

Kinship through Imaging

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ABSTRACT

Currently there is no any software which will automatically detect kinship from photo, we require such system because now days it's very simple to take a photo and upload it or share it on social networking websites. But from photo it is difficult to predict the blood relationship among the people in a photo. It will be helpful if automated software based system is there for this. Our system comes under machine learning and image processing. Initially system is trained under machine learning and then real time image is given for testing. Main emphasis given to the system is for human face detection from photo, feature extraction from detected face, machine learning and then real time testing. System is trained under KinFaceW-I and KinFaceW-II dataset.

Keywords: automated system, machine learning, image processing, feature extraction.

1. INTRODUCTION

There is large work done on face detection and Identification but kinship verification is relatively less explored. Such system is very much helpful on social networking sites to prompt automatic relation among the person in photo, other than these it will be helpful to build family tree from a photo album, for finding missing children or child adoption.

2. LITERATURE SURVEY

2.1 K-Nearest- Neighbors

First attempt of kinship verification is done by R. Fang, K. Tang, N. Snavely, and T. Chen [2], they have evaluated a set of local features for parent child classification. They made Parent-child database from Internet which consist of 150 images. Dataset have variations in gender, race age etc. They identified 22 main features like eye-distance, skin-color, eye to nose-distance, and global feature like HoG magnitude etc, using simplified pictorial structures model from face image then computed important 6 features and combined them into a 10 dimensional feature vector. They have traied the system with K Nearest- Neighbors with K = 11 and Euclidean distance and used Support Vector Machine with a radial basis function (RBF) kernel and the LibSVM package for classification. This ultimately gives pairs of face images are related or unrelated.

2.2 sparse representation-based classification (SRC)

Ruogu Fang, Andrew C. Gallagher, Tsuhan Chen, Alexander Loui have proposed method in [3], they reconstruct the Query person and it suggests whether that person belongs to a family. This used scarcity. By facial parts of family members Query person is reconstructed. Dictionary, which contains large number of parts of family faces, is used. Face recognition is based on sparse representation-based classification (SRC) approach. They prepared "Family 101" dataset with 206 nuclear families, and their family tree with large number of individual images is used. If number of people in same family is increases, then it increases the accuracy.

2.3 Transfer subspace learning

Two papers on kinship verification [1] [4] are proposed by Siyu Xia & Ming Shao. Their first paper [4] was based on transfer learning for these they collected KinFace version 1.0 dataset. After that they proposed face recognition with context [1]. Previous attempt was face recognition without context. The information like time when the photo is captured, location of photo, patterns of reoccurrence and co-occurrence, position of a person in photo, clothing, or any other text or link information provides contextual information. Transfer subspace learning considers parents old age as well as young age image, UB KinFacedatabase contain child image, old parent image and young parent image i.e. parent images with their different ages. It shows that comparing children image with young parent gives better result than comparing with old parent. For feature they used Gabor filters. For latter paper[1] database is improved as Ub KinFace Ver. 2.0.

2.4 Self-Similarity Representation of Weber Faces

SSRW algorithm (Self Similarity Representation of Weber Faces) [6] proposed by Aaa N. Kohli, R. Singh, and M.

Vatsa, contains four major steps. face detection is done by Adaboost face detector ,after preprocessing is done by Webbers Normalization. key points are extracted by Difference of Gaussian (DoG) and then Self Similarity Descriptor is used to find the similarity. Its output is given to the SVM classifier. This algorithm gives 75% results on the database which is set by 272 kin pairs while UB Kinship Database gives 55% accuracy.

3. IMPLEMENTATION DETAILS

Fig.1.Shows the block diagram of the system with Query image as input containing family photo from that all human faces are detected and feature extraction is done on any two randomly selected faces that will be given for kinship identification. Before that system is trained under two different datasets containing pairs of parent and children images. Machine is trained under extracted features of such pairs. Our system is divided in following models:

