

GAIT RECOGNITION FOR SECURITY AND SURVEILLANCE APPLICATIONS

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ABSTRACT: - The quick evolution of technology and infrastructure has made our lives easier. The dawn of technology has also enlarged the traffic threats and road accidents happen regularly which roots to an outsized loss of life and property thanks to the poor emergency facilities. Our project will provide the best solution to the present problem. consistent with this project when a vehicle encounters an accident or if a car rolls over instantly Vibration sensor will sense the signal and sends it to the RASPBERRY PI controller. Alcohol detection is performed by the RASPBERRY PI Microcontroller and it alerts mail through the IoT including the situation to the police room or a rescue team. So, the police can immediately after confirming the situation can take the required action. This paper is beneficial in detecting the accident precisely through both vibration sensors and MEMS sensors. As there's room for enhancement and as future employment, we will add a wireless webcam for capturing the pictures which can help in providing driver's assistance. We present a camera-based sign reader to assist the driving force to read the names of the signboard on the roads. The camera acts because the main vision in detecting the label image of the sign or board then the image is processed internally and separates the label from the image by using the open CV-library and eventually identifies the merchandise. This identified product name is pronounced through voice.

Key Words: Raspberry Pi, Open CV, IoT, Gait and logistic regression machine learning algorithm

1. GAIT RECOGNITION

Gait recognition is that the tactic of identifying the walking pattern, through which an individual is detected. This pattern uses machine learning techniques to mitigate the natural variations in gait among different Subjects. the foremost goal of gait recognition is to spot people by the way they walk.

This biometric approach is taken into account as non-invasive, since it's performed at a distance, and is that the contrast as compared to other methods like iris or finger print-based approaches. during this method, the primary step involved is silhouette extraction. The second step involves the feature extraction from each frame using

image Processing methods. The features include the middle of mass, step size length, and cycle length.

And for testing purposes, the logistic regression algorithm is employed for identification. Individual recognition is critical to spot people. There are many biometric methods to spot the individual There are many physiological methods like fingerprints, face recognition, iris scans, and hand scans and behavioral, like keystroke-scan and speech patterns.

Gait could even be a replacement biometric method that identifies humans at a distance. Gait recognition researches are still within the tactic which gained more interest and is becoming more popular. Gait recognition could even be a challenging task because the walking pattern of an individual may vary when a person got the injury in his leg and also due to other factors like clothing, footwear and when carrying heavy loads. Many questions have risen against the study of gait recognition.

All biometrics have different covariates and complications. Compared to other biometrics gait recognition has advantages. There are many proposed methods like velocity movements, discrete symmetric operator, analysis of subject trajectory; kinematics and dynamics were used. Gait biometrics is employed in surveillance scenarios since it's often captured from a distance whereas other biometric methods can't be used. Moreover, gait has non- invasiveness property and thus the person needn't cooperate with any hardware devices. during this paper center of mass from each frame is employed as a feature vector for the popularity of gait.

Technology has invaded our lives as never before, and thus the effectiveness of current security systems has become increasingly important. the event of automatic personal identification systems has increased in recent years, and worldwide effort has been dedicated to broaden and enhance personal identification systems. especially, biometric recognition has become an area of particular interest and is used in numerous applications.

Biometric recognition aims to identify individuals using unique, reliable and stable physiological and or behavioral characteristics sort of a fingerprint, palm print,

face, and gait. Gait recognition deals with the discrimination of individuals by the mode or manner they walk. Gait as a biometric trait is usually seen as advantageous over other forms of biometric authentication techniques for subsequent reasons:

- The gait of a person walking is often mined and examined from remoteness with none reference to the sensor.
- The images utilized within the recognition of gait are often.

effortlessly provided by low-resolution, video-surveillance cameras. Gait recognition techniques are often categorized into two methods: model-based and model-free approaches. A model-based approach models the person's structure and uses the estimation over time of static body parameters for the popularity task (i.e., trajectory, limb lengths, etc.). This process is typically computationally intensive since one must model and track the subject's body.

The major challenges of methods belonging to the model-free gait recognition are thanks to the effect of various covariates, which are the results of the presence of shadows, clothing variations and carrying conditions (backpack, briefcase, handbag, etc.). From a technical point of view, the segmentation process and viewing dependency are further causes of gait recognition errors. This has motivated the work presented during this paper, which aims to mitigate the effect of the covariates and hence to strengthen the popularity performance. Within this work, we introduce a wrapper feature selection algorithm combined with a modified phase-only correlation (MPOC) matching method. It's an improved version of the phase-only correlation (POC) matching algorithm employing a band-pass-type spectral weighting function to know superior performances.

According to the initial medical and physiological studies, the gait of private consists of 24 different components, which shows that the gait pattern is exclusive for people. However, the numerous factors which may disturb the popularity performance may exist. Do these include the surface of the walk, quite a shoe, clothing, carrying condition, medical condition, emotions, etc. the because of addressing these problems is an acute challenge? There are two main parameters in gait recognition, namely appearance-based and model-based gait recognition. The previous emphases on statistical analysis over the looks of the gait video frames, whereas the latter is on assessing physical body structure parameters.

2. PREVIOUS WORK

The automation of Surveillance systems becomes a requirement to avoid human faults and an effectual strategy for tackling crimes and averts further terrorist attacks. The mixing of biometric technologies into the closed-circuit television may be a major milestone to enhance the automation process to trace the criminals. The walking pattern of a private is often captured and perceived from a distance even with poor resolution video in contrast to other biometric modalities during which their performance deteriorates in surveillance scenarios. The security and security of citizens of the country are considered because

the most needed requirement which has got to be ensured and guaranteed against the drastic increase in uncountable crimes and surprise attack rates. The closed-circuit television works supported mounting cameras at remote location order to transmit video streams which are stored and monitored at real-time. Since Han proposed the gait energy image as a replacement spatial-temporal gait representation, an outsized number of improved approaches have emerged. Lain[3] present a unique approach to extract gait features supported gait energy image, and P Theekhanont [4] uses gait energy image transformed to a trace transform image for human identification S Sivapalan [5] demonstrate the applicability of compressed sensing within the field of gait recognition as an effective dimensionality reduction technique. And Xue applies PCA and LDA to extract the most vector of the gait feature of GEI.

In this paper, the Gabor magnitude of GEI and an innovative reduced dimensions method is proposed to pick distinctive features. For biometrics to be ultra-secure and to supply quite an average accuracy quite one sort of biometrics requires. Hence the need arises for the usage of multimodal biometrics. This uses a mixture of various biometrics recognition technologies. Multimodal biometrics expertise uses quite one biometric identifier to associate the individuality of the person.

Two basic feature extraction techniques are classified as select individual features and characterization of the geometrical relationship. A holistic method like principal component, linear discriminate analysis and independent component analysis used appearance information extracted from the whole image. Holistic feature extraction approaches find features with minimized dimensionality by projecting the first data onto the idea vectors. These extracted features can improve classification performance by reducing irrelevant features from the data set. Collection of important features and eliminating irrelevant features play a big role within the recognition and computation process.

In the former work, many techniques are projected for explaining gait analysis. Which include scrutiny of subject trajectory, velocity movements, and discrete symmetric operator, continuous HMM and a couple of other approaches supported kinematics and dynamics model Han and Bhanu [3] use gait energy image for gait analysis. They used a statistical feature extraction approach for learning active feature and have fusion strategy is employed to advance the popularity.

In [4], Eigen space transformation supported Principal Component Analysis (PCA) is applied to scale back the dimensionality of the input feature space. Then supervised pattern classification techniques are finally performed within the lower-dimensional Eigen space for recognition. Su and Zanga use the fuzzy principal component for recognition.

3. PROPOSED METHODOLOGY

3.1 SEGMENTATION

3.1.1 Edge Based Segmentation Method

The edge detection techniques are well-developed techniques of image processing on their own. The edge-based segmentation approaches are supported by the fast iteration of intensity value in a picture because one intensity value doesn't offer good info about edges.

Edge detection methods trace the sides where either the primary derivative of intensity is bigger than a selected threshold or the second derivative has zero crossings. In edge-based segmentation methods, first of all, the sides are detected then are connected to make the thing boundaries to segment the specified regions. The elementary two edge-based segmentation methods are Gray histograms and Gradient-based methods. to identify the sides one among the first edge detection methods like Sobel operator, canny operator, and Robert's operator, etc are often made use of. the result of those methods is fundamentally a binary image. These are the structural techniques supported by discontinuity detection.

3.1.2 Region-Based Segmentation Method

The region-based segmentation methods are the approaches that segment the image into numerous regions having comparable characteristics. There are two basic techniques supported this method.

3.1.3 Region growing methods:

The region growing based segmentation methods are the methods that segment the image into various regions supported the growing of seeds (initial pixels). These seeds are often selected manually (based on prior knowledge) or automatically (based on the actual application). Then the expansion of seeds is controlled by connectivity between pixels and with the assistance of the prior knowledge of the matter, this will be stopped. The basic algorithm (based on 8-connectivity) steps for region growing method are:

- It is the original image that is to be segmented and is that the binary image where the seeds are located. Let $T(x, y)$ be any predicate that is to be tested for each location. First of all, all the connected components of, s'' are eroded.

