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Proposed System for Animal Recognition using Image Processing

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Abstract - *In this paper, we are present a way in which image recognition can be used in order for an animal to be recognized so that people in the area can be alert of the presence of a dangerous animal. We have chosen five animals and are using PCA algorithm with Eigenfaces methods in order to identify the animal so that proper authorities can be alerted. This is required so that people need nature reserve can live without fear of a wild animal attack. With multiple camera already available all we need to do is to use the software in order to detect the presence of the animal.*

Key Words: **Eigen Values, Euclidean Distance, PCA, Eigen Faces.**

1. INTRODUCTION

The problem of image recognition is a complex and highly challenging one having a variety of parameters including illumination, orientation, expression and animal size. In this project we are presenting an independent, study and some of the benefits and drawbacks of PCA (Principal Component Analysis) when used for image recognition. In recent years, a new view-based approach to image recognition has been developed. The above-mentioned method is one of the most popular techniques for image recognition. The animals are identified by classes that is, each class will be representing a particular animal. Here there are total 5 classes (leopard and others). We performed PCA on two classes with 20 images per class by forming 5 cases. The detailed description of the cases is given in sections below.

2. Literature Survey

A. Researches on Power Spectral the researchers also have tried to find whether the presence of animal in the image scene will change the power spectral of the image or not. The power spectral can be defined as the amplitude of the signal in the frequency domain. This can be constructed by transforming the images from spatial domain into the frequency domain, by using transformation function such as the Fourier transform. The main idea is to help the human observer to realize the presence of the animal in the scene by inspecting the power spectral. Work in found that the human observer will not prefer to use this approach if they want to quickly detect the animal.

B. Animal Detection Using Face Detection Approach For research regarding locomotive behavior of wild animal, method combining detection and tracking of targeted animal faces has been applied in using Haar-like feature and Adaboost classifiers. The video recorders is only turn on when it is positive that targeted animal been detected to prolong battery life time and to ensure recorded video contain research value. This method especially crucial in situation whereby video man is not suitable to present at the recording scene for safety issue or video man might scare off some timid animal away. The animal faces are measured by utilizing face detection method with different local contrast configuration of luminescence channel to detect the image region of animal faces

C. Animal Detection Based on Thresholding Segmentation Method Target extraction from background can be performed by using threshold segmentation method. In, the object is found by using background subtraction method after obtaining the background image. In, threshold segmentation method based on the pixel values is performed. However, in this technique, researchers should carefully choose the threshold value as they also should consider the negative value obtained at certain pixel point by direct subtraction. The idea of threshold segmentation is simple, which pixel of gray that greater than threshold is set to white (i.e. intensity 255) and those less than the threshold value will be set to black (i.e. intensity 0). As stated in, it is difficult to select the threshold accurately as the background image periodically changes. Therefore, different appropriate threshold should be chosen for different background scene.

3. Existing System

Among all the existing system, none of the solution use computer vision technology in order to alert or track an wild animals movement. Most advance solution is mostly likely a real time video stream that has to monitored by a person in order to make sure that the wild animals and humans do not enter areas they are not supposed to enter.

4. Limitation of Existing System

The existing solution have a lot of limitations such as lot of point of failure as there is a possibility for both mechanical as well as human errors.

And as the there would be need for multiple cameras to setup for full coverage which there make the work of monitoring these streams extremely difficult.

5. Proposed System

To resolve these issues, we propose an image-based animal detection system using method based on eigenface and using the PCA algorithm.

The proposed system is better mainly due to the use of animal features rather than the entire animal. Its advantages are in terms of:

• Recognition accuracy and better discriminatory power Computational cost because smaller images (main features) require less processing to train the PCA.
• because of the use of dominant features and hence can be used as an effective means of authentication.

6. Algorithm

A. Overview

Principal component analysis (PCA) converts a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components using an orthogonal transformation. PCA was invented by Karl Pearson in the year 1901. The number of distinct principal components is one less than the number of original.

Variables or the number of observations. This transformation is defined in such a way that the first principal component has the largest possible variance (variance is the tendency of data to be different), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components. The resulting vectors are uncorrelated, orthogonal basis set. PCA is sensitive to the relative scaling of the original variables.

Following steps are followed to perform PCA: -

Step 1: Discrete Cosine Transform. Transform coding constitutes an integral component of applications of contemporary image processing.

Each pixel in an image exhibits a certain level of correlation with its neighboring pixels. Thus, a transformation is defined to map this correlated spatial data into transformed coefficients that are uncorrelated. Palpably, the transformation should utilize the fact that the information content of an individual pixel is relatively small i.e., to a large extent visual contribution of a pixel can be predicted using its Neighbors.

Step 2: Perform covariance on extracted matrix of size 3x3 based on subjective analysis.