- Normalization
- Face Detection and Feature Extraction
- Machine learning

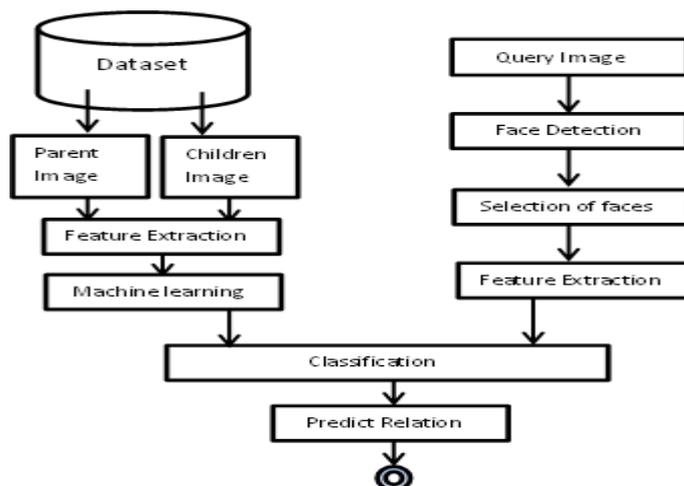


Figure 1 Block Diagram

3.1 Normalizations

In color image, color values depend on the illumination i.e. lighting conditions. To avoid that image is converted in to gray scale called normalization which changes the range of pixel intensity values.

3.2 Face detection and Feature Extraction

Viola-Jones sliding window detector [11] is used for object detection it was motivated to develop face detection which is developed by Paul Viola and Michael Jones and based on basically skin color. It is based on

- Haar-like features
- Adaboost Learning algorithm
- Cascade Classifier

Haar-like features involve the sums of image pixels within rectangular areas known as Integral Image and then Differences of sums of intensity is calculated. Fig. 2 shows some the rectangle features used in Haar-like features.

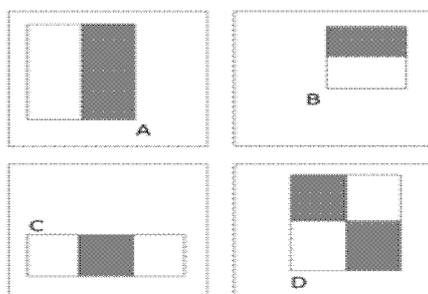


Figure 2 Feature types used by Viola and Jones

There are thousands of features from sliding window so AdaBoost learning algorithm is used to select the best features and to train classifiers. Strong classifier is generated by cascading no. of weak classifier. Fig. 3 shows Cascade Architecture of classifiers

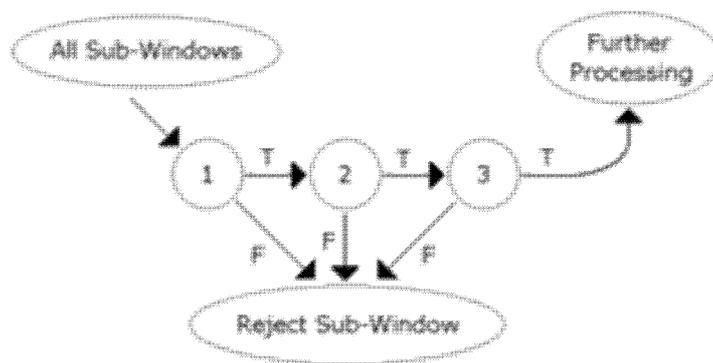


Figure 3 Cascade Architecture

3.3 Machine learning

From extracted features of training dataset, matrix of 16×16 is generated that is nothing but image of matrix of percentage difference of block size 16×16 pixels. Maximum difference of two pixels is 255. From difference matrix vector of 5 is generated. That is generated by considering the threshold 3, 6, 9, 12 and 15. Threshold is taken to neglect the maximum difference between two pixels, e.g. if threshold 3 then the maximum difference between two pixel up to 3 is neglected.

4. EXPERIMENTAL RESULTS

4.1 Dataset

System is trained under KinFaceW-I and KinFaceW-II [9], Both dataset contains images of parent and children of size 64×64 pixels, are collected from Internet. Fig. 4 and Fig. 5 shows the some of the pairs of dataset of KinFaceW-I and KinFaceW-II respectively. four kinship relations considered in dataset are father-daughter (F-D), mother-daughter (M-D), father-son (F-S), mother-son (M-S). In KinFaceW-I data set, there are 134, 127, 156,116 pairs of images respectively. For the KinFaceW-II data set, each relationship contains 250 pairs of kinship images.



Figure 4 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 5 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.

The difference between dataset is that the kinship pairs photos in KinFaceW-I is collected from two different photos while in KinFaceW-II is collected from same Photo. So in real application both the dataset results different.

