Edge detection methods of Iris based system for Animal Identification

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1.1 Introduction

Biometric system is used for identification as well as the recognition. Biometric traits /characteristics are used for the identification purpose. For animal identification we can use face of animal, Iris, texture etc. feature. For our system development we use the iris based feature extraction and classification method. We capture the data from camera traps for collecting wild life pictures. Motion Sensor camera traps collects the wild life pictures with economically. It reduces the manual task. The features are extracted from the collected images[1].The classification is done based on the features. The Fusion is done for the recognition purpose. We train the images by using neural network classifier which improves the accuracy.

1.2 Objective:

1) Collection of information of various Fauna tigers of India.
2) Study of various methodology of Biometric identification.
3) Automated Identification of animals.
4) Accuracy in the measurement of animals.
5) Medical diagnosis of the animal like bone fracture and tumor images.
6) To reduce the manual task at the forest sector.

Operations of Biometric system:

Biometric system is used for person's recognition in security system. An accurate automatic personal authentication is becoming more important for the operation of our electronically interconnected information society[1]. Several systems require authenticating a person's identity before giving an access to resources. Biometrics has been known as a robust approach for person authentication[2]. With new advances in technologies, biometrics has becoming emerging technology for authentication of individuals. Biometric system identifies or verifies a person based on his or her physiological characteristics such as fingerprint, face, palm print, iris etc or behavioral characteristics such as voice, writing style, and gait. Theoretically, any human physiological or behavioral characteristic can be used to make a personal identification .Unlike the possession based and knowledge based personal identification schemes, the biometric identifiers cannot be misplaced, forgotten, guessed or easily forged [3], some examples of biometric system are fingerprint recognition, iris recognition , face recognition, palm print recognition, voice recognition etc. Biometric systems used in real world applications are unimodal [4]. The use of biological traits to confirm the identity of individual [5].

The term Biometric comes from the Greek word bios which mean life and metrikos which means measure. It is well known that humans intuitively use some body characteristics such as face, gait or voice to recognize each other. Since, a wide variety of application requires reliable verification schemes to confirm the ID of an individual, recognizing human on basis of their characteristics[6].

The characteristics are as follows:

1. Voice
2. Finger Prints
3. Body contours
4. Retina & Iris
5. Face
6. Soft Biometrics.
7. Iris

A biometric system is fundamentally a pattern-recognition system that recognizes an individual based on attribute vector derived from a specific physiological or behavioral characteristic that the person possesses. That feature vector is frequently stored in a database (or recorded on a smart card given to the individual) after being extracted. A biometric system based on physiological characteristics is normally more reliable than one which adopts behavioral characteristics, even if the last may be easier to integrate within certain specific application. Biometric system can than run in two modes: verification or identification. While recognition involves comparing the acquired biometric information against templates corresponding to all users in the database, verification involves comparison with only those templates corresponding to the claimed identity. This implies that identification and verification are two different concepts [7].

2. Survey of Animal Identification:

Machine learning enables computers to the user to solve the task. Supervised learning of State-of-the-art methods by showing them correct pairs of inputs and outputs [8].

Various authors have been many attempts to automatically identify animals in camera-trap images; however, many relied on hand-designed features [9] to detect animals, or were applied to small datasets.

Most related works are camera-based studies of wildlife that use image analysis to identify individual animals of select species with unique coat patterns (e.g., spots or stripes). Bolger et al. [10] applied software to help identify individual animals based on coat patterns for subsequent photographic mark-recapture analysis. The data they used was image based, which is a cost-effective, non-invasive way to study population. The method they used was the SIFT key points extraction and matching. Thus, they only focused on individual animal identification for these strongly marked texture species Identifying class from remote camera images remains a major challenge that has not been addressed. In the community of computer vision, there exist a lot of methods to recognize general object. One of the most successful ones is Yang's work [11], in which ScSPM is applied. Spatial pyramid matching (SPM) with max pooling [12] can not only model the spatial layout of local image features, but also achieve translation invariance of animal body. As being easy and simple to construct, the SPM kernel turns out to be highly effective in practice [13]

Individual animal identification allows producers to keep records on an animal's parentage, birth date, production records, health history, and a host of other important management information. Accurate records provide the producer with enough information to make individual or whole herd/flock management decisions. In many instances, the producer needs to be able to quickly identify an animal. A successful identification system makes this task more efficient. There are many identification systems, but selection should be based on the method that best fits an operation's needs. Factors such as size of the operation, type of records kept, and source of replacement breeding stock, determines which system(s) to choose. When selecting forms of identification, consider the application methods for each type, along with visibility from a distance, equipment needed for application, cost, permanence, and how easy or difficult the method is to apply. Two different methods should be used to assure permanent identification. Once a system has been selected, it is important to be consistent with providing each animal a unique and permanent identification number that matches with each method used [14].

