - [Haar of Oriented Gradients]. The HOOG is used for extracting the shape and texture features separately and combined those features using joint Learning approach for animal detection. After combining the shape and texture feature, two detection algorithms have been used for identifying the animals.

III. PROPOSED SYSTEM

The proposed system uses W-CoHOG feature vector to implement animal recognition. Firstly image is captured from the camerasat fixed intervals. The image is preprocessed in order to achievebetter accuracy. Later, theimage is processed with sliding window technique in order to identify the animal in the image. W-CoHOG feature vector used to calculate the feature vector. This feature vector supplied to the classifier to detect the animal in a particular window. In sliding window technique different sliding windows used in order to identify animals in different sizes of animal and zoom level of the camera.

In the CoHOG method, gradient directions are used to calculate feature vector and the magnitude is ignored. In the proposed method magnitude is also considered to extract more robust features. Weighted Co-occurrence Histograms of Oriented Gradients (WCoHOG) is used for more robust feature descriptors than CoHOG.

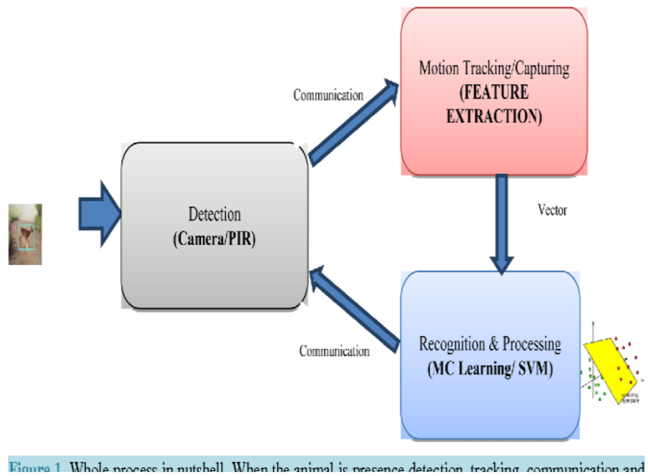


Fig: Overall process

IV. METHODOLOGY

*4.1. Pre-processing***:**

Pre-processing operations are performed at the lowest level of abstraction, which reduces the noise, distortions and enhances the image data or particular interest parts in the image. Firstly, Histogram equalization is performed on a given input image to enhance the contrast in the given image. Later sharpening filter is applied to the image to enhanceand highlight the region of interest and causes better object recognition.

4.2. Feature Extraction:

After preprocessing the image, the feature vector calculation is performed using Weighted Co-occurrence Histogram Oriented Gradients technique. Firstly, gradients are computed for a given image in magnitude and direction form using popular operators like Sobel and Roberts operators. Equation (2),(3) shows operators of Sobel Wild-Animal Recognition in Agriculture… and Robert's filters respectively. These gx and gy are calculated by convoluting two matrices on a given input image A.

4.2.1. Sobel Operator

$$\text{(a) } G_x=\begin{bmatrix}-1 & 0 & +1\\ -2 & 0 & +2\\ -1 & 0 & +1\end{bmatrix} x\,A \quad \text{(b) } G_y=\begin{bmatrix}+1 & +2 & +1\\ 0 & 0 & 0\\ -1 & -2 & -1\end{bmatrix} xA \qquad (2)$$

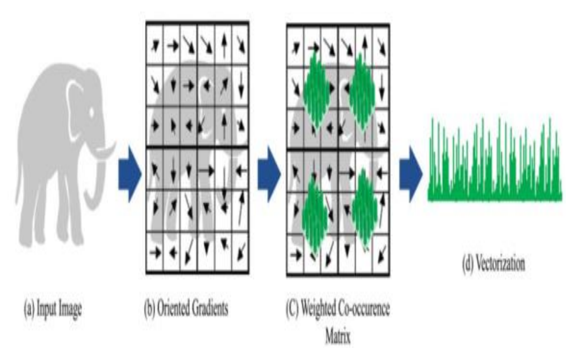
4.2.2. Robert's Operator

$$\text{(a) } G_x=\begin{bmatrix}+1 & 0\\ 0 & -1\end{bmatrix} x\,A \qquad \text{(b) } G_y=\begin{bmatrix}0 & +1\\ -1 & 0\end{bmatrix} x\,A \qquad (3)$$