4.2 Performance / Testing

To identify the kin relation system is trained under KinFaceW-I and KinFaceW-II database. Initially system is trained under KinFaceW-I with training relation Father_daughter, Father_son, Mother_Daughter and mother_Son . System is trained for randomly selected 50 pairs of each relation and tested for randomly selected 16 pairs of each relation. Table 1 and table 2 shows the results on testing under KinFaceW-I and KinFaceW-II respectively.

Table 1: Results on KinFaceW-I

Relation	Train 50,Test 16 Pairs		Train 100,Test 16 Pairs	
	Match Pairs	% result	Match Pairs	% result
Father_daughter	6	38	7	44
Father_son	5	32	8	50
Mother_Daughter	4	25	6	38
mother_Son	4	25	8	50
Mean	4.75	30	7.25	45.5

For KinFaceW-II system is trained for above mentioned relation for randomly selected 50, 100 and 200 pairs of each relation; and tested for same randomly selected 50 pairs of each relation.

Table 2: Results on KinFaceW-II

Relation	Train 50,Test 50 Pairs		Train 100,Test 50 Pairs		Train 200,Test 50 Pairs	
	Match Pairs	% result	Match Pairs	% result	Match Pairs	% result
Father_daughter	12	24	15	30	19	38
Father_son	15	30	19	38	21	42
Mother_Daughter	12	24	13	26	16	32
mother_Son	14	28	16	32	19	38
Mean	13.25	26.5	15.75	31.5	18.75	37.7

5. CONCLUSION AND FUTURE SCOPE

In this paper we have proposed a method for kinship verification which first detects the face and then extracts the features. As system comes under machine learning it is trained and tested on 2 different datasets, the datasets which are considered are largest datasets for till now for parent children datasets, so till date our system is trained under maximum training samples. Also the dataset we have considered is wild dataset i.e. it is invariant of pose, lighting effect, age, expression, background etc. above results shows as we increase the training dataset it increases the results. Also it is remarkable to notice that the percentage verification rate for parents (either Mother or father) and son is above average while that for parents and daughter is below average. As compare to daughters son faces more resembles to their parents. System can give better results if system is trained with more no of pairs. This work can be extended for kin relation identification in sibling like Brother sister, brother brother or sister sister but for that proper dataset is required.

REFERENCES

- [1] Siyu Xia, Ming Shao, Jiebo Luo, Yun Fu, "Understanding Kin Relationship in a Photo", IEEE Transactions on multimedia, Aug. 2012.
- [2] R. Fang, K. Tang, N. Snavely, and T. Chen, "Towards computational models of kinship verification," in Proc. IEEE Int. Conf. Image Process., 2010, pp. 1577–1580.
- [3] Ruogu Fang, Andrew C. Gallagher, Tsuhan Chen, Alexander Loui, "KINSHIP CLASSIFICATION BY MODELING FACIAL FEATURE HEREDITY"
- [4] S. Xia, M. Shao and Y. Fu, "Kinship verification through transfer learning," in Proc. Int. Joint Conf. Artificial Intell., 2011, pp.
- [5] <http://www.digitaltrends.com/social-media/according-to-facebook-there-are-350-million-photos-uploaded-on-the-social-network-daily-and-thats-just-crazy/>
- [6] Aaa N. Kohli, R. Singh, and M. Vatsa. Self-similarity representation of Weber faces for kinship classification. In IEEE BTAS, pages 245–250, 2012.
- [7] Hamdi Dibeklioglu, Albert Ali Salah, and Theo Gevers, "Like Father, Like Son: Facial Expression Dynamics for Kinship Verification"
- [8] Kathirvalavakumar Thangairulappan*, Jebakumari Beulah Vasanthi Jeyasingh, "Face Representation Using Combined Method of Gabor Filters, Wavelet Transformation and DCV and Recognition Using RBF", Journal of Intelligent Learning Systems and Applications, 2012, 4, 266-273
- [9] Jiwen Lu, Junlin Hu, Xiuzhuang Zhou, Yuanyuan Shang, Yap-Peng Tan, Gang Wang "Neighborhood Repulsed Metric Learning for Kinship Verification", Pattern Analysis and Machine Intelligence, IEEE Transactions, Volume: 36, Issue: 10, 1109/TPAMI.2013.134.
- [10] Cha Zhang and Zhengyou Zhang, "A Survey of Recent Advances in Face Detection", June 2010, Technical Report, MSR-TR-2010-66.
- [11] Paul Viola, Michael Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features, accepted conference on computer vision and pattern recognition 2001"

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