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Is in your Blood?

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ABSTRACT

In social networking Image-based kinship recognition is inspiring problem. The question of Whether or not two people are kin, earlier studies based on image-based kinship recognition have focused on pairwise kinship verification. Such methodologies fail to achieve the fact that there are many real-world photographs contain several family members but we are looking only for parent and children relation. In this effort, we propose a wavelet based approach for feature extraction from identified faces in a family photo that incorporates facial similarities between parents – child face in a photograph in order to improve the performance of kinship recognition.

Keywords:- kinship recognition, wavelet, feature extraction

1. INTRODUCTION

Kinship plays an important role in a special type of social relationship and thus in the field of social network analysis. Algorithms that are based on image for kinship recognition, attempt to recognize kinship between people based merely on photographs of their faces. This work is very much helpful in uncovering and analyzing social networks, and has applications in criminal investigations and in surveillance. It is a tough task even for humans to recognize kinship among people based on facial similarities. There are some recent studies have demonstrated the possibility of kinship verification based on image that that identify facial patterns that people may have inherited from their parents e.g. shape of the eyes, nose, eyebrows, mouth, skin color etc.. Previous work has some limitations first they do not identify exact relation they identify only whether or not kinship exists between a pair of faces [2] i.e. kinship verification; second database used for training and testing is comparatively small [1][2]. In proposed work we focused on kinship recognition.

2. LITERATURE SURVEY

First attempt for kinship verification [2] is done in year 2010 by R. Fang, N. Snavely, K. Tang, and T. Chen. Before that the work done was only on face detection, and verification. They have collected Parent –Child dataset of different variation that include age, race, gender etc. It contains modified Pictorial structure model and it is based on normalized cross relation. In cross relation first step is to defined face template and then score of 22 features are matched against to template position. Feature extraction depends on color, facial parts, facial distance and gradient histogram. Another approach for implementing kinship detection is to reconstruct query person. This is implemented by authors of [3] using sparse representation-based classification (SRC). Face of query person is reconstructed by using the facial parts of family members. Dictionary of large number of family person's facial part is prepared. But disadvantage if this process is it requires family member's photo and tree. If number of persons in a family increases then only it rises the accuracy. They have collected "Family 101" dataset of 206 nuclear families, and their family tree with individual photo of each. Authors of [1][4] have proposed the methods on Transfer subspace learning. In this method they are children photo with their parent's young age photo instead of parents recent or old age photo. In general parent and children have the age difference is approximately of 25- 30 years. So considering these children's photo compared with parents young age photo gives more accurate results than parent's old age photo. They have set two different dataset having children, their parents young and old age photo. For feature extraction they used Gabour Filters. SSRW (Self Similarity Representation of Weber Faces) algorithm proposed in [5] contains 4 steps. First face detection done by AdaBoost face detector, second preprocessing done by Webbers Normalization, then key point extraction done by Difference of Gaussian (DoG) and then Self Similarity Descriptor is used to find the similarity. They prepared new dataset of by considering other kin relation like brother – brother, brother – sister, sister-sister, which were not implemented and considered in any earlier approach they have considered only son -mother, daughter- mother, son -father and daughter - father relation. Authors of [6] have proposed NRML (Neighborhood repulsed metric learning) algorithm for kinship verification. In this algorithm the pairs of images that look similar but are non kin are kept as far as possible and pairs of images that are actually kin but looks different are kept as close as possible but they have not trained and tested against proper dataset. They have prepared KFW-I and KFW-II dataset but it has the efficiency of pairs of similar looking non kin. One of the key reasons for less contribution in this area is availability of dataset. Authors of [7] have proposed most recent method for kinship verification based on graph. They used LBP (Local binary pattern) for feature extraction. They have also considered age and gender features.

3. IMPLEMENTATION DETAILS

We propose system for kinship recognition. Following is the algorithm for that.
Algorithm of the system
1. Train the system using N pairs in dataset
For each i=0, 1, 2…N do the Following
a. Select parent and children face image and perform Feature extraction.
b. Save Generated vector from matrix in text file along with relation.
2. Select family photo of parent children as a input to the system
3. Detect all faces from photo
4. Select any two random photo one of parent and one of children
5. Extract features of selected two faces
6. Generate Feature vector
7. Compare newly generated feature vector with existing N vectors in Text file.
8. Predict result as mother son, father son, mother daughter, father daughter.
System contains following module
- Face detection
- Feature Extraction
- Similarity measurement
- Machine Learning

3.1 Face detection

For face detection Harr cascade algorithm is used. It contains three main contributions. First: By performing some operation on pixel calculated then Harr like features can be captured. Second: Using AdaBoost prepare efficient classifier from small classifiers Third: Prepare cascade structure of complex classifiers.

3.2 Feature Extraction

Feature extraction is done using discrete wavelength transform [8]. Wavelets are based on small waves of varying frequency and limited duration. In addition to frequency, wavelets capture temporal (Time) information also. The two dimensional discrete wavelet transform (DWT) is an effective way to analyze images. It analyses image in a multiscale framework. It captures localized image details in both frequency and in space domains. The DWT is well implemented via the Mallat's tree algorithm. It applies iterative linear filtering. It down-samples on the original image that consist of three high-frequency directional sub-bands at each scale level and in addition it have to one low-frequency sub-band that usually known as image approximation. Directional sub-bands are images exhibiting image details according to diagonal, horizontal and vertical orientations. This decomposition process is illustrated in Figure 1. The top image is original image that undergoes for first level decomposition and generates one image approximation (A1) and 3 detail sub-bands (V1, H1 and D1). At second level the approximation image (A1) is decomposed and again produces new second low level approximation(A2) and second scale level of image details (V2, H2 and D2) . The resulting 2-level DWT is shown in Figure 2.

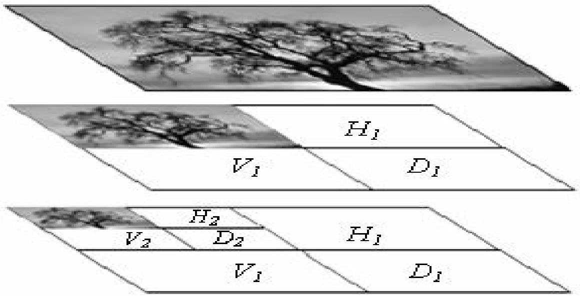

Figure 1 A two-level wavelet decomposition

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Figure 2 Resulting sub-bands for a 2-level DWT (original image in Figure 1)

3.3 Similarity measurement

4.1 For finding the similarity matric or calculating distance Euclidean distance is used. The Euclidean distance between point's p and q is the length of the line segment connecting p and q ($\overline{\mathbf{pq}}$).

if p = (p_1, p_2,..., p_n) and q = (q_1, q_2,..., q_n) are two points, then the distance (d) from p to q, or from q to p is given by the formula:

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \mathrm{d}(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)}$$

$$= \sqrt{\sum_{i=1}^{n}(q_i -}$$

3.4 Machine Learning

Initially system is trained under training dataset. Training dataset contain face image. Features are extracted using 2 D – DWT for each pair of relation. Then similarity matrix for two feature matrix is calculated by using Euclidean distance. Then from feature matrix feature vector is generated and store for further processing.

4. EXPERIMENTAL RESULTS

4.1 Dataset

For training and testing the KinFaceW-I and KinFaceW-II dataset [9] is used. Both dataset contains parent and children face images of size 64 × 64 pixels. Images in dataset are collected from Internet. It contains images of four kin relations that is father-daughter (F-D), mother-daughter (MD), father-son (F-S), mother-son (M-S). The difference between two dataset is, face images pair in KinFaceW- II are collected from same photo while in KinFaceW-I dataset face images pair are collected from different photos. KinFaceW-II data set contains face images of 250 pairs of each relation, while KinFaceW-I data set contains 134, 127, 156,116 pairs of images for relation father-daughter (F-D), mother-daughter (MD), father-son (F-S), mother-son (M-S) respectively. Fig. 3 and fig. 4 shows images in dataset.

