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"Implementation of Image Contrast Enhancement using Svd, Dwt and Fuzzy Measures"

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ABSTRACT- The performance of the Fingerprint recognition system will be more accurate with respect of enhancement for the fingerprint images. We use Fingerprint image contrast enhancement technique based on the discrete wavelet transform (DWT) and singular value decomposition (SVD) has been proposed. This technique is compared with conventional image equalization techniques such as standard general histogram equalization and local histogram equalization. A significant contrast between ridges and valleys of the best, medium and poor finger image features to extract from finger images and get maximum recognition rate using fuzzy measures. The experimental results show the recognition of superiority of the proposed method to get maximum performance up gradation to the implementation of this approach. In medical image, preserving mean brightness, average informs definition can be regarded as an attempt to determine the boundaries. Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. In this work by using fuzzy technique modified CLUSTER means and estimate the image features like contrast, brightness, peak signal to noise ratio(PSNR),image quality index(IQI) by using MATLABSOFTWARE

Indexed Terms-Discretewavelettransform, SingularValueDecomposition,Imageequalization, Fingerprint image contrast enhancement, fuzzy measures, fuzzy sets

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I. INTRODUCTION

Fingerprint based identification has been one of the most successful biometric techniques used for personal identification. Each individual has unique for finger prints. A fingerprint is the pattern of ridges and valleys and singular point on the finger tip. The performance of finger image improves from its contrast .Contrast enhancement is frequently referred to as one of the most important issues in image processing. To improve the contrast enhancement several techniques are used base of general histogram equalization and local histogram equalization. We have proposed a new method for fingerprint image equalization is based on the SVD of an LL sub band image obtained by DWT. DWT is used to separate the input low contrast finger image into different frequency sub bands, where the LL sub band concentrates the illumination information. Fuzzy set theory provides a new tool to deal with multimodal histograms. It can incorporate human perception and linguistic concepts such as similarity, and has been successfully applied to image thresholding the resultant image will be sharper with good contrast and other varied forms of communication infrastructure complete circuit functionality and transform the mixed components into a regular working.

II. METHODOLOGY:

2.1Discrete wavelet transform:

The transform of a signal is just another form of representing the signal. It does not change the information content present in the signal. The Wavelet Transform provides a time-frequency representation of the signal. It was developed to overcome the short coming of the Short Time Fourier Transform (STFT), which can also be used to analyze non stationary signals. While STFT gives a constant resolution at all frequencies, the Wavelet Transform uses multi-resolution technique by which different frequencies are analyzed with different resolutions.

A wave is an oscillating function of time or space and is periodic. In contrast, wavelets are localized waves. They have their energy concentrated in time or space and are suited to analysis of transient signals. While Fourier

Transform and STFT use waves to analyze signals, the Wavelet Transform uses wavelets of finite energy.

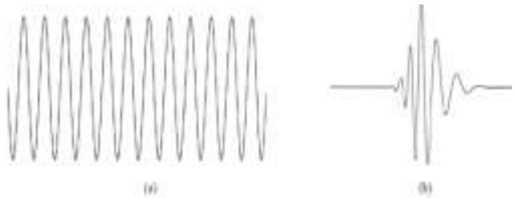


Figure2.1.1: demonstration of a wave and a wavelet

The wavelet analysis is done similar to the STFT analysis. The signal to be analyzed is multiplied with a wavelet function just as it is multiplied with a window function in STFT, and then the transform is computed for each segment generated.

However, unlike STFT, in Wavelet Transform, the width of the wavelet function changes with each spectral component. The Wavelet Transform, at high frequencies, gives good time resolution and poor frequency resolution, while at low frequencies; the Wavelet Transform gives good frequency resolution and poor time resolution.

2.2 Singular value decomposition:
Introduction:

Singular value decomposition (SVD) can be looked at from three mutually compatible
Points of view. On the one hand, we can see it as a method for transforming correlated
Variables into a set of uncorrelated ones that better expose the various relationships
Among the original data items. At the same time, SVD is a method for identifying and
Ordering the dimensions along which data points exhibit the most variation. This tie in
To the third way of viewing SVD, which is that once we have identified where the most
Variation is, it's possible to find the best approximation of the original data points using

Fewer dimensions. Hence, SVD can be seen as a method for data reduction. As an illustration of these ideas, consider the 2-dimensional data points in Figure 1.8. The regression line running through them shows the best approximation of the original data with a 1-dimensional object (a line). It is the best approximation in the sense that it is the line that minimizes the distance between each original point and the line.