An image of animal is captured from the camera so there are chances that the image is corrupted due to various kinds of noises such as creases, smudges and holes. It is almost impossible to recover the true ridge/valley structures from the unrecoverable regions; any effort to improve the quality of the image in these regions may be futile. Therefore, any well known enhancement algorithm may be used to improve the clarity of images in recoverable regions and to mask out the unrecoverable regions [15]. The image can be enhanced with the help of image Binarization.

The enhancement process, which combine filters and noise reduction techniques for pre and post processing. We use histogram equalization for contrast expansion and DFT for linear filtering which found in many applications such as quantum mechanics, noise reduction and image reconstruction. This is followed by the image Binarization process. Thinning is then carried on the Biometric image.

3. Animal Image Preprocessing :

a. Data collection:

For the data collection the images of Tiger are collected from the Google. Near about 50 images taken for performing the various operations. The down load image Database is as follows [16].

Figure 1: Data Collection

b. Image cropping and Normalisation:

The collected images of the dataset of iris are cropped and the images are preprocessed and normalized.

Normalization is the process of converting a random sized image into a standard size. To bring all characters into a common size platform in order to extract features on the same footing, a minimum bounding box is fitted to the character and the element is cropped and then resized to fit into 32x64 windows. In, the cropped element is normalized to a size of 36x36 pixels without disturbing the aspect ratio using bilinear standard transformation. There is another method for resampling which is based on equi arc length.

In image processing, normalization is a process that changes the range of pixel intensity values. Applications include photographs with poor contrast due to glare, for example. Normalization is sometimes called contrast stretching or histogram stretching. In more general fields of data processing, such as digital signal processing, it is referred to as dynamic range expansion. The purpose of dynamic range expansion in the various applications is usually to bring the image, or other type of signal, into a range that is more familiar or normal to the senses, hence the term normalization. Often, the motivation is to achieve consistency in dynamic range for a set of data, signals, or images.

Normalization is one of the most important steps of image pre-processing techniques. Experimental Database has been acquired on a restricted size grid, Normalization includes basic techniques like, scaling, translation, and rotation etc, is used to avoid scaling and rotational problems.

Figure 2: Data Collection

c. Converting the image into Gray:

The input of the enhancement algorithm is a gray-scale image. The output of original image is converted to gray scale. Convert an RGB image or colormap to grayscale rgb2gray converts RGB values to gray scale values by forming a weighted sum of the R, G, and B components

$$0.2989 * R + 0.5870 * G + 0.1140 * B$$

These are the same weights used by the rgb2ntsc function to compute the Y component. The coefficients used to calculate gray scale values in rgb2gray are identical

$$0.299 * R + 0.587 * G + 0.114 * B$$

Image enhancement is used to make image clear for better use which is very easy to handle and can operate easily for further operation. Basically image is full of noise. The Image enhancement step is basically designed to reduce this noise and to enhance the definition of ridges against valleys[26]. There is various Image enhancement techniques.

Image enhancement techniques have been widely used in many applications of image processing where the subjective quality of images is important for human interpretation. Contrast is an important factor in any subjective evaluation of image quality.