Covariance is a measure of how changes in one variable are associated with changes in a second variable. Covariance is hence used on the Discrete Cosine Transform matrix so that a kind of distance measure is performed on the pixel values thus providing their relative measures of intensity. The covariance of two variants provides a measure of how strongly correlated these variables are, and the derived quantity

$$cor(x_i, x_j) \equiv \frac{cov(x_i, x_j)}{\sigma_i \sigma_j}$$

where i, j are the standard deviations, is called statistical Correlation of xi and xj. The covariance is symmetric since cov(x, y) = cov(y, x) Covariance is performed on the extracted 3*3 DCT matrix and covariance matrix is calculated using the following formulae Given n sets of variants denoted

{x1},.....,{xn}, the first-order covariance matrix is defined by

$$Vij = cov(x_i, x_j) \equiv \langle (x_i - \mu_i)\ (x_j - \mu$$

Where i is the mean. Higher order matrices are given by

$$Vi^m\ j^n = \langle (x_i - \mu_i)^m\ (x_j - \mu_j)^n \rangle$$

An individual matrix element vij = cov(xi, xj) is called the covariance of xi and xj .

Step 3: Solve for maximum Eigen value by generating characteristic equation from the covariance matrix.

A characteristic equation is generated from the covariance matrix. This characteristic equation is a cube root equation and the maximum root is found out using Cardan's method. This maximum root is the eigen value i.e. the principal component of the data set which uniquely identifies the image.

Step 4: Perform comparison of Eigen values by Least Mean Square Algorithm (LMS).

LMS=Sum {Square[(Cij-Em)q-(Cij-Em)d]}(i,j)

where i : row element number, j : column element number, Cij : Covariance element at ith row and jth column, Em: Maximum Eigen value, q: query image element, d: Image element of the database.

We have defined that for LMS value that computes:

1. 0 will give a exact match
2. Otherwise, a "no match".

B. Working

1. We resize the images of training dataset to some constant size (here 256 x 256) and convert these two-dimensional matrices into one Dimensional vector and calculate the mean of each pixel position of images.
2. Then we calculate the Eigen Faces and Eigen Values of the images.
3. Next using the Eigen Faces and Eigen Values, we centered image vectors.
4. Then we calculate projection of centered images into face space.
5. Now we acquire the test image and calculate its projection by using previously obtained mean.
6. Now we compare the projection of our test images to projections of dataset by calculating the Euclidean Distance.
7. The projection of dataset which is most near to projection of test image, i.e. the dataset image with least Euclidean Distance is our Recognized Image.
8. To improve the accuracy and determine which image is not of animal and addition threshold has been added by us which determined whether the minimum obtained Euclidean Distance is near enough for the image to be recognized as animal.

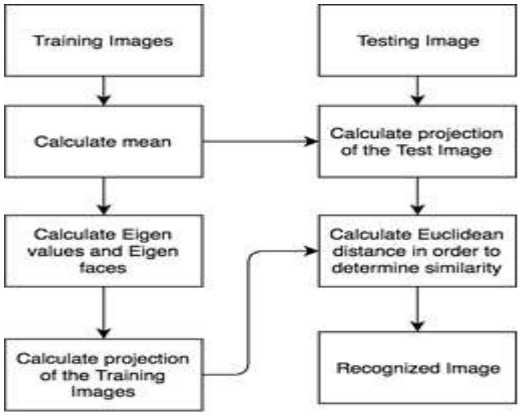
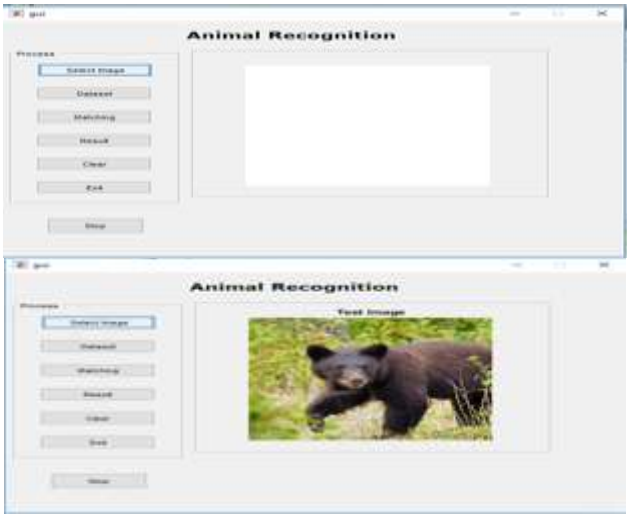


Table 1: Mapping of Working steps to steps of algorithm

Steps of Working	Steps of Algorithm
1	Step 1
2,3,4	Step 2
5	Step 3
6,7,	Step 4
8	This step is custom added by us and is not a part of original PCA Algorithm

7. CONCLUSIONS

The Proposed system is real time animal detection. It would detect the animals in the wild and alerts the authorities. It can solve all the problems of the existing system. In this we use PCA algorithm.



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