PROTECTION OF CROPS FROM ANIMALS USING INTELLIGENT SURVEILLANCE SYSTEM

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Abstract: Traditional methods of detecting animals in paddy fields and farms include the use of human eyes to witness animal movements. 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. The methods used for the recognition of the animals include segmentation and object detection process. In the segmentation process frame differencing is used which is followed by thresholding. In the process of frame differencing two consecutive frames are subtracted which will leave only the moving objects. The process of segmentation is followed by object detection. There is a state of art overview to go through the work done by people in this field. After studying several object detection methods, finally the scale invariant Fourier transform method is selected owing to several advantages as compared to its counterparts.

Keywords: segmentation; frame differencing; Fourier transform; thresholding; coherent

1. Introduction:

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.

Figure 1: Animals eating away crops.

Researches related to animal's detection in image processing have been an important parameter for various applications. Many algorithms have also been developed by human beings related to this. Intelligent video surveillance system deals with the real time monitoring of persistent and transient in a specific environment. The main aim of this system is to manifest atomization of scenes and also foretell the various actions and interactions.

2. State-of-art: overview:

Over the years a lot of research has been done over object detection. In this section we mention a few related works related to this field.

Robert MacCurdy, Rich Gabriel son, Eric Spaulding have proposed real-time, automatic animal tracking using direct sequence spread spectrum. A method for tracking animals using a terrestrial system similar to GPS is shown. This process permits simultaneous detecting of thousands of animals with transmitters that are more compatable [1].

Pooya Khorrami, Jiang ping Wang and Thomas Huang propose multiple animal species detection using principal component analysis and large displacement animal flow. This paper examines the process of identifying various types of animals in videos taken [2].

The paper titled animal detection using template matching algorithm proposed by Mansi Parikh and Mrinal Patel states that animal detection is important in the prevention of animal-vehicle accidents and will increase human and wildlife safety, which will detect large animals before they enter the road and warn the driver through audio and video signals [3].

The paper titled Animal Detection using GPS by Dinesh Singh and Partha Das states that the Global Positioning System (GPS) is a free service which is space-based satellite direction finding system that provides location and time information, on any place where there is a clear line of sight to four or more satellites. Researchers have used these GPS receivers for navigation and tracking of animals [4].

The paper entitled new object detection method in complex environment proposed by P Viola and Rex Gomes examines the problems of detecting various types of animals in video sequences taken in the wild. Given that manually extracting and labeling an animal's position in a video sequence is very labour intensive, an automatic solution could be extremely useful and they proposed a method that provides accurate localization of the animals using a very general approach [5].

Detection of animals during animals mowing- proposed by A Fackelmier states that during pasture mowing in spring time every year countless animals such as fawns are killed or several injured and also in comparison to different animal safeguard laws, this is a big problem for farmers due to killing of several animals in this process. Many different processes have been found out to either scar the fawns away or to look out by a hunting dog and to manifest the necessary processes [6].

The paper titled a complete safety for wildlife using mobile agents and sensor clouds proposed by Sumit Kumar Tetarave and Ashish Kumar Srivastav states that with growing human population and search for new habitus and unsustainable use of natural resources, which is resulting in exploitation of forests and wildlife is under threat. This is resulting in decline of resulting flora and fauna [7].

The paper titled multi static radar for detection of wild animals proposed by A Mammerri [8] states that power spectral of the image can be defined as the magnitude of the signal in the frequency domain. Initial researches were based on getting the information whether the presence of animal in the image affects the spectrum of the image or no. Work done shows that this method is not convenient and effective if a person wants to have quick information about the animals detection. It fails to recognize the animals when the faces are not clearly visible and it fails to detect the animals completely. The paper entitled tracking animals in wildlife videos using face detection by Tito Bukhart [9] states that detection algorithm is based on human face detection method, utilizing Haar like features and Ada Boost classifiers. The face tracking is implemented using the Kanade-Lucas-Tomasi tracker and by applying a specific model to the face which is detected. By adding the two methods a reliable and temporally coherent detection/tracking of animal faces is achieved. In addition to the detection of a particular species of animal, the data which is produced by the tracker can be used to boost the priors in the probabilistic Semantic classification of wildlife videos.

The paper entitled wireless design of low cost detection system using GSM technology by Surabhi Agarwal and Chandrika Chandra [10] proposes a paper to check the moisture in four sectors of area and control the water

pumps respective to that sector. This technology involves monitoring soil moisture of a remote area divided into four sectors, where each sector consist of water pumps and continuously monitoring the conditions such as dry, wet , fully filled in that particular sector.

3. Proposed methodology:

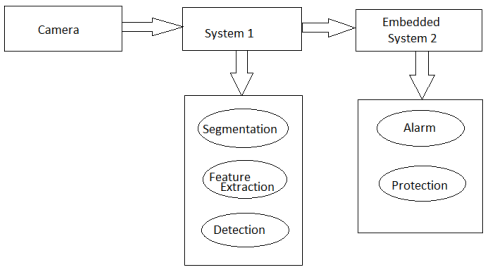

Figure 2: Block diagram for the proposed system.

Acquisition-This is basically used for acquiring the images. There is a whole array of camera models used for monitoring needs. They are analog and digital and can be power operated or not. Solar cameras are also used in many applications. The video captured by the surveillance cameras must be sent to the recording, processing and viewing. The cameras capture live videos.

Figure 3: Example of picture captured by camera.

Segmentation- This is a computational vision process of extracting foreground objects in a particular scene. Here the process of frame differencing is used which is used to subtract two consecutive frames which will leave only moving objects. Once the process of frame differencing is over, the thresholding process is done. In thresholding process the color image or gray scale image is reduced to binary image.