- Compute a binary image $P T$. Where $P T(x, y) = 1$, if $T(x, y) = \text{True}$.
- Compute a binary image, q'' , where

$q(x, y) = 1$, if $P T(x, y) = 1$ and (x, y) is 8-connected to seed in s'' .

3.2 EROSION:

Erosion is one among the 2 elementary operators within the area of mathematical morphology, the opposite is dilation. It is naturally applied to binary images, but

some forms work on grayscale images. The basic outcome of the operator on a binary image is to wear away the borders of regions of foreground pixels (i.e. white pixels, typically). Thus areas of foreground pixels shrink in size, and holes inside those areas become bigger.

3.3 DILATION

The most basic morphological processes are dilation and erosion. Dilation improves pixels to the boundaries of objects in an image, while erosion eliminates pixels on object boundaries. The number of pixels added or far away from the objects in a picture depend on the dimensions and shape of the structuring element wont to develop the image. In the morphological dilation and erosion operations, the state of any given pixel within the output image is provided by implementing a rule to the corresponding pixel and its neighbors in the input image. The rule used to process the pixels defines the operation as dilation or an erosion.

3.4 SILHOUETTE

The feature for gait analysis is often obtained from GEI (GAIT ENERGY IMAGE). The silhouette is made by

- Converting videos into images then

color images (RGB) images into grayscale images.

- To obtain an approximate background from the image the sequence of a walking people, the primary mean image is computed by averaging the gray-level at each pixel over the whole image sequence (in Fig.1 (b)). Let $I_k(x, y)$, $k=1, 2, \dots, N$, represent the sequence of N images. Background images $b(x, y)$ are often computed by: $b(x, y) = \text{median}(I_k(x, y))$, $k=1, 2, \dots, N$

- The moving object is extracted by background subtraction.
- Image processing actions like Erosion, dilation are functional to enhance the excellence of extracted silhouette, and reduce noise.

3.5 FEATURE EXTRACTION:

The feature is defined as a function of 1 or more quality of objects that are capable to differentiate an object from one another. Our gait image feature vector is contained with the parameters of moment features in image regions covering the walking person. Gait feature extraction is a very significant task in recognition of the human gait. It must be reasonably robust to the varying conditions and will be capable of describing the standard of people. Spontaneously, the silhouette appears to be a good feature to exploit since it captures the motion of most of the parts of the body and also encodes structural as well as transitional information. Particularly, it is independent of the clothing, illumination, and textures, etc.

Since now we have a database in silhouette form, silhouette display maximum of the body part so we can extract feature from this silhouette. Two elementary feature extraction techniques are classified as feature-based and holistic methods. The feature-based method chooses individual features and classification of geometrical relationships. Holistic methods such as principal component, linear discriminate analysis and independent component analysis used appearance information extracted from the entire image. Holistic feature extraction approaches find features with minimized dimensionality by projecting and original data onto the basis vectors. These extracted features can improve classification performance by reducing irrelevant features from the info set. An assortment of vital features and removing irrelevant features play an important role in the recognition and computation process. The feature vector is a way to represent a part of an image by measuring a set of features. Image is represented in 2d matrix, the individual pixel is $B(i, j)$ = the brightness of the image at the purpose (i, j) .

At the time of walking, the human body center of mass change from instance to instance so we are using the center of mass as a feature this center of mass show the brighter weighted average of x and y coordinates pixels within the frame. The Center of the mass of the white pixel's area for binary images is that the same because the center of mass if we consider the intensity to some extent because of the mass of that time. In a binary image, we can compute the center of mass coordinate by using the following formula

$$\bar{x} = \frac{\sum_{i=0}^n \sum_{j=0}^m j * B(i, j)}{A}$$

$$\bar{y} = \frac{\sum_{i=0}^n \sum_{j=0}^m i * B(i, j)}{A}$$

4. RESULTS AND DISCUSSIONS



FIG 1: grayscale image



FIG 2: gradient image



FIG 3: dilated image



FIG 4: dilated gradient mask



FIG 5: binary gradient mask



FIG 6: binary image

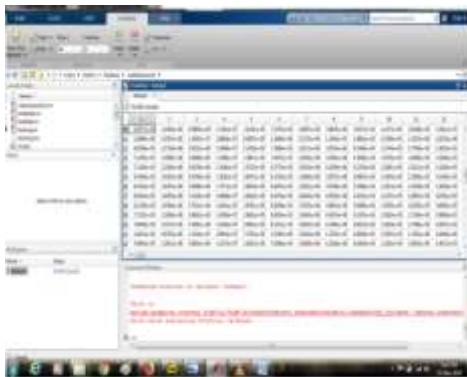


FIG 7: centroid value of the full database

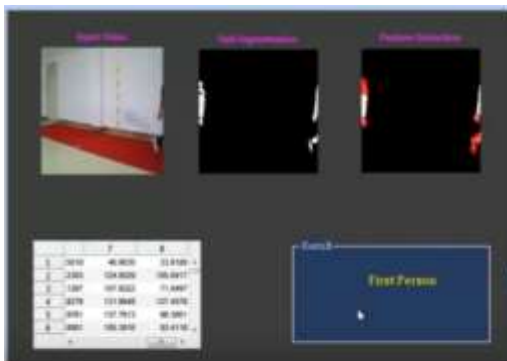


FIG 8: Gait pattern of the particular person is identified.