Later, Gx and Gy are translated into gradient magnitude (M) and direction (Θ) form as shown in Equation (4). The gradient magnitude matrix (M) is convoluted with C7x7 shown inequation (5) which removes the aliasing effect. The gradient directions (Θ) are converted into eight equal bins with 450 intervals.

$$\text{(a) } \theta = \tan^{-1}\frac{g_x}{g_y} \quad \text{(b) } m = \sqrt{{g_x}^2 + {g_y}^2} \qquad (4)$$

$$C_{7x7} = \frac{1}{49}\begin{bmatrix}1&1&1&1&1&1&1\\1&1&1&1&1&1&1\\1&1&1&1&1&1&1\\1&1&1&1&1&1&1\\1&1&1&1&1&1&1\\1&1&1&1&1&1&1\\1&1&1&1&1&1&1\end{bmatrix} \qquad (5)$$



4.3. Weight Function:

In this proposed method, the magnitudes of the gradients are used in weight function in order to compute weighted co-occurrence matrix. Firstly, the magnitudes of the input image are calculated followed by calculating magnitude weighted co-occurrence matrix calculation. Weight function is applied to the co-occurrence matrix to improve accuracy. The weight function is calculated for each small region of the image as shown below.

Equation 6 and 7 explains the process of calculating Weighted Co-occurrence Matrix, where Δx, Δy arethe offsets of the co-occurrence matrix.

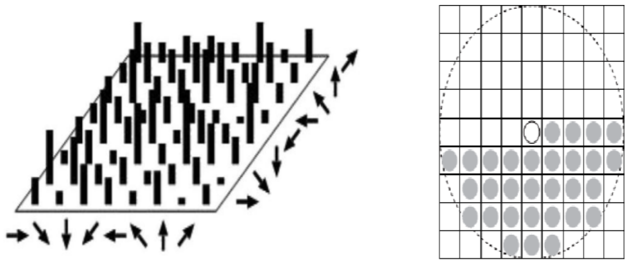
$$C_{\Delta x,\Delta y}(i,j) = \sum_{p=1}^{n}\sum_{q=1}^{m}\{W_{(p,q),(p+\Delta x,p+\Delta y)} * \alpha \quad (6)$$

$$\text{Where } \alpha = \begin{cases} 1 & if\, O(p,q) = i\, and\, O(p+\Delta x, q+\Delta y) = j \\ 0 & Otherwise \end{cases} \quad (7)$$

In a given input image Δx, Δy are the offsets of the co-occurrence matrix. The weighted co-occurrence matrix is calculated for each small region in the image. The weight function W is calculated by using the magnitude of the gradients of the image. Equation 8 shows the weight function for a given input image.

$$W_{(p,q),(p+\Delta x,p+\Delta y)} = \left(\frac{m_{p,q}}{\bar{M}} * \frac{m_{p+\Delta x,p+\Delta y}}{\bar{M}}\right) + \mu \quad (8)$$

Let $m_{p,q}$ is gradient magnitude of p, q location in a given input image. $\bar{M}$ is mean of gradient magnitudes of an image I and μ is a constant and equals to one. Likewise, magnitude weighted co-occurrence matrix is computed for each small region of the image. The typical co-occurrence matrix is a 8 x 8 matrix because the gradients are divided into eight orientations. Finally, all weighted co-occurrence matrices are vectorized by concatenating all the matrices elements into a single row. Offsets of cooccurrence matrix playcrucial role in feature vector. Near offset represents local features of the object and far offsets represent global features. Among 31 possible offsets two offsets sufficient for animal recognition, and selected a pair which contains local feature and global features.



(a) (b)

Figure 1: Co-occurrence matrix and offsets

4.4. Dimensionality Reduction:

Principal Component Analysis [24] is a dimensionality reduction technique which reduces the dimensionality of the feature vector. Dimensionality reduction also saves the memory to store the feature vector. The dataset consists of thousands of images of different classes which require larger memory to load the feature vector. Applying PCA reduces feature vector drastically without affecting the accuracy of the feature vector. The feature vector sizeof W-CoHOG is 4096 for two offset values reduced to 200 dimensions.