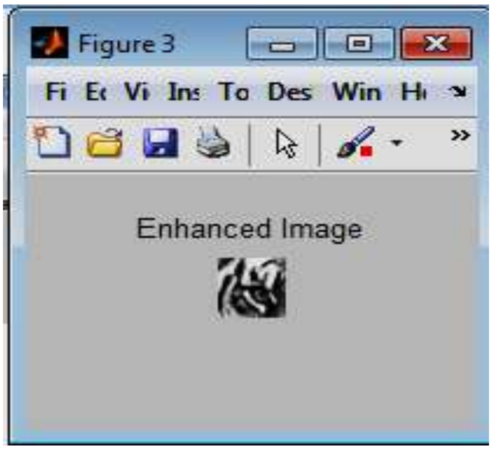

Figure 3 : Enhanced Image

d. Image segmentation:
Segmentation divides the image in to its constituent regions or objects. Segmentation stops when the object or region of interest in an application has been detected. In image analysis if some part of the object anomalies, such as missing component is their then segmentation required to identify those elements. In an image there are foreground regions and the background regions. The foreground regions have a high variance value while the background regions have low values. Segmentation separates the foreground regions from the background image for reliable extraction of minutiae. The image is divided into blocks. For each block the gray scale variance is calculated. If the value is lower than the global threshold it is assigned to the background else it is assigned to the foreground [26].

e. Edge Detection Techniques:
The edge representation of an image significantly reduces the quantity of data to be processed, yet it retains essential information regarding the shapes of objects in the scene. This explanation of an image is easy to incorporate into a large amount of object recognition algorithms used in computer vision along with other image processing applications. The major property of the edge detection technique is its ability to extract the exact edge line with good orientation as well as more literature about edge detection has been available in the past three decades. On the other hand, there is not yet any common performance directory to judge the performance of the edge detection techniques. The performance of an edge detection techniques are always judged personally and separately dependent to its application. Edge detection is a fundamental tool for image segmentation. Edge detection methods transform original images into edge images benefits from the changes of grey tones in the image. In image processing especially in computer vision, the edge detection treats the localization of important variations of a gray level image and the detection of the physical and geometrical properties of objects of the scene. It is a fundamental process detects and outlines of an object and boundaries among objects and the background in the image. Edge detection is the most familiar approach for detecting significant discontinuities in intensity values.

5.1 Roberts Edge Detection:
The Roberts edge detection is introduced by Lawrence Roberts (1965). It performs a simple, quick to compute, 2-D spatial gradient measurement on an image. This method emphasizes regions of high spatial frequency which often correspond to edges. The input to the operator is a grayscale image the same as to the output is the most common usage for this technique. Pixel values in every point in the output represent the estimated complete magnitude of the spatial gradient of the input image at that point.

5.2 Sobel Edge Detection:
The Sobel edge detection method is introduced by Sobel in 1970 (Rafael C.Gonzalez (2004)). The Sobel method of edge detection for image segmentation finds edges using the Sobel approximation to the derivative. It precedes the edges at those points where the gradient is highest. The Sobel technique performs a 2-D spatial gradient quantity on an image and so highlights regions of high spatial frequency that correspond to edges. In general it is used to find the estimated absolute gradient magnitude at each point in n input grayscale image. In conjecture at least the operator consists of a pair of 3x3 complication kernels as given away in under table.

5.3 Prewitt Edge Detection: The Prewitt edge detection is proposed by Prewitt in 1970 (Rafael C.Gonzalez [27]). To estimate the magnitude and orientation of an edge Prewitt is a correct way. Even though different gradient edge detection wants a quite time consuming calculation to estimate the direction from the magnitudes in the x and y-directions, the compass edge detection obtains the direction directly from the kernel with the highest response.

5.4 Kirsch Edge detection:

Kirsch edge detection is introduced by Kirsch (1971). The masks of this Kirsch technique are defined by considering a single mask and rotating it to eight main compass directions: North, Northwest, West, Southwest, South, Southeast, East and Northeast. The masks are distinct.

5.5 Canny Edge Detection:

In industry, the Canny edge detection technique is one of the standard edge detection techniques. It was first created by John Canny for his Master's thesis at MIT in 1983, and still outperforms many of the newer algorithms that have been developed. To find edges by separating noise from the image before find edges of image the Canny is a very important method. Canny method is a better method without disturbing the features of the edges in the image afterwards it applying the tendency to find the edges and the serious value for threshold. The algorithmic steps are as follows:

- Convolve image f(r, c) with a Gaussian function to get smooth image f^(r, c). f^(r, c) = f(r,c)*G(r,c,6)
- Apply first difference gradient operator to compute edge strength then edge magnitude and direction are obtain as before.
- Apply non-maximal or critical suppression to the gradient magnitude.
- Apply threshold to the non-maximal suppression image. Unlike Roberts and Sobel, the Canny operation is not very susceptible to noise. If the Canny detector worked well it would be superior.

