Certain investigation on feature extraction in dorsal hand vein image

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Abstract. Biometrics refers to people being known by their fingerprints or attributes. This research takes into account veins on the back of the hand called the dorsal vein. The primary target of this work is to build up an individual acknowledgment framework dependent available dorsal vein design with high acknowledgment rate. Attributes such as LBP (Local Binary Pattern), HOG (Histogram of Oriented Gradients) and WLD (Weber Local Descriptor) are extracted and the technique of Chi-square, Cityblock, Euclidean and Minikowski is used for recognition speeds. The quality assessment is conducted in terms of accuracy of category. Hand vein biometrics offer higher security, simple to get the hand vein picture and extremely difficult to fashion the information contrasted with progressively settled biometric check techniques.

1. Introduction
1.1 Image
An image is a square pixel (picture components) cluster or lattice masterminded in segments and columns [1]. A picture can be portrayed as a two-dimensional flag that contains force and shading data sorted out along a x and y spatial hub [2].

1.2 Digital image processing
Computerized picture preparing incorporates forms whose data sources and yields are picturesand envelops forms that remove characteristics from pictures and furthermore incorporates the acknowledgment of individual items [3].

1.3 Biometrics
There many methods to authenticate an individual as shown in the Figure 1.1. The simplest form of authentication is to enter a password or PIN (knowledge) [4].

1.3.1 Types of biometrics
Biometrics is the investigation of consequently perceiving people by methods for inalienably one of a kind physical or social attributes. Biometrics has been used mostly in the computer and physical security industry, where robust authentication methods used to control access to physical locations or computer systems were needed [5]. Biometrics to be used as feature for authentication is shown in the Figure 1.
As an issue of first significance, it ought to be across the board, with each individual having the given trademark. Next, there ought to be certain immutability intrinsic to the component, i.e., the purposeful segments should remain commonly steady over a period of time [6].

1.4 Dorsal hand vein
Dorsal hand vein pattern recognition system is a very hygienic contactless device and removes any apprehension between people about coming into contact with something that has already been touched by other people as shown in Figure 2. As near-infrared light is used to acquire the image it is non-harmful to the humans [7].

2. Proposed system
Bio metric plays a vital role in authentication. The system merges with the idea that for authentication purposes the dorsal vein image is used. Here are the algorithms as shown in Figure 3.
2.1 Roi extraction

The highlights of vein designs extricated from a similar district in various dorsal hand vein pictures are thought about for acknowledgment step [8]. The removed locale is known as the area of intrigue (ROI). The procured picture is first changed over to a gray scale picture and after that its ROI separated utilizing default editing capacity from MATLAB [9].

2.2 Local binary pattern

The basic idea for working up the LBP manager was to represent twodimensional surfaces by two proportional measures: adjacent spatial models and separate diminishing scale [10]. LBP provides a strong surface descriptor with an invariant turn, and Figure 4 shows a diagram of the basic LBP head. For each pixel in an image, it differentiates its view and all the adjacent pixel values [12].

![Figure 4. Example of Operator Basic LBP](image)

The LBP administrator can be stretched out to neighborhoods of various sizes. The pixel esteems can be interjected for round communities to allow any sweep and number of pixels in the areas [13].

2.3 Weber local descriptor

Find out that the chief figuring the power contrasts of the current pixel is really Laplacian head for the critical differential excitation element against its neighbours. Since the chairman of Laplacian is prone to uproar, in this procedure substitute with LoG (Laplacian of Gaussian). As a prominent descriptor of the area, LBP was essentially highly equivalent, computationally efficient and invariant to changes in monotonic dim measurement.

2.4 Histogram of oriented gradients

HOG are highlight descriptors used in PC vision and image processing for the end goal of object recognition. The approaches include restricted parts of an image's angle introduction events [14].

![Figure 3. Proposed System of Dorsal Vein Biometric](image)
technique is like edge implementation histograms, scale-invariant feature shift descriptors, and shape settings, but it differs in that it is processed in a thick network of continuously divided neighborhood cells and is used for more precise discernment of neighborhood standardization. HOG descriptors rely on neighborhood objects appearance and shape within a picture that can be represented by the dispersion of inclinations of force or edge directions. The descriptor of the HOG retains a few primary focuses over other methodologies of descriptors.