4.5. Classification:

The feature vector size is very high in W-CoHOG due to histograms of co-occurrence matrix calculated for different offset. The proposed method contains higher dimensionality than sample size and multi-classes, where support vector machine performs well. LIBLINEAR [21] is an open source library for large-scale linear classifier and performs faster than SVM for huge instances of data. It supports different kernel functions and multi-class classification [22]. In this proposed method, multi-class non-linear SVM classifier *uses LIBLINEAR.*

V. HOG ALGORITHM

The technique is based on the evaluation of histograms calculated on the basis of the orientation of the gradients of the input image. The concept behind is the edges and the shapes of objects can be well characterized by the intensity of individual local gradients. Computation of each histogram is obtained by dividing the image into a grid of cells and for each of them is computed a histogram of gradients (sobel 3X3 operator). Then the cells are grouped into regions called blocks. In addition, to release the response.

From information of the individual blocks you get a descriptor (trained dataset in vector format) that will be used for detection. The above operations are performed on windows of finite size that analyze the image at multiple scales. For each window is then obtained a descriptor that is then given to a linear SVM classifier that provides predictions about the presence or absence of a Animal.

Being the construction procedures of individual descriptors independent of each other, you can run them simultaneously with a multi-threading system. In this way you get a significant performance improvement. The robustness of the algorithm used (SVM algorithm) and accurate image scanning at multiple scales, often produce a dense group of detection windows for each object, then a merger is required (mean-shift) that brings up to a final identification window. by the terms of brightness, can be useful normalize individual blocks.

VI. SVM CLASSIFIER

A Support Vector Machine (SVM) is a machine learning technique used for classification or regression2. It was introduced by Vladimir N. Vapnik and C. Cortes in 1995 [12]. In other words it is a technique that allows to organize data according classes (or category) in order to determine the class of another sample. Definition In a n-dimensional space, an hyperplane is a subset of dimension n 1 which separates the space into two half spaces. It can be described as a set of points x.

VII. HISTOGRAM ORIENTED GRADIENTS

Histogram of Oriented Gradients, commonly called HOG, is a computer vision technique commonly used to detect all kind of objects. Unlike background subtraction algorithms, it has a region-based approach which makes it robust against geometric and photometric transformations. The motivation for using this technique is mainly its robustness. Indeed, the training is computed with SVM on a database with hundreds of images. The algorithm is designed to recognize specific kinds of objects, which makes it a good choice for Animal detection purposes. Compared to other algorithm, like ASM (Active Shape Model). which uses statistical models and deform the shape of an object to fit a reference image, HOG shows better result in both positive and negative matches (meaning that there are rate of true positive/ true negative is better). The algorithm was described by N. Dalal and B. Triggs in [3], It uses gradients magnitude and direction to describe all parts (or cells) of an image[9]. It can be combined with a SVM detector for human detection purposes.

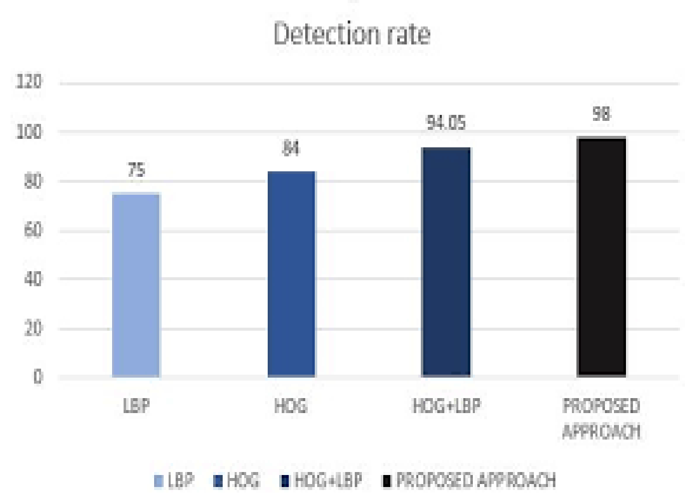


Fig: Detection rate

VIII. CONCLUSION AND FUTURE WORK

In this paper, we proposed a new algorithm for animal recognition. This method achieved better accuracy on two benchmark datasets compared to other existing algorithms. The experiments were conducted on static images. In future, we will implement a technique for recognizing animals in the video. In the future, we work on improving the algorithm to improve the accuracy.

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