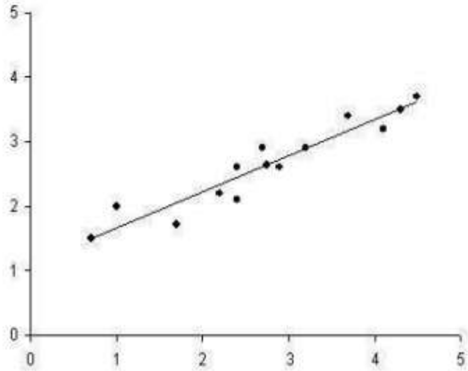


Figure 2.2.1: Best-fit regression line reduces data from two dimensions into one

Perpendicular line from each point to the regression line, and took the intersection of those lines as the approximation of the original data point, we would have a reduced representation of the original data that captures as much of the original variation as possible. Notice that there is a second regression line, perpendicular to the first, shown in Figure 2. This line

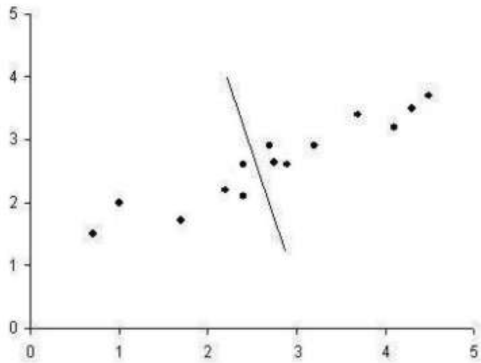


Figure 2.2.2: regression line along second dimensions captures less variation along original data

Captures as much of the variation as possible along the second dimension of the original Data set. It does a poorer job of approximating the original data because it corresponds

To a dimension exhibiting less variation to begin with. It is possible to use these Regression lines to generate a set of uncorrelated data points that will show sub Groupings in the original data not necessarily visible at first glance. These are the basic Ideas behind SVD: taking a high dimensional, highly variable set of data points and reducing it to a lower dimensional space that exposes the substructure of the original data more clearly and orders it from most variation to the least. What makes SVD practical for NLP applications is that you can simply ignore variation below a particular threshold to massively reduce your data but be assured that the main relationships of interest have been preserved.

2.3 Fuzzy set theory:
Introduction:

Fuzzy set theory defines set membership as a possibility distribution. The
General rule for this can expressed as:

F: [0, 1] n [0, 1]

Where n some number of possibilities. This basically states that we can take n possible events and us f to generate as single possible outcome. This extends set membership.Since we could have varying definitions of, say, and hot curries. One person might declare that only curries of Vindaloo strength or above are hot whilst another might say madras and above are hot. We could allow for these variations definition by allowing both possibilities in fuzzy definitions.

Once set membership has been redefined we can develop new logics based on combining of sets etc. and reason effectively. The membership degree can be expressed by a mathematical function that assigns, to each element in the set, a membership degree between 0 and 1. Let be the universe (finite and not empty) of discourse and an element of .The function is used for modeling the membership degrees. This type of function is suitable to represent the set of bright pixels and is defined as

$$\mu_{AS}(x)=S(x;a,b,c)$$
$$=\begin{cases} 0, & x\le a \\ 2\left\{\dfrac{(x-a)}{(c-a)}\right\}^2, & a\le x\le b \\ 1-2\left\{\dfrac{(x-a)}{(c-a)}\right\}^2, & b\le x\le c \\ 1, & x\ge c \end{cases}$$

Where b=(1/2)(a+c) The -function can be controlled through parameters a and c.

Parameter is called the crossover point where the higher the gray level of a pixel (closer to white), the higher membership value and vice versa. A typical shape of the Z-function is presented in Fig. 1. The -function is used to represent the dark pixels and is defined by an expression obtained from -function as follows:

$$\mu_{AZ}(x)=Z(x;a,b,c)=1-S(x;a,b,c).$$

Both membership functions could be seen, simultaneously, in Fig. The -function in the right side of the histogram and the Z-function in the left.

1.7.2 Measure of fuzziness

A reasonable approach to estimate the average ambiguity in fuzzy sets is Measuring its fuzziness. The fuzziness of a crisp set should be zero, as there is no Ambiguity about whether an element belongs to the set or not. Ifthe set