For our experiment we used Canny Edge Detection technique.

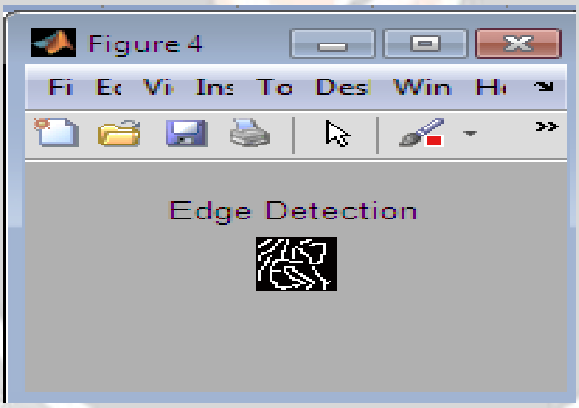

Figure 4 : Canny Edge detection technique

6. Conclusion:

For the edge detection I applied various edge detection methods like Prewitt edge detection, Canny Edge detection methods. Out of which Canny Edge detection technique gives the better result for our database. In future I will study for the pattern recognition method for the matching and the recognition.

References:

1) R. Clark, "Human Identification in Information Systems: Management Challenges and Public Policy Issues", Journal of Information Technology and People, vol.7, no.4, pp. 6-37, 1994.
2) M. Deriche, "Trends and Challenges in Mono and Multi Biometrics", in Proc. Of Image Processing Theory, Tools and Application (IPTA), Sousse, pp.1-9, 23-26 Nov 2008.
3) A. Mishra, "Multimodal Biometrics it is: Need for Future System, International Journal of Computer Application", vol. 3, no. 4, pp. 28-33, June 2010.
4) M. S. Ahuja and S. Chabbra, "A Survey of Multimodal Biometrics", International Journal of Computer Science and its Applications, pp. 157-160.

5) Arun Ross, Karthik Nandkumar, Anil K. Jain, "Handbook of multibiometric", Springer 2006.
6) Neena Godbole, "Information Security System", Wiley Publication.
7) Khattab M. Ali Alheeti, "Biometric Iris Recognition Based on Hybrid Technique", International Journal on Soft Computing (IJSC) Vol.2, No.4, November 2011.
8) Mohri M, Rostamizadeh A, Talwalkar A (2012) "Foundations of machine learning". (MIT press).
9) Swinnen KRR, Reijniers J, Breno M, Leirs H (2014) "A novel method to reduce time investment when processing videos from camera trap studies." PLOS ONE 9(6):1–7.
10) B. Bolger, DT Morrison, TA Vance, D Lee, H Farid, "A computer-assisted system for photographic mark–recapture analysis." Methods Ecol. Evol. 3(5), 813–822 (2012).
11) J. Yang, K Yu, Y Gong, T Huang, Linear spatial pyramid matching using sparse coding for image classification, in IEEE Conference on Computer Vision and Pattern Recognition, (Miami, 20-25 June 2009), pp. 1794–1801
12) T. Serre, L. Wolf, T. Poggio, Object recognition with features inspired by visual cortex, in 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, vol. 2, (San Diego, CA, 20-26 June 2005), pp. 994–1000
13) S. Lazebnik, C. Schmid, J. Ponce, Beyond bags of features: spatial pyramid matching for recognizing natural scene categories, in 2006 IEEE Computer Society Conference on Computer Vision and Pattern Recognition,vol.2, (New York, 17-22 June 2006), pp. 2169–2178
14) Michael Neary, Extension Animal Scientist Ann Yager, Animal Sciences Student, "Methods of Livestock Identification", Purdue University Department of Animal Sciences
15) Raymond Thai, Fingerprint Image Enhancement and Minutiae Extraction, Technical Report, the University of Western Australia, 2003.
16) https://www.google.com/?q=tiger+images+hd&tbm=isch& source=univ& sa=X& ved=2ahUKEwj Ap4jnpv _hAhUKgI8KHSZ1DtwQsAR6BAgHEAE&cshid=1556884667367794&biw=1366&bih=657 (Tiger image link)