International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 35 • 2017

Discrete Cosine Transform with LBP based New Fusion of SVT for Face Recognition

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Abstract: In this article, we want the merger of the two organizations based face recognition algorithms: two local regulations and the DCT domain and Singular Value Decomposition (SVD) is characterized by simple and effective. Efficient ORL show the experimental results used show that the proposed strategy is to test the true face cream on the process.

Keywords: Discrete cosine transform, LBP, Face Recognition, SVD.

1. INTRODUCTION

Face Detection used in recent years in the area active research is the need for security and the ability to trade and law enforcement. The facial recognition system, but to show significant practical results, the face detection is difficult because of changes in face images.

In general, it characterized by extraction and classification into two fundamental characteristics of a facial recognition system. Better recognition, it is necessary to contribute to such efforts. Extraction of characteristics is used for the image size to more than image planning options linear or non-linear represented in the best possible all over the world. However, there are problems such as the status of lightning, fire, people, aging and changes in extraction. So, how to solve the problem and change the face recognition system? It will be a challenge if we are only to solve the problem with the optical image.

Description of this article Melting main SVD [8, 9] and DCT LBP [1]. SVD-based systems, our approach is the right singular vector and right that a certain rate of better recognition of the SVD-system shows a vector drawing. LBP LBP DCT use force to reduce delays. The paper is organized as follows. Assessment provides the detection of SVD and DCT against LBP in chapter 2. Chapter 3 of the integration of the proposed system. The simulation results are shown in chapter 4, in the end, the request under Article 5.

2. A SVD AND LBP SERIES

2.1. Cosine Only

DCT's imaging and video compression technology, which converts the frequency signal reflects local screen. Next 2D DCT [10] The *x* model block N is defined as eqn 1 and the inverse transform fu.

$$C(u,v)=\alpha(u)\alpha(v)\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}f(x,y)\times\cos\left[\frac{\pi(2x+1)u}{2M}\right]\cos\left[\frac{\pi(2y+1)v}{2N}\right] \quad (1)$$

and the inverse transform eqn is

$$f(x,y)=\sum_{u=0}^{M-1}\sum_{v=0}^{N-1}\alpha(u)\alpha(v)C(u,v)\times\cos\left[\frac{\pi(2x+1)u}{2M}\right]\cos\left[\frac{\pi(2y+1)v}{2N}\right] \quad (2)$$

whereas

$$\alpha(u)=\begin{cases}\sqrt{\frac{1}{M}}, & \text{if } u=0\\ \sqrt{\frac{2}{M}}, & \text{if } 1\le u\le M-1\end{cases}$$

$$\alpha(v)=\begin{cases}\sqrt{\frac{1}{N}}, & \text{if } v=0\\ \sqrt{\frac{2}{N}}, & \text{if } 1\le v\le N-1\end{cases}$$

and X and Y are the spatial coordinates of the image block, and U and V pixels in the block of DCT coefficients. Figure 1 shows the properties of the DCT coefficients X and N blocks and zigzag using JPEG compression using the DCT coefficients. While the total energy is equal to the X-block, changing the distribution of power and the most powerful on the market with low coefficients. 2D DC coefficient C (0,0).

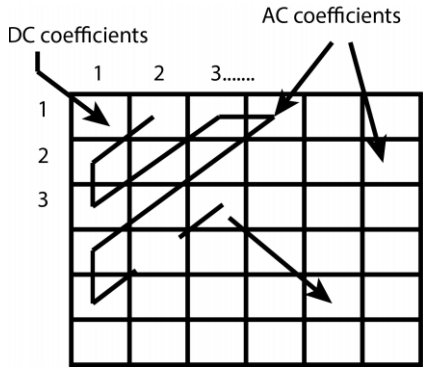

Figure 1: Number one DCT coefficient block long and the zig-zag

Department DCT. According to the cosine of zero it is usually simple:

$$C(0,0)=\frac{1}{M\times N}\sum_{x=0}^{M-1}\sum_{y=0}^{N-1}f(x,y) \quad (3)$$

The DC coefficient, which is located at the upper left corner, holds most of the image energy and represents the proportional average of the $M\times N$ blocks. The remaining $((M\times N))$ coefficients denote the intensity changes

among the block images and are referred to as AC coefficients. The DCT is performed on the entire image obtained after processing the input face images by histogram equalization

To this end, the scientists examined action to reduce the computation time. For example, used 2D DCT [10] change as facial recognition and feature extraction (Figure 2).

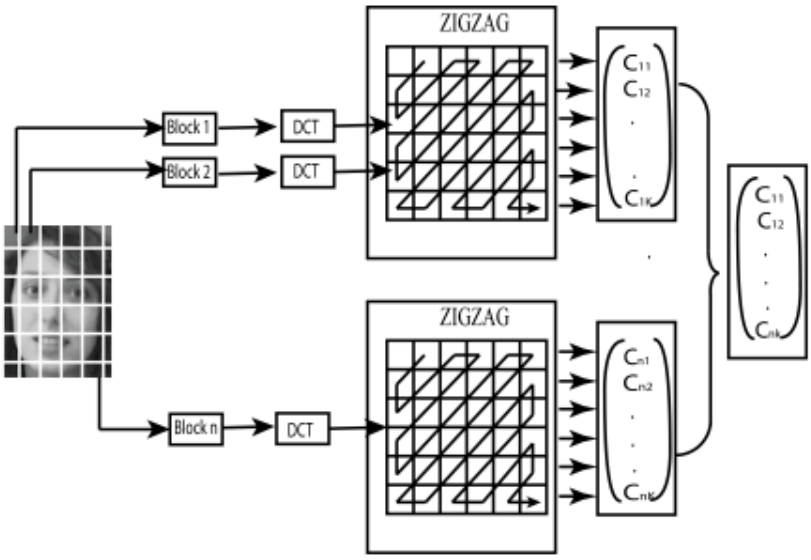

Figure 2: DCT and feature extraction LBP

2.2. Local Binary Pattern

In this section, we describe the application of LBP features and improvements. Before that recognize faces and normalized related changes [4]. Binary vectors of local repeat function in the image function into gray scale vector is used to create a histogram of the local structure of each pixel and operators of the application. The original LBP is constructed as follows: 3×3 pixels, as shown in Figure 3, the binary operator, the central pixel in the world to set the pixel half links in the opposite direction. If the average resistance neighbor pixel zero, reallocation. This is an 8-bit binary number to provide dot serves 256 bin histogram of the same value. Figure shows LBP-screen histogram frequency value of each bit in the film. Thanks to its design, planning of strong change carriers monotonous intensity LBP-control affects the amount of different intensity. No Stock Plan positions a small offset, and then the histogram calculation code can be easily LBP in a scan collects the film. DD code is pixel values (x_c, y_c) is calculated:

$$\mathrm{LBP}_{\mathrm{P,\,R}} = \sum_{\mathrm{P}=0}^{\mathrm{P}-1} s(g_{\mathrm{P}} - g_c)2^{\mathrm{P}} \tag{4}$$

With a strong sense of (x_c, y_c) gray level of the centre pixel, the P value refers to gray GP evenly distributed on a circle of radius R and S are the limits of the work as follows:

$$s(x) = \begin{cases} 1, & \text{if } x \geq 0 \\ 0, & \text{if otherwise} \end{cases} \tag{5}$$

This service can extend its nearest neighbors, when the radius R of P selected in the sample number. Calculated values, bilinear interpolation. Number of officials in the number of possible binary values, and also the length of the vector elements determined. To reduce the length of the vector, Ojala et. al., [7], the pattern is two double transition (0 to 1 or 1 and 0) and add the 90 cities on the pattern of the texture.

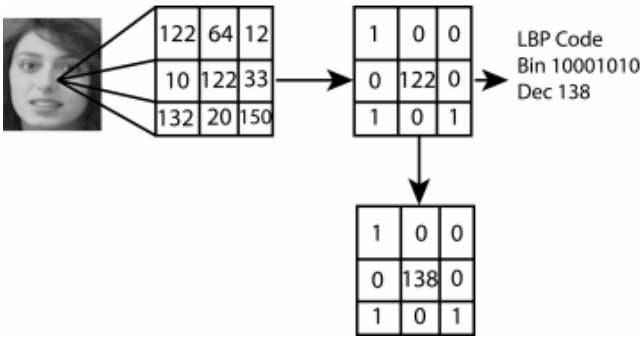

Figure 3: No local binary pattern determined by comparing the center neighbor pixel in the system assigned to the system. Binary values are single binary numbers LBP histogram

2.3. Face Recognition Algorithm based on PCA

The main objective of the CPA [2] algorithm used as raw images represented our special orthogonal vectors (private) show. This goes as follows:

Submit form column vector form, and meet all training vectors matrix X.

$$X = X - \mu \tag{6}$$

$$G = X^T X \tag{7}$$

Study data is based on the average urn.

Decision is the eigenvector matrix W defined a matrix. $\wedge$ in series, to solve the following features:

$$GW = \wedge W \tag{8}$$

Projecting all training with W^T as shown below eqn

$$Y = W^T X \tag{9}$$

Edit each test vector image column T and then used for TP models and can use some classification agreements. To show that the similarity between two vectors used, p Minkowski.

$$L_p = \left(\sum_{i=1}^{n} | X_i - Y_i |^p \right)^{\frac{1}{p}} \tag{10}$$

$$X = (x_1, ..., x_n) \text{ et } Y = (y_1, ..., y_n).$$

Such as We can, we use two of the city Minkowski came, got the first $p = 1$ Manhattan (L1) and the second obtained Euclidean $p = 2$ (L2).

2.4. The Feeder Value Decomposition (SVD)

The point value decomposition (SVD) and significant and linear algebra. SVD has many practical and theoretical value? A unique feature of SVD that every (m, n) matrix to be. Let's say I matrix A and rows and columns and rows R and $r \leq n \leq$ them. When the matrix is treated by:

$$A = USV^T \tag{11}$$

$$U = [U_1, U_2, ..., U_r, U_{r+1}, ..., U_m]$$

The column vector U_i where $i = 1, 2, 3, 4, ..., n$ form the orthogonal set

$$U_i^T U_j = \delta_{ij} = \begin{cases} 1, & \text{if } i = j \\ 0, & \text{if } i \neq j \end{cases} \tag{12}$$

And similar with V_i

$$V_i^T V_j = \delta_{ij} = \begin{cases} 1, & \text{if } i = j \\ 0, & \text{if } i \neq j \end{cases} \tag{13}$$

$S \times n$ this singular value diagonal matrix (SV) diagonally. Matrix S is in the following table.

$$S = \begin{bmatrix} \sigma_1 & 0 & 0 & \cdots & 0 & 0 & \cdots & 0 \\ 0 & \sigma_1 & 0 & \cdots & 0 & 0 & \cdots & 0 \\ \vdots & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 \\ \vdots & 0 & \cdots & \sigma_1 & 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 & \sigma_1 & 0 & \cdots & 0 \\ \vdots & 0 & \cdots & 0 & 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 & 0 & 0 & \cdots & \sigma_n \end{bmatrix} \tag{14}$$

For, $i = 1, 2, 3, 4, ..., n$

$$\sigma_1 \geq \sigma_2 \geq ... \geq \sigma_r \geq 0 \text{ and } \sigma_{r+1} = \sigma_{r+2} = ... \sigma_N = 0$$

3. APPROACHING TO PROPOSED FUSION

In this section we present our next two values-based approach towards the nature of identity: SVD and DCT LBP. No 5 shows a block diagram of the system. It consists of:

- Representatives of the person as SVD and DCT LBP;
- DSVD vector calculation and DDCT LBP-out in the database;
- Vector normalization agree;
- The combination of the two vector merger decision.

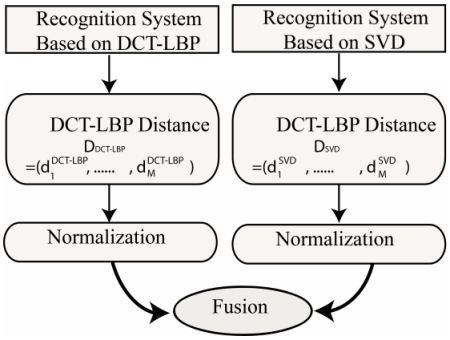

Figure 5: Proposed Fusion figure

3.1. Normalization

Due to the differences in various standardizing heterogeneous cream production needed to replace the lack of conformity before the combination. In this work, we have a process of normalization min-max and Z-score.

Vector map of the process [0, 1] go. This reflects D_{min} D_{max} and the long end [7] and is calculated as

$$D_n = \frac{D - D_{min}}{D_{max} - D_{min}} \tag{15}$$

where, $D_{min} = \min(d_1, ..., d_M)$ and $D_{max} = \max(d_1, ..., d_M)$

The process changes the distribution of average 0 and standard deviation 1. Improve the methods () and DTS (), the average deviation and size of each disc [7]:

$$D_n = \frac{D - \text{mean}(D)}{\text{std}(D)} \tag{16}$$

4. RESULTS AND DISCUSSION

To increase the effectiveness of the proposed method, we have the basis for ORL (Olivetti Research Laboratory) using [10] to perform much more complex situation, and the authenticity of the 2D facial evaluation simple and profound changes. He is 40, as. In Figure 6, 400 for everything we represent 10 different picture of the size of 112 × 92 pixel For some people, at different times of the images taken. The second table in Table 1 are the results obtained by the DCT prevent LBP recorded with different parameters. Note that P is the number of times the circular R and SVD.

Figure 6: The unique design and database ENT

Table 1
Price basis of various parameters DCT and SVD% LBP

P = 4	*R = 2*	*R = 4*	*R = 6*	*R = 8*
DCT-LBP and SVD	94.62	95.20	95.80	98.2
DCT-ACP and SVD	94.62	95.20	95.80	98.2
P = 8	*R = 2*	*R = 4*	*R = 6*	*R = 8*
DCT-LBP and SVD	94.41	95.43	95.93	98.7
DCT-ACP and SVD	94.62	95.20	95.80	98.2
P = 16	*R = 2*	*R = 4*	*R = 6*	*R = 8*
DCT-LBP and SVD	94.75	95.82	95.98	98.83
DCT-ACP and SVD	94.62	95.20	95.80	98.2

In the simulation, we chose five members, and the rest of the film to learn for the review. Accordingly, a number of forming the model and test 200 is for two people. It calculates the rate in the study of SVD and DCT-LBP.

Table 2, in which (number of studies and a photo ID 200) represents the study and identification and calculates software developed in Matlab. Remember, SVD significantly reduces the time and identity.

Table 2
Training and test times per second

Time	*Training*	*testing*
SVD	24.284	28.334
DCT-LBP	28.863	29.645
DCT-PCA	28.863	29.645
DCT-LBP with SVD	18.762	19.398
DCT-PCA with SVD	18.789	20.354

5. CONCLUSIONS

With the inclusion of the information relatively new research area. This article presents a new application process combining DCT and PCA.PCA algorithm is much higher or lower and fast DCT and durability is used for the reduction of the output image. So in the end, we can provide that the combination of DCT AVS close and facial restoration of cream settings detection system .Éliminer provide as the current system. The main advantage of these changes is an excessive loan DCT information, which for a better result does not leave singular vectors of SVD has unique value rights. In the future we will test our complex fusion image as a full size image of 2D or 3D images.

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