5. CONCLUSION

The human motion analysis method using gait and logistic regression machine learning algorithms to extract its features. Human motion analysis is necessary for various areas of computer science such as biometrics and computer graphics. Also, human motion in security monitoring to detect potentially harmful and suspicious behaviors can be used. Moreover, a human motion has several advantages in the general classification. Gait biometric as a pattern recognition system might be an advantageous method within the use over the normal

biometric systems because it is taken into account unobtrusive and may be measured in a way that does not require a person to present any more information that is already available to a casual observer, and studies have suggested it is very difficult to imitate. However, terrain, fatigue, and injury that might influence the precision of gait recognition. Viewpoint (view angle of the camera) might also affect gait recognition performance. The most recent aim is to use the Convolutional neural network, which is at the heart of deep learning in computer vision, in the gait identification problem. Also, the combination of more than one biometrics (multimodal biometrics) such as gait, face and foot pressure which could be one of the future intentions.

REFERENCES

- [1] Y. Huang, D. Xu, and T. Cham, "Face and Human Gait Recognition Using Image-to-Class Distance," *IEEE Transactions on Circuits and Systems for Video Technology*, vol.20, no.3, pp.431-438, March 2010.
- [2] Han J, Bhanu B. B.: Individual recognition using gait energy image[J]. *IEEE Transactions on Pattern Analysis & Machine Intelligence*, 2006, 28(2):316-322.
- [3] Liang S C, Zhou M, An-An L I. GEI based gait recognition by using KPCA and SVM [J]. *Application Research of Computers*, 2010, 27(7):2798-2800.
- [4] Theekhanont P, Miguet S, Kurutach W. Gait recognition using GEI and pattern trace transform[C]// *International Symposium on Information Technology in Medicine and Education*. IEEE, 2012:936-940.
- [5] Sivapalan S, Rana R K, Chen D, et al. Compressive Sensing for Gait Recognition[C]// *International Conference on Digital Image Computing: Techniques and Applications*. IEEE Computer Society, 2011:567-571.
- [6] Xue H, Hao Z. Gait recognition based on gait energy image and linear discriminant analysis[C]// *IEEE International Conference on Signal Processing, Communications and Computing*. IEEE, 2015.
- [7] J. Han, and B. Bhanu, "Individual recognition using gait energy Image," *IEEE Transactions on Pattern Analysis and Machine*
- [8] H. Sadeghi, P. Allard, F. Prince, and H. Labelle, "Symmetry and limb dominance in able-bodied gait: a review," *Gait & Posture*, vol. 12, no. 1, pp. 34-45, 2000.
- [9] Z. Liu, and S. Sarkar, "Improved gait recognition by gait dynamics normalization," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol.28, no.6, pp.863-876, June 2006.

[10] J. Yang, D. Zhang, A.F. Frangi, and J. Yang, "Two-dimensional PCA: a new approach to appearance-based face representation and Recognition," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol.26, no.1, pp.131-137, Jan 2004.

[11] N.V.Chawla, and K.W. Bowyer, "Random subspaces and subsampling for 2D face recognition," *IEEE Computer Society Conference on Computer Vision and Pattern Recognition(CVPR)*, vol.2, pp. 582- 589, June 2005.

[12] X. Wang, and X. Tang, "Random sampling LDA for face recognition," *IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR)*, vol.2, pp. 259-265, July 2004.

[13] Z. Liu, and S. Sarkar, "Simplest representation yet for gait recognition: averaged silhouette," *International Conference on Pattern Recognition (ICPR)*, vol.4, pp. 211-214, Aug 2004.

[14] D. Gafurov, E. Sneekenes, and P. Bours, "Improved gait recognition performance using cycle matching," in *Proceedings of 2010 IEEE 24th International Conference on Advanced Information Networking and Applications Workshops (WAINA)*, Perth, WA, pp. 836-841, 2010.

[15] L. Rong, D. Zhiguo, Z. Jianzhong, and L. Ming, "Identification of individual walking patterns using gait acceleration," in *Proceedings of the 1st International Conference on Bioinformatics and Biomedical Engineering (ICBBE2007)*, Wuhan, China, pp. 543-546, 2007.