Figure 3 Several image examples of our KinFaceW-I database. From top to bottom are the father-son (F-S), father daughter (F-D), mother-son (M-S), and mother-daughter (M-D) kinship relations, and the neighboring two images in each row are with kinship relation, respectively.

Figure 4 Several image examples of our KinFaceW-II database. From top to bottom are the father-son (F-S), father daughter (F-D), mother-son (M-S), and mother-daughter (M-D) kinship relations, and the neighboring two images in each row are with kinship relation, respectively.

4.2 Experimental setting

All images i.e. training and query images are firstly converted in to gray scale. Under machine learning system is trained in two environments using two different datasets i.e. KinFaceW-I and KinFaceW-II. All images are of size 64 × 64 pixels. For feature extraction , 2 level , 2D – DWT is applied i. e. at level 2 we get 16 ×16 pixels approximation image. Difference matrix of size 16 ×16 is generated by taking the Euclidean distance of two feature matrix. Feature vector is generated from distance matrix by taking 5 different threshold values and magnitude. For each training image pair feature vector is stored against their true kin relation. Query image containing parent and children face image is given as an input at real time. Feature vector is calculated as same way as machine learning and that real time generated vector is matched against vectors stored in database. Minimum difference vector is selected and its relation is shown as a kin relation for real time input face image pair.

4.3 Experimental results

Table 1: Results on KinFaceW-II

	KinFaceW-II , Test on 50 pairs					
	Intensity Difference			2D -DWT		
	Train 50	Train 100	Train 200	Train 50	Train 100	Train 200
Father daughter	12	15	19	23	27	29
Father son	15	19	21	27	33	34
Mother Daughter	12	13	16	24	28	29
mother Son	14	16	19	28	31	33
Mean	13.25 (26.5%)	15.75 (31.5%)	18.75 (37.7%)	25.5 (51%)	29.75 (59.5%)	31.25 (62.5%)

Table 2: Results on KinFaceW-I

	KinFaceW-I , Test on 16 pairs			
	Intensity Difference		2D -DWT	
	Train 50	Train 100	Train 50	Train 100
Father daughter	6	7	8	10
Father son	5	8	8	10
Mother Daughter	4	6	7	9
mother Son	4	8	9	11
Mean	4.75(30%)	7.25(45.5%)	8(50%)	10(62.5%)

Table 1 and table 2 shows the experimental results on KinFaceW-II and KinFaceW-I dataset respectively. For KinFaceW-I (table 2) system is tested on 16 randomly selected pairs of each relation and system is trained under randomly selected 50 pairs of four relations and then on randomly selected 100 pairs. First two columns specify the results of kinship recognition system using intensity deference [10], while last two columns of kinship recognition system implemented using 2 D – DWT for feature extraction and Euclidean distance for generating distance matrix. similarly for KinFaceW-II (table 1) , system is tested on randomly selected 50 pairs of each relation. It is trained using 50, 100, and 200 pairs of each relation. Performance of the system is compared using system implementation, using Intensity Difference [10] and proposed implementation using 2D-DWT. Graph Results on both datasets i.e. KinFaceW-I and KinFaceW-II shown using graphs in fig. 5 and in fig. 6 respectively.