3. RESULTS AND DISCUSSION

3.1 Histogram of oriented gradients

The dorsal vein identification method using Oriented Gradient Histogram is performed for verification purposes with the K-NN classifier. The obtained result is from MATLAB simulation. Figure 5 shows the characteristic extraction of the Histogram from the dorsal vein illustration. Table 1 displays the chi-square, city block, euclidean and minikowski simulated values.

**Table 1. Tabulation of HOG Left**

| K fold cross validation | Distance Measure | Chi-square | City Block | Euclidean | Minkowski |
|-------------------------|------------------|------------|------------|-----------|-----------|
| K = 1                   | Testing Images   | 204        | 95.5882353| 90.19607843| 85.29411765| 83.33333333 |
| K = 2                   | 204              | 98.0392157| 97.05882353| 93.62745098| 91.66666667 |
| K = 3                   | 204              | 97.0588235| 96.07843137| 94.11764706| 92.15686275 |
| K = 4                   | 204              | 98.0392157| 98.03921569| 97.05882353| 95.58823529 |
| K = 5                   | 204              | 98.0392157| 96.56862745| 92.15686275| 91.66666667 |
| Average Recognition Rate|                 | 97.35294118| 95.58823529| 92.45098039| 90.88235294 |

**Figure 5. Graphs of HOG Left**

The HOG identification rate left for chi-square is 97%, city block is 95%, Euclidean 92% and minikowski 90%. The chi-square includes in the Oriented Gradient Histogram with high recognition values.

With the K-NN classifier, the validation goal is accomplished using the Oriented Gradient Histogram. The rate of identification of chi-square, city block, euclidean and minikowski as shown in Table 2. The graph is drawn for recognition rate as shown in the Figure 6.
Table 2. Tabulation of HOG Right

| K fold cross validation | Testing Images | Chi-square | City Block | Euclidean | Minkowski |
|-------------------------|----------------|------------|------------|-----------|-----------|
| K = 1                   | 204            | 95.0980392 | 92.15686275 | 88.23529412 | 87.25490196 |
| K = 2                   | 204            | 99.0196078 | 97.54901961 | 97.05882353 | 94.11764706 |
| K = 3                   | 204            | 99.5098039 | 99.50980392 | 97.54901961 | 96.56862745 |
| K = 4                   | 204            | 98.5294118 | 98.52941176 | 96.07843137 | 95.58823529 |
| K = 5                   | 204            | 99.5098039 | 98.03921569 | 94.11764706 | 94.11764706 |
| Average Recognition Rate|                | 98.3333333 | 97.15686275 | 94.60784314 | 93.52941176 |

Figure 6. Graph of HOG Right

The recognition rate in HOG right for chi-square is 98%, cityblock is 97%, Euclidean is 94% and minikowski is 93%. The chi-square consists of high recognition rate in Histogram of Oriented Gradient.

3.2 Local binary pattern

The validation objective is achieved with the K-NN classifier using Local Binary Template. Table 3 shows the recognition frequency of local binary pattern chi-square, cityblock, euclidean, and minikowski. The graph is drawn for recognition rate as shown in the Figure 7.

Table 3. Tabulation of LBP Right

| K fold cross validation | Testing Images | Chi-square | City Block | Euclidean | Minkowski |
|-------------------------|----------------|------------|------------|-----------|-----------|
| K = 1                   | 204            | 87.254902  | 83.82352941 | 75.98039216 | 68.62745098 |
| K = 2                   | 204            | 92.1568627 | 91.66666667 | 86.2745098 | 82.35294118 |
| K = 3                   | 204            | 95.5882353 | 93.62745098 | 88.7254902 | 86.76470588 |
| K = 4                   | 204            | 93.1372549 | 94.11764706 | 89.21568627 | 84.80392157 |
| K = 5                   | 204            | 93.1372549 | 91.17647059 | 83.3333333 | 75.98039216 |
| Average Recognition Rate|                | 92.25490196 | 90.88235294 | 84.70588235 | 79.70588235 |
The recognition rate in LBP right for chi-square is 92%, cityblock is 90%, Euclidean is 84%, and minikowski is 79%. The chi-square consist of high recognition rate in Local Binary Pattern.

The validation purpose is performed with the K-NN classifier using the Local Binary Pattern. Table 4 reports the recognition frequency of local binary pattern chi-square, cityblock, euclidean, and minikowski. The graph is drawn for recognition rate as shown in the Figure 8.

**Figure 7.** Graph of LBP Right

**Table 4.** Tabulation of LBP Left

| K fold cross validation | Chi-square | City Block | Euclidean | Minkowski |
|-------------------------|------------|------------|-----------|-----------|
| K = 1                   | 204        | 81.8627451 | 77.45098039 | 65.19607843 | 55.88235294 |
| K = 2                   | 204        | 92.1568627 | 90.19607843 | 85.29411765 | 79.90196078 |
| K = 3                   | 204        | 92.6470588 | 91.17647059 | 84.80392157 | 80.39215686 |
| K = 4                   | 204        | 96.0784314 | 92.64705882 | 87.25490196 | 83.33333333 |
| K = 5                   | 204        | 90.6862745 | 85.29411765 | 79.41176471 | 74.50980392 |
| Average Recognition Rate| 90.6862745 | 87.35294118 | 80.39215686 | 74.80392157 |
The recognition rate in LBP left for chi-square is 90%, cityblock is 87%, Euclidean is 80% and minikowski is 74%. The chi-square consists of Local Binary Pattern's high recognition frequency.

3.3 Weber local descriptor

The validation purpose is performed with the K-NN classifier using Weber Local Descriptor. The chi-square, city-block, euclidean, and weber local descriptor minikowski recognition level as shown in Table 5. The graph is drawn for recognition rate as shown in the Figure 9.

Table 5. Tabulation of WLD Left

| Distance Measure | K fold cross validation | Chi-square | City Block | Euclidean | Minkowski |
|------------------|-------------------------|------------|------------|-----------|-----------|
| K = 1            | 204                     | 54.4117647 | 55.39215668 | 47.54901961 | 41.66666667 |
| K = 2            | 204                     | 65.6862745 | 68.62745098 | 59.3137254 | 52.45098039 |
| K = 3            | 204                     | 70.0980392 | 73.52941176 | 63.7254902 | 56.8627451  |
| K = 4            | 204                     | 61.2745098 | 68.1372549 | 56.37254902 | 51.96078431 |
| K = 5            | 204                     | 63.7254902 | 70.09803922 | 56.37254902 | 51.47058824 |
| Average Recognition Rate | 204 | 63.03921569 | 67.15686275 | 56.66666666 | 50.88235294 |

Figure 8. Graph of LBP Left
The recognition rate in WLD left for chi-square is 63%, cityblock is 67%, Euclidean is 56% and minikowski is 50%. The Cityblock consist of high recognition rate in Weber Local Descriptor.

The validation objective with the K-NN classifier is achieved using Weber Local Descriptor. The recognition level of the local weber descriptor chi-square, city-block, euclidean and minikowski as shown in Table 6. The graph is drawn for recognition rate as shown in the Figure 10.

Table 6. Tabulation of WLD Right

| Distance Measure | Chi-square | City Block | Euclidean | Minkowski |
|------------------|------------|------------|-----------|-----------|
| K fold cross validation | Testing Images | Recognition Rate(%) |          |           |
| K = 1 | 204 | 60.2941176 | 64.21568627 | 55.88235294 | 47.54901961 |
| K = 2 | 204 | 67.1568627 | 68.62745098 | 59.80392157 | 52.94117647 |
| K = 3 | 204 | 69.1176471 | 70.09803922 | 62.25490196 | 57.84313725 |
| K = 4 | 204 | 68.1372549 | 71.56862745 | 62.74509804 | 55.39215686 |
| K = 5 | 204 | 58.8235294 | 63.23529412 | 51.96078431 | 46.07843137 |
| Average Recognition Rate | 64.70588235 | 67.54901961 | 58.52941176 | 51.96078431 |

Figure 9. Graph of WLD Left

Figure 10. Graph of WLD Right
The recognition rate in WLD right for chi-square is 64%, cityblock is 67%, Euclidean is 58% and minikowksi is 51%. The Cityblock consists of Weber Local Descriptor's high recognition level.

4. Conclusion
Dorsal vein is eliminated using local binary pattern (LBP), local weber descriptor(WLD) and K-NN classifier. The MATLAB simulation evaluated the function level fusion for each of its recognition. While the WLD, LBP and HOG are contrasted, in cityblock technique The WLD has a low recognition rate, the LBP has a high recognition level in chi-square technology and the chi-square technology has high recognition rate. The LBP is successful n comparing WLD and HOG and has a high recognition level. The proposed system increases the biometric system's trustworthiness and also enhances the system's overall performance.

5. Future work
The future work will concentrate with the filters on the endowment of the process. The reliability is improved by applying the filters to the proposed work and can make sure and contribute to the output.

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