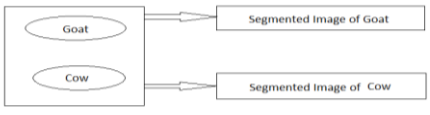

Figure 4: Illustration of segmentation.

Object detection- Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects. Here scale invariant feature transform algorithm is used for object detection purpose. SIFT is an algorithm in computer vision to detect and describe local features of different types of images. An object is recognized in a new image by individually comparing each feature from the new image to the database and then matching features based on Euclidean distance.

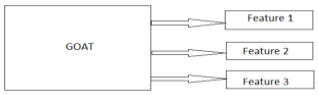

Figure 5: Extraction of features of goat.

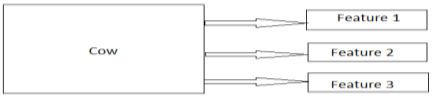

Figure 6: Extraction of features of cow.

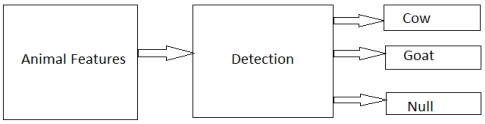

Figure 7: Detection of animals.

Alarm and protection- Once the animal of the interest is matched and the object is identified, the output is finally sent to the microcontroller where an alarm is generated and an SMS is sent to the owner that an intruder has entered the field.

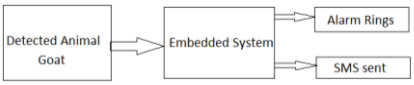

Figure 8: Alarm generation in case goat is detected.

Figure 9: Alarm generation in case cow is detected.

4. Background subtraction:

In background subtraction the foreground objects are extracted from a scene. The foreground object is best described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task which is under study. The foreground object can be thought of as a coherently moving object which is present in a scene. Emphasis must be given on the word coherent because if a person is walking in front of the leaves, the person forms the foreground object while the leaves are considered as the background due to its repetitive behavior.

Figure 10: Background image for segmenting cow.

Here in case of background subtraction the moving object is extracted from the video sequence. In some cases, the distance of the moving object also forms a basis for it to be considered the background. Example, if in a scene one person is close to the camera while the other person is far away, the far away person is ignored due to its small size and the lack of information that it provides.

This technique segments out objects of interest in a scene of applications such as monitoring of objects which are of different kinds. Also to develop a good background subtraction algorithm, firstly it should be robust to different changes in illumination and secondly it should avoid detecting non stationary background objects and

shadows which are cast by different forms of moving objects. A genuine background subtraction model should be quick to adapt itself to changes in background, for example the movement of an object.

The background subtracted image is obtained by subtracting two consecutive video frames. A good background subtracted model should have a good foreground detection rate. While detecting objects two situations are encountered, that is by static camera and by moving camera. The simplest method used for background subtraction is frame differencing and we are first implementing frame differencing method followed by thresholding. Here in order to get the background subtracted image first frame differencing is done which is followed by thresholding. In frame differencing two consecutive frames are subtracted which will leave only moving object which uses a reference background image for comparison purposes and the image is compared to reference image pixel by pixel.

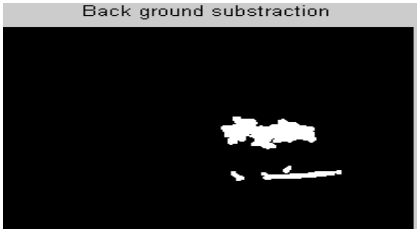

Figure 11: Background subtracted image of cow.

Frame differencing also known as temporal differencing uses the video frame at time t-1 as the background model for the frame at previous time. This method is immune to noise and different variations in illumination.

Figure 12: Background image for segmenting goat.

Frame differencing has many advantages to other algorithms. This process can work successfully even on night time and is immune to noisy conditions and changes in temperature and environment.

Figure 13: Background subtracted image of goat.

Thus by the process of thresholding we get the background subtracted image and also the objects are detected. The objective of binarization is to mask pixels that belong to true foreground regions with a single intensity and background regions with different intensities.

5. Proposed algorithm:

1. Get input video and slit it to frames.

2. Apply background subtraction technique for object motion detection.

3. Apply morphological operations.

4. Crop separate objects from original frame.

5. Give objects to SIFT algorithm for feature extraction.

- Find main key points using Harris corner point locations by multistate filter bank.
- Find orientation points using gradient values.
- Find descriptor local features.

6. Do same feature extraction for data set images using SIFT algorithm.

7. Now match features using Euclidian distance.

8. Sort match points and find object classification.

9. Send SMS using GSM according to classified object name.

4. Results and discussion:

Object recognition is a process of finding and identifying objects in an image of video sequence. Here in the process of object detection we use the process of SIFT (scale invariant feature transform). SIFT is an computer based algorithm to detect and describe local features in an image. This particular algorithm was first generated by David Lowe. First the SIFT key points of objects are extracted from a set of reference images.

Figure 14: Original frame of cow.

To perform recognition which is reliable, the features should be extracted which could be detectable even under noise and changes in illumination. SIFT images are first extracted from a set of reference images and stored in a database.

Figure 16: Detected object (cow).

An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vector.

Figure 16: Original frame of goat.

To filter out good matches the subsets of key points that match on the object and its location in the new image are to be identified. An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vector. To filter out good matches the subsets of key points that match on the object and its location in the new image are to be identified.

Figure 17: Detected object (goat).

5. Conclusion:

We have showed why animal detection is very important and emerging area due to a large number of real life applications. In our work we have assumed video to be a series of images and have extended the concept to identify animal from different videos. Different videos of cows and goats have been collected and processed for background subtraction techniques followed by thresholding. The moving object is subtracted from the background image. After this, object detection is done by the SIFT algorithm and once the object detection is performed, the output is sent to the micro-controller and alarm is generated.

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