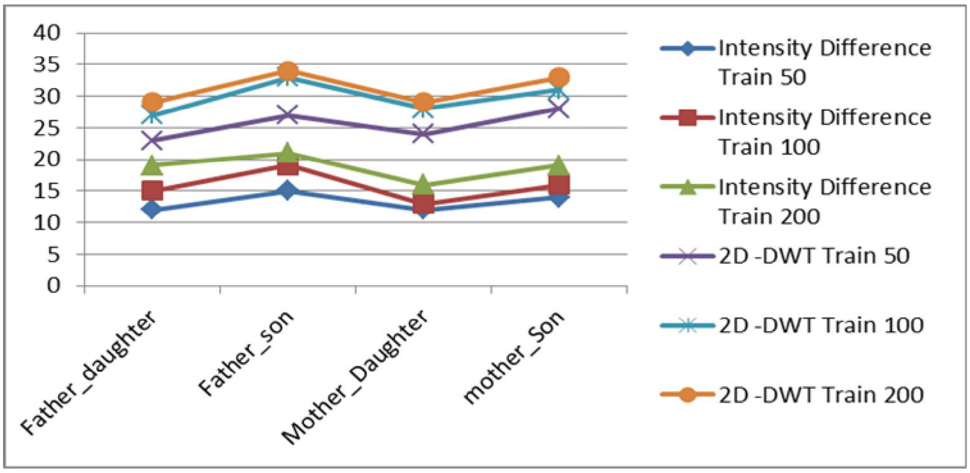

Figure 5 Graph on Results on KinFaceW-II

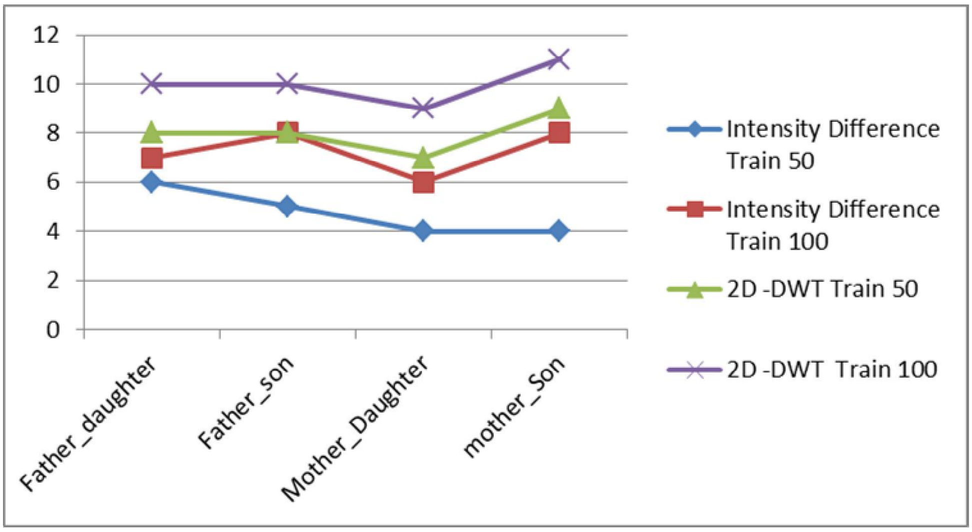

Figure 6 Graph on Results on KinFaceW-II

Analysis shows Mean percentage results for KinFaceW-I using intensity Difference for all four relations is 30%, when system is trained under 50 pairs of each relation and 45.5% when it trained using 100 pairs of each relation; And 50% and 62.5 % results of 2D-DWT implementation on KinFaceW-I dataset for training under 50 pairs and 100 pairs respectively . Similarly mean percentage result on dataset KinFaceW-II is 26.5%, 31.5%, 37.5% for intensity difference while 51%, 59.5%, 62.5% by system implementation using 2D –DWT. In both the cases system is trained under randomly selected 50, 100 and 200 pairs of all the relations respectively.

5. CONCLUSION AND FUTURE SCOPE

In this paper we have proposed a system for kinship recognition using 2D-DWT. The system first deletes the faces then lossless compresses the image and extracts the feature using 2D – DWT calculation by Mallets Algorithm. Performance of System is tested using two different datasets that are the largest wild datasets available till date. Some of the image pairs from datasets are taken for machine learning while some of them are taken for testing. Result analysis shows that mean percentage result for system implementation using 2D DWT is same (i.e. 62.5%) on dataset KinFaceW-II and KinFaceW-I, when it is trained for 200 images of all the pairs and tested on 50 pairs from the dataset. Then as Father Son and mother son kinship matching is more than mother son and mother daughter it resembles that son faces are more resembles to their mother or father than daughter. Also kinship recognition implementation using 2D-DWT gives the improved performance than other system. The system can be further improved by considering the sibling relations, but for that proper dataset is to be prepared.

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