$$\mu_A(x)=0.5,\forall x.$$

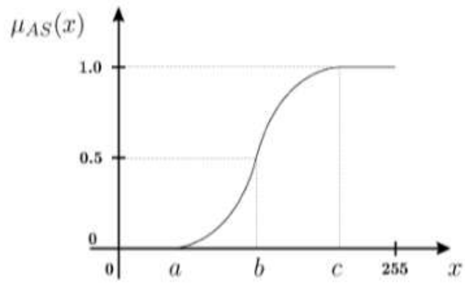


Figure 2.3.1:Typical Shape of the S-function

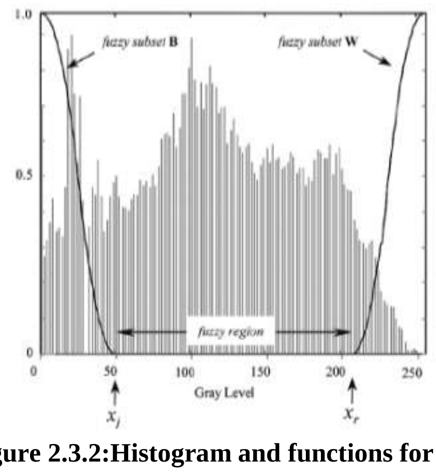


Figure 2.3.2:Histogram and functions for the seed subset

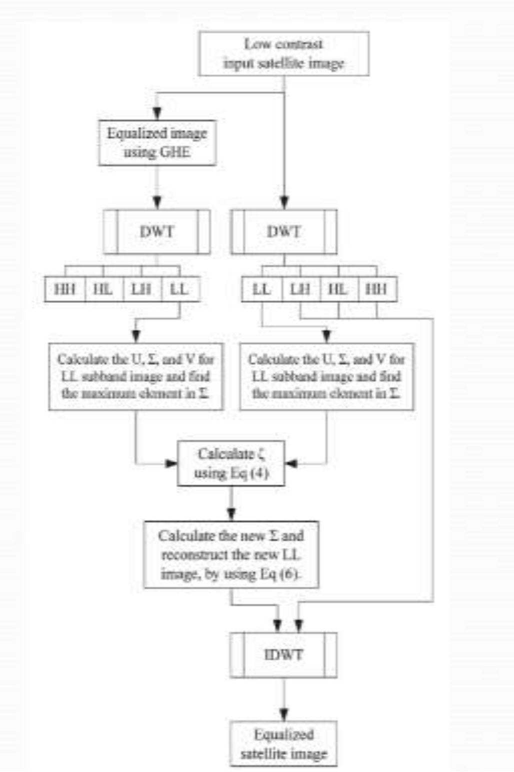
Is maximally ambiguous and its fuzziness should be maximum. Degrees of membership near 0 or 1 indicate lower fuzziness, as the ambiguity decreases. Kaufmann in [20] introduced an index of fuzziness (IF) comparing a fuzzy set with its nearest crisp set. A
Fuzzy set A * is called crisp set of A if the following conditions are satisfied:

$$\mu_{A^*}(x) = \begin{cases} 0, & \text{if } \mu_A(x) < 0.5 \\ 1, & \text{if } \mu_A(x) \geq 0.5. \end{cases}$$

This index is calculated by measuring the normalized distance between A and A defined as:

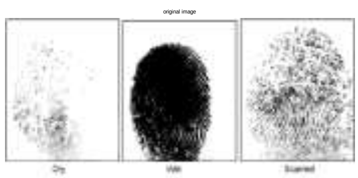
$$\psi_k(A) = \frac{2}{n^{\frac{1}{k}}} \left[\sum_{i=1}^{n} \left| \mu_A(x_i) - \mu_{A^*}(x_i) \right|^k \right]^{\frac{1}{k}}$$

III. DETALIED FLOWCHART:

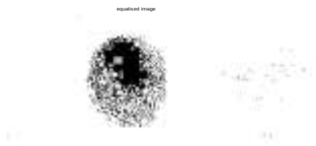


IV. RESULTS :

Original Image



Equalized Image



After applying proposed method

V. ADVANTAGES AND APPLICATIONS

5.1. Advantages:

- Very accurate detection
- It also checks surface and near surface of the cracking position
- Accidents is reduced

5.2. Applications:

- Medical Applications
- Digital Cinema
- Image Transmission and Coding
- Color Processing
- Remote sensing
- Multidimensional Image Processing
- Video processing
- High Resolution Display

VI. CONCLUSION

The above methods are implemented and by comparing the outputs, the performance of the SVD, DWT and Fuzzy Measures method is more accurate contrast enhancement compared to Otsu method. Contrast enhancement techniques are used and implemented in fingerprint image processing and improve the recognition rate using SVD, DWT and Fuzzy Measures to get goodness of result. The different quality finger images are implemented with MATLAB code.

VII. FUTURE SCOPE

The calculation of a, c values in the membership function is difficult. The easy way of calculating those values should be found. The pixel values that are similar should be taken once instead of checking them each and every time. By changing the values of a and c we get different quality images. This method can be applied to normal images and it can be extended in recognizing the finger print images of criminals

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