

Face Recognition in the Scrambled Domain Using MK-RDA and ANN

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ABSTRACT

Facial look identity is a vital mission by means of human-interacting structures that goal to be aware of versions within the human's emotional state. the principle challenge or the crucial part in surveillance society is the privacy-shielding era. because the rapid improvement in the internet international it turns into very essential to scramble the pics in the video or files for the duration of transmission. in this the biometric identity of photographs or faces from scrambled pictures plays a completely tough mission. Numbers of various technology are carried out to provide privateness for the duration of surveillance or during transmission of video however they're lack of essential traits, like reversibility or visible fine maintenance. in lots of scrambling methods the faces are covered by a few animation which may additionally or may not cover all faces or it receives hard to recover pics from this technique. Many guide method also are us used by which we will unscramble an photo but they are no longer powerful that a good deal. to overcome all this matters we proposed a novel approach- Many-Kernel Random Discriminate analysis (MK-RDA) to find out discriminative patterns from chaotic indicators. structures get better accuracy bring about best photos. To PIE and ORL datasets has getting above ninety% accuracy.

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1. INTRODUCTION

As the speedy improvement within the net international it will become very essential to scramble the images in the video or files all through transmission. As a end result, face scrambling A. Melle, J.-L. Dugelay [13] is emerging as a practical approach to defend the consumer's bodily identification. Therefore by scrambling face detected in non-public video is carried out.

Scrambling could be very easy and proper method as compare to other technique as in scrambling not all the matters are hiding. The unscrambling also can be accomplished thru manual technique. Scrambling has acquire more recognition within the area of surveillance as it hold the privateness rules. Any other benefit of the scrambling approach is that it less difficult than the standard encryption methods. The scrambling is executed through many techniques simply by way of protecting or by way of putting caricature in the front of face for privateness reason. However from this kind of scrambling the recognition or identity turns into very hard specifically in the area of protection had been erasing the face turns into difficult to pick out the man or woman.

On this we've used Arnold transformation algorithm is used to scramble the images Y. Wang, T. Li [15]. This technique scrambled the photographs by pixel enlargement technique.

Within the discipline of face recognition inside the recent years it achieves plenty of factors to become aware of the faces. This technique commonly considers the semantic face fashions which is integration of different semantic matters together with nostril, eye, and mouth. by using the usage of this semantic nearby

binary styles (LBP) may be built to recover the photograph. Instead of 2nd a 3D model is used for better impact on recovered photograph. The district of interest is decoded by means of restrict decryption with complete or incomplete records of the name of the game key, therefore maximum critical to one of a kind tiers of scrambling amendment. Information of the entire secret key gives legitimate customers image revival at a excellence stage very near the particular. despite the in fashionable method is lossy, we display that during series loss, planned thru resemblance metrics, is equal or smaller than the only occur by JPEG density.

But the scrambled image could be very one of a kind as examine to the authentic facial photograph. It becomes difficult to compare the 3D model Perakis, P. ; Passalis, G. ; Theoharis, T. ; Kakadiaris, I.A. [1] with scrambled photographs because the semantic model grow to be chaotic pattern. To avoid those records-driven tactics is used; in this technique chaotic signals are surely taken into consideration as a set of records points spread over manifolds. Plenty of recovery method or technique is given and they efficiently used for information-driven face reputation. But, for the scrambled photos we need a strong approach to address the scrambled snap shots. in this paper we proposed a new method known as Many-Kernel Random Discriminate evaluation (MK-RDA) to deal with chaotic images more efficaciously within the scrambled domain. We additionally gives a way salience version used in MK-RDA for pattern discovery from chaotic facial alerts.

1.1. Face Scrambling

Scrambling captured personal photograph can be answer to simplifying a scheme. We propose an image-scrambling method for numerous formatted (bitmap and JPEG) images to non-public information. The normal photos are transformed into peculiar layout or encrypted layout. those scrambled photographs are hiding the facts of photos. using Arnold rework. that is remodel pixel or coloration. as the chaotic scheme may be very diffused to scheme parameters and initial values, the chaotic series that's made has the characters of sophistication noise, wide band, correct renewal and complicated to prediction lengthy-term.

1.2. Semantic Facial Components

All face is depending upon facial features which has detected face in natural pictures to discover expression of pix the usage of special patches. In laptop imaginative and prescient to detecting patches has used to specific styles of approach or set of rules.

PCA (Principal Component Analysis) is photograph compression and reputation which has extracted the issue or item. PCA is a procedure that makes use of an orthogonal change to transform a fixed of reasons of likely connected variables or moving object into a fixed of values of linearly uncorrelated variables referred to as important mechanisms. The precise mutable price extra than or equal to quantity of predominant thing. this modification is distinct in such a method that the leader fundamental characteristic has the principle and all following thing in move has the highest alteration viable under the restraint that it's far orthogonal characteristic. The resulting vectors are an uncorrelated orthogonal foundation set. PCA is expressive to the comparative scaling of the specific variables.

FLDA (Fisher Linear Discriminant Analysis) excerpt the attribute from snap shots which preserves the discriminative issue of images whilst plummeting measurement at the photograph area. FLDA gets the modification matrix by means of exploiting the among-elegance scatter medium FLDA can not reservation the specific covers of that particular magnificence. LFDA has been destiny to triumph over drawbacks of FLDA Y. Rahulamathavan, R. C.-W. Phan, J. A. Chambers, D. J. Parish [5].

LFDA (Local Fisher Discriminant Analysis) divisions picture examples in every elegance into manifold local classes within the better dimensional photo space by using $A_{i;j} \delta_{i;j}$. It then schemes photographs fitting to a neighborhood magnificence in advance to every other while maintaining predictable imageries of other neighborhood training separately Y. Rahulamathavan, R. C.-W. Phan, J. A. Chambers, D. J. Parish [5].

2. SYSTEM ARCHITECTURE

Schematic machine architecture is as shown in Figure 1. The image that is to be scrambled is first given to the device by using the user. From this image, face is detected via the Viola-johns set of rules to scramble the face or to encrypt the image that is to be sending to different side. After the face detected by means of Viola-Johns algorithm photograph is or face is scrambled by means of using Arnold Transformation algorithm. Then this scrambled image is send to different aspect. To perceive the individual or face in scramble photo at give up aspect a MK-RDA i.e. Many-Kernel Random Discriminate evaluation technique is used. This photo is then examine with different pix saves in dataset and according to their match rating is given to every pictures that's same to that recover photo. The dataset used in this gadget for matching faces are ORL Dataset, PIE Dataset, and PUBFIG dataset.

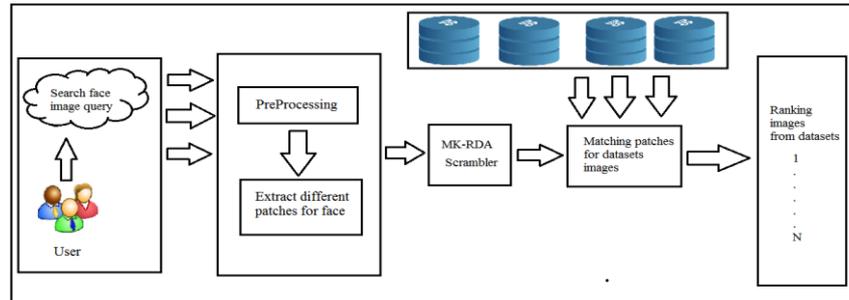


Figure 1. System Architecture

2.1. User Module:

User can upload the scrambled image to the system or upload the datasets to the system.

2.2. Pre-processing:

In image processing operation implement to the pre-processing. In the system image convert into grey scale image means image convert into black and white image which remove brightness of image. In facial image find face is facial or non facial which is find or implement into face reorganization algorithm.

2.3. Viola Jones:

Using viola jones algorithm detecting human faces with faces pattern like eyes, nose and lips. The problem to be solved is detection of faces in an image. A human can do this easily, but a computer needs precise instructions and constraints. To make the task more manageable, Viola–Jones requires full view frontal upright faces. Thus in order to be detected, the entire face must point towards the camera and should not be tilted to either side. While it seems these constraints could diminish the algorithm’s utility somewhat, because the detection step is most often followed by a recognition step, in practice these limits on pose are quite acceptable.

2.4. MK-RDA

Many kernels Random Decrement Analysis for random face recognition techniques. Which has used to different types of kernel used like blur image sharpness, increasing brightness to increase image quality. After increase quality image will be recognized using chaotic signals.

2.5. Feed-Forward Neural Networks

A collection of neurons connected together in a network can be represented by adirected graph:. Nodes represent the neurons, and arrows represent the links between them.

Each node has its number, and a link connecting two nodes will have a pair of numbers (e.g. (1, 4) connecting nodes 1 and 4). Networks without cycles (feedback loops) are called a feed-forward networks (or perceptron).

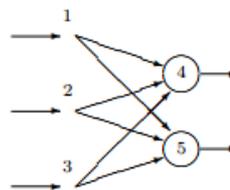


Figure 2. Feed-forward Neural Networks

- a. Input nodes of the network (nodes 1, 2 and 3) are associated with the inputvariables (x_1, \dots, x_m) . They do not compute anything, but simply pass the values to the processing nodes.
- b. Output nodes (4 and 5) are associated with the output variables (y_1, \dots, y_n) .

3. MATHEMATICAL MODEL

$S = \{s, e, X, Y, \Phi\}$

Where,

s = Start of the program.

1. Login with System.
2. Upload scrambled image.

e = End of the program.

Find matching of scrambled image in ranking.

X = Input of the program. Input of this system is data of different scrambled image upload or upload different datasets which convert into scrambled.

Y = Output of the program. First we are going to extract the distinct kind face reorganization algorithm that are come across to eye, lips and nostril. Those every part put in force to MK-RDA through chaotic signal.

$X, Y \in U$

Let U be the Set of System.

$U = \{Sc, Dsc\}$

Where Sc, Dsc are the elements of the set.

Sc = Scrambled image.

Dsc= Scrambled image datasets.

A.)Equation

In scrambled device has done operation in exclusive datasets. every datasets has one-of-a-kind size formatted photos are to be had. In gadget database stored and matching located the pictures in these datasets.

D= Datasets.

$$P_i = \lim_{n \rightarrow d} (\text{extract}(\text{Img})) \quad (1)$$

Where,

P_i = no of facial patches

Img= Image.

In eq(1) has calculated patches of facial images. It using viola Jones algorithm for detecting facial attribute like eyes, nose, and lips corner. These patches are extracted to images using algorithm.

$$SI = \int_{i=0}^N \sum P_i \quad (2)$$

Where,

SI=Scrambled image.

For generating scrambled images apply Arnold transform for facial images. In transformation has different expansion which has convert image into scrambled domain.

$$img_i = \iint_{i=0}^N \ker(SI) \quad (3)$$

Where img_i =top k matching images.
 Ker=MK-RDA kernel

In equation (3) calculating MK-RDA kernel for scrambled images which has different types kernel used. It has calculating similar images with using facial patches.

4. DATASET EVALUTION

On this device we've got taken on attention a database or dataset for comparison of obtained images with the dataset snap shots for recognition of pictures from the scrambled pix. We used three form of dataset for evaluation purpose which can be as observe:

4.1. ORL Dataset:

The Our Database of Faces, formally known as as “The ORL Database of Faces”. Include face pictures taken from April 1992 to April 1994 on the lab with ten special pix of each of forty distinct topics. For a few subjects, photos have been excited about varying mild, extraordinary facial expression and facial information.

4.2. PIE Dataset:

PIE Dataset known as it as CMU Pose, Illumination, and Expression (PIE) database. This dataset contain 41,368 pictures of 68 human beings under 13 specific angles, forty three one-of-a-kind lights conditions, and with four specific expressions.

4.3. PUBFIG Dataset:

PUBFIG dataset is Stands for Public Figures Face Dataset is the biggest dataset of real phrase encompass 58,797 pictures of two hundred people gathered from the internet. These dataset photos are taken in exclusive out of control and non cooperative situation. as a result there's large variant is expression, lights, pose, camera, scene, parameters and imaging situations, and so on.

5. EXPERIMENTAL SETUP AND RESULT ANALYSIS

5.1 Experimental Setup

Proposed scrambled image matching system became applied in Java. It can be run on windows XP/windows Vista or on windows 7 working system. For storing records database used is MySQL

5.2 Result Analysis

5.2.1 Image Processing:

Upload image to feed forward algorithm to image processing which has get image key points to matching result.

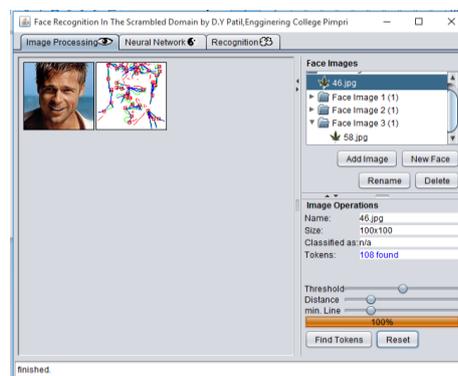


Figure 3. Image Processing

5.2.2. Error Graph:

It is display to processing image graph how many images are train, faces are detected are some combinational values.

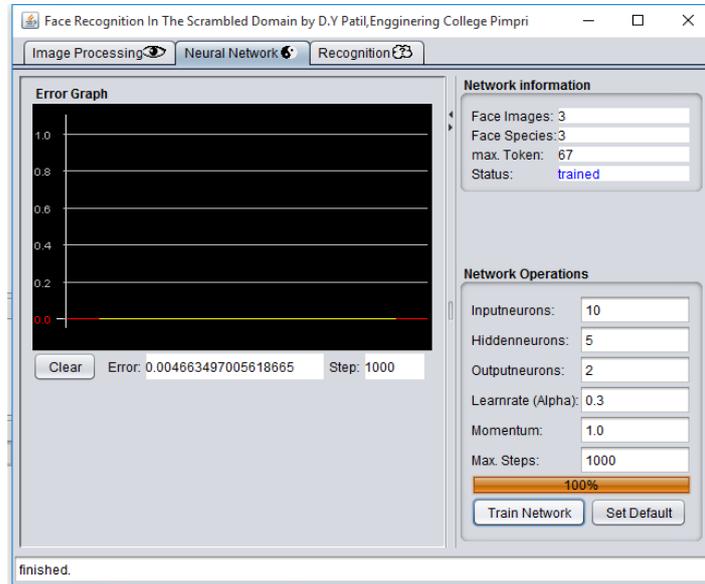


Figure 4. Error Graph

5.2.3 Recognition:

It has find to matching images to dataset by using facial key point's values. It display the all matching images in dataset.

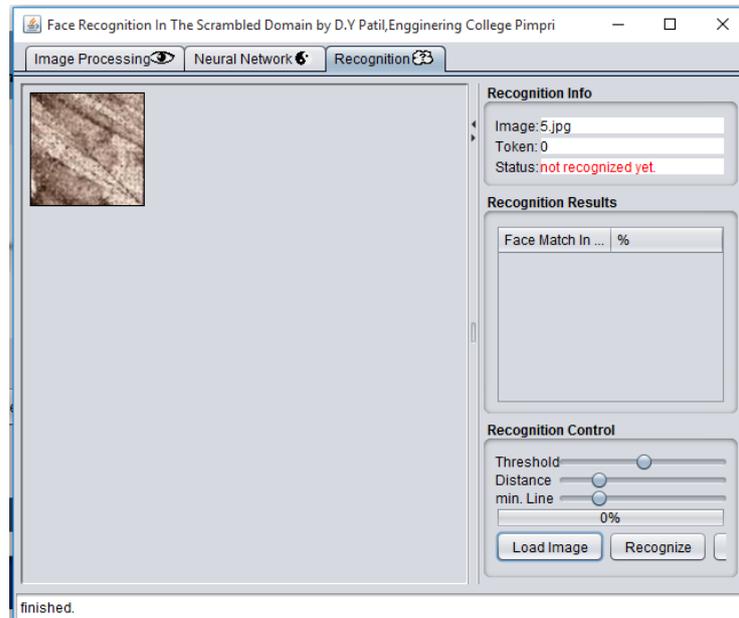


Figure 5. Recognition

5.2.4 Matching Accuracy:

It Display the accuracy of matching result.

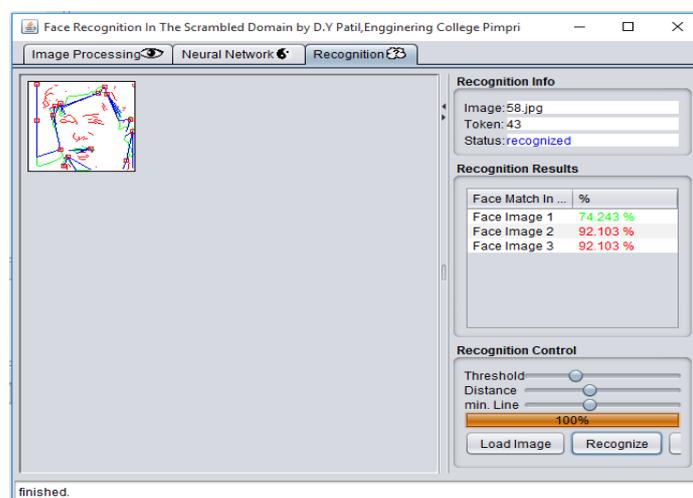


Figure 6. Matching Accuracy

For evaluation cause, we keep in mind the state of affairs of face isolation safety. in spite of our approach may be implemented to a diversity of photograph glad, human faces are notably used for difficulty reputation. In our imitation test, we carried out the projected filter out to a separation of approximately 200 faces from the special of Faces and one of a kind principles for the scrambling strength restriction λ .

In scrambled images area has one of a kind forms of datasets are used. In all datasets have exceptional size capable photographs are available. In scrambled pictures accuracy and overall performance to be had in best of images and length. If image excellent is low then now not come across to proper facial

attribute in gadget. In current system has detected to the face in herbal pix. However it has low accuracy and efficiency fee in our set of rules.

Table 1. Method Result

Method	PCA	KPCA	LDA	KLDA	LLP	MK-RDA
Accuracy	76.0	76.0	80.0	81.5	83.1	90.1

In above table has show the different styles of approach and its accuracy degree. It compares the distinctive approach which has used to In exclusive datasets has extraordinary accuracy discover. due to the fact each datasets picture length and nice are modified. picture scrambled domain are dependable into image nice due to the fact many time noise pictures are available for detection so facial characteristic are not detected well. To discover facial attribute we used to facial algorithm which has locate precisely all sensitive facial attribute.

Table 2. Result for ORL Dataset

Method	PCA	KPCA	LDA	KLDA	LLP	MK-RDA
Accuracy	75	75	77	80	85	92

Above end result for ORL datasets which pictures are better satisfactory for PIE datasets so routinely elevated accuracy of device. System is implemented up to First, in the system images are stored to directory for the matching purpose which is called dataset and path of the image stored into the database. From the file browser image is to given as input for the further processing. After getting image to the system, it first preprocesses the image. After Preprocessed image, image processing operations to be done on the image.

6. CONCLUSION

We have got located the issues related to the scrambled pictures for the duration of the biometric healing of pictures. For that we advanced a brand new technique – Many-Kernel Random Discriminant analysis (MK-RDA) for scrambled face reputation. We extensively utilized a salience-conscious face recognition scheme which can work with chaotic patterns in the scrambled domain. Which extract unique pattern and used to more than one kernel to find similar ranking of datasets facial pictures

REFERENCES

- [1] Richard Jiang, Somaya Al-Maadeed, Ahmed Bouridane, Danny Crookes. "Face Recognition in the Scrambled Domain via Saliency-Aware Ensembles of Many Kernels". *IEEE Trans of Information* vol 11, no 8, Aug 2016.
- [2] Perakis, P.; Passalis, G.; Theoharis, T.; Kakadiaris, I.A. "3D Facial Landmark Detection under Large Yaw and Expression Variations", *IEEE Trans Pattern Analysis and Machine Intelligence*, 2013; 35(7): 1552 – 1564.
- [3] Taheri, S., Patel, V.M., Chellappa, R. "Component-Based Recognition of Faces and Facial Expressions", *IEEE Trans Affective Computing*, 2013; 4(4): 360 - 371.
- [4] Singh, A.; Karanam, S.; Kