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FACE RECOGNITION BASED ON DWT AND IFSVM

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ABSTRACT

This paper proposes a face recognition method which is based on DWT and IFSVM for face recognition. Discrete wavelet transform is one of the approaches used to extract features and IFSVM classify the feature data. Firstly the face image is decomposed by 2-dimentional DWT, then the low frequency approximation image selected then IFSVM classifier is built and face image can be recognized. The experiment carried on ORL face data base that shows the considerable results.

Keywords- Face Recognition, DWT, SVM, FSVM, IFSVM.

I INTRODUCTION

Today's security demands are necessity to develop more error free security systems as biometric security system is preferred because of its natural uniqueness refers to the identification. [1]. One of the biometric identification is done by the face of the person. Face recognition system has its advantages over other biometric methods as it can be detected from much more distance without need of physical contact. There are several methods are proposed so far for the face recognition system using different feature extraction techniques or different classification approaches for better efficiency . This paper proposes a feature extraction method which is based on DWT .we used Improved Fuzzy Support Vector Machine (IFSVM) as a classification algorithm. Here, we apply a fuzzy membership to each input point and reformulate the FSVMs such that different input points can make different contributions' to the learning of decision surface [2].

II. DISCRETE WAVELET TRANSFORM (DWT)

Wavelets can be described as a set of filter banks contain a highpass (wavelet) and a low-pass (scaling) filter, each and every required right after by simply down-sampling involving two. The low-pass filtered and demolished output is recursively moved out through similar filter banks to more decrease the dimension, which is as well as called a multiresolution analysis. In one dimensional transform, samples are deteriorated into lowpass and high-pass samples. Low-pass samples address to a down sampled, low resolution variant of the original set. High-pass samples address to a down sampled residual rendition of the original set [3].

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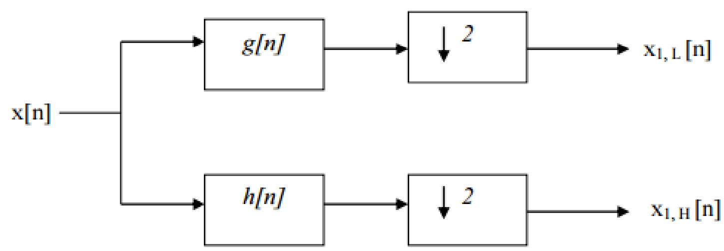

Figure 1.Wavelet Transform

The wavelet transform idea is shown in Figure 1

Where x[n] is the input, h[n] and g[n] is the high pass filter and low pass filter respectively, and 2 is the down-sampling by the factor of 2, Where:

$x_{1,\ L}$[n]- is the output of the low pass filter

$x_{1,\ H}$[n]- is the output of the high pass filter

g[n]- is just like the mother wavelet function in continuous wavelet transform

h[n] - is the just like the scaling function in continuous wavelet transform.

The coefficients of Daubechies filters are generally represent as h[n] and g[n].

$x_{1,\ L}$ [n] - is the rough part of the input x[n]

$x_{1,\ H}$[n]- is the detail part of input

In image compression, we typically retain $x_{1,\ L}$[n] and discard $x_{1,\ H}$[n] to accomplish the compression

III. IMPROVED FUZZY SUPPORT VECTOR MACHINE (IFSVM)

FSVM was first used by Shigeo Abe in 2001[2] to decide the unclassifiable regions problem. In 2002 Chun-Fu Lin, used FSVM for classification by to reducing the effect of outliers. In SVM, each point is assumed in one class. But, in real life problems, some input points may not exactly define their class.

In SVM, each input points are considered equal in terms of contribution to the training phase. But, sometimes some points corrupted due to noise so they have less contribution to training model and this is better that system discard them. This dissertation aims to handle such kind of data points by using fuzzy approach. This approach giving them a weight which gives their contribution to the training model. The weights are determined using membership function. Such approach is called FSVM.

Fuzzy Property of Input

In many real-life areas, each training points have different contribution. But, some training points are more important than other points in classification. We should concentrate on the meaningful training points and not

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worried about some training points like noises. It may happens that 90% points belong to one class and 10% may be meaningless, and it may 25% points belong to one class and 75%be meaningless [4].

So, here is a fuzzy membership $0 < \mu_i \leq 1$ linked with each training point x_i. This fuzzy membership can be position of the training point in the direction of one class in the classification problem and the value **(1- μ_i)** can be worthless. It is the extension of SVM as FSVM with fuzzy membership.

For solution of such problems, fuzzy memberships assign a membership value μ_i to each training point x_i. This value μ_i makes the point x_i less significant, and vice-versa .

Assume there are n dataset with their fuzzy membership as {(x_1, y_1, μ_i)…. (X_n,y_n, μ_n)}, where $x_i \in R^n$ is belongs to their class as $y_i \in \{-1,+1\}$ which has fuzzy membership $\sigma \leq \mu i \leq 1$ with enough small $\sigma > 0$.

Since the fuzzy membership μ_i is the position of the point x_i toward their class and the parameter ξ_i is ameasure of error in the SVM, the term $\mu_i \xi_i$ is a error with different weighting.

Therefore, the separating hyperplane is

$$\min \frac{1}{2}\|\mathbf{w}\|^2 + C(\sum_{i=1}^{n} \mu_i \xi_i) \qquad (1)$$

Related to $y_i(x_i w+b) \geq 1-\xi_i$,i=1,……..l (2)

$\xi_i \geq 0$,

Where C is a constant. It is noted that a smaller μ_i reduces the effect of the parameter ξ_i in problem (2) so; x_i point is treated as less significant.

For solving this optimization problem we use Lagrangian function as :

L (w, b, ξ, α, β)

$$=\frac{1}{2}w.w+C\sum_{i=1}^{l}\mu_i\xi_i-\sum_{i=1}^{l}\alpha_i\left(y_i(w.z_i+b)-1+\xi_i\right)-\sum_{i=1}^{l}\beta_i\xi_i \qquad (3)$$

Find the saddle point of L (w, b, ξ, α, β)All parameters must satisfy the subsequent conditions:

$$\frac{\partial L(w,b,\xi,\alpha,\beta)}{\partial w} = w - \sum_{i=1}^{l}\alpha_i y_i z_i = 0 \qquad (4)$$

$$\frac{\partial L(w,b,\xi,\alpha,\beta)}{\partial b} = -\sum_{i=1}^{l}\alpha_i y_i = 0 \qquad (5)$$

$$\frac{\partial L(w,b,\xi,\alpha,\beta)}{\partial \xi_i} = s_i C - \alpha_i - \beta_i = 0 \quad (6)$$

Apply these conditions into the Lagrangian equation (3) and the problem (2) can be formulated as

$$\max W(\alpha) \equiv \sum_{i=1}^{l} \alpha_i - \frac{1}{2} \sum_{i=1, j=1}^{l} \alpha_i \alpha_j y_i y_j K(xi, xj)$$

Related to

$= \sum_{i=0}^{l} \alpha_i \; y_i = 0, \; 0 \le \alpha_i \le \mu_i c$

$$\bar{\alpha}_i (y_i \bar{w}.z_i + \bar{b} - 1 + \bar{\xi}_i) = 0, \; i=1,\ldots\ldots\ldots\ldots\ldots l \quad (7)$$

$$(\mu_i C - \bar{\alpha}_i)\bar{\xi}_i = 0, \; i=1,\ldots\ldots\ldots\ldots l \quad (8)$$

The point $x_i$with the $\alpha_i > 0$ is called a support vector. There are two types of support vectors.

The one with corresponding$0<\alpha_i < \mu_i C$ lies on the margin of the hyperplane.

The other with$\bar{\alpha}_i = \mu_i C$ is misclassified.

There is a key difference between SVM and FSVM is that the points with the same value may indicate a different type of support vectors in IFSVM due to the effect of membership value μ_i[5].

Here membership function generation can be written as the following stages:

Algorithm-

Step 1: First of all, Find the membership degree ($\mu_1(x)$) based on distance.

Step 2: Find the membership degree based on Pearson correlation ($\mu_2(x)$).

Step 3: To find out membership degree based on clusters ($\mu_3(x)$). Perform clustering on the training data set.

a) Select a clustering algorithm

b) Perform clustering on the training data set

c) Determine a subset containing clusters that contain both normal and abnormal data. Denote this subset as ALLCLUS.

d) For each data point x ∈ ALLCLUS, set its fuzzy membership to 1

e) For each data point x∉ALLCLUS, do the following

i. Find out the cluster whose center is closest to x

ii. Calculate fuzzy membership of x with this cluster

Step 4: Find the membership degree$\mu(x)$ based on different observations, by taking mean as:

$$\mu(x) = \text{mean}\, [\mu_1(x), \mu_2(x), \mu_3(x)]$$

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$$\mu(x) = \begin{cases} 1 & , if \mu(x) \geq 0.6666 \\ 0 & , Otherwise \end{cases}$$

IV. EXPERIMENTAL RESULTS

The ORL face database composed of images of size 112 x 92 resolution. The training set was set up by a random selection of four images and a testing set of the other six images. We applied Db2 as the mother wavelet. We performed 1-level, 2-level, and 3-level decomposition respectively and the dimensions of the sub band LLl, LL2, LL3 is 57×47, 30×25, and 16×14.the recognition rate at different level with IFSVM shown in table1.

TABLE 1: Experiment Results

DWT Decomposition Level	Recognition Rate with IFSVM
1	93.32
2	96.12
3	93.54

We can find out that experimental result shown in table 1,and the recognition rate reaches 96.12% when the decomposition level is 2 using IFSVM and. So we could come to the conclusion that IFSVM is superior to traditional FSVM [3]. So we could come to the conclusion that our system outperforms the best recognition accuracy on the ORL dataset.

V.CONCLUSION AND FUTURE DIRECTION

This paper presents DWT approach for feature extraction during the face recognition; the Improved Fuzzy Support Vector Machine (IFSVM) is tested for wide facial variations. It gives better performance on reducing the effects of outliers than some existing methods. The experiments that we have conducted on the ORL database show that the IFSVM method achieves excellent performance than FSVM in terms of recognition rates. Here remains some future work to be done as Combine with the other subband coefficients of wavelet decomposition to improve recognition ability is required to be studied future. Wavelet transform and multisolution analysis can reduce image data greatly and extract main face information which is adequate for recognition. The ultimate goal is to automatically determine an appropriate fuzzy membership function that can reduce the effect of noises and outliers that can help face recognition in different situations. One of the great issues in FSVM that how to reduce the time in solving face recognition.

REFERENCES

[1] "Biometrics: Overview", Biometrics.cse.msu.edu. 6 September 2007.

[2]S. Abe and T. Inoue, "Fuzzy Support Vector Machines for Multiclass Problems," in 2002 Proc. ESANN Conf, pp. 113-118.

[3]Navin Prakash, Yashpal Singh, "Improved Fuzzy Support Vector Machine for Face Recognition" Sch. J. Eng. Tech., 2016; 4(1):70-82.

[4]C.F. Lin, and S.D. Wang, Fuzzy Support Vector Machines, IEEE Transactions on Neural Networks, 13(3):466-471, 2002.

[5] Jiang X, Yi Z, Lv JC; Fuzzy SVM with a new fuzzy membership function. Neural Computing & Applications, 2006; 15(3-4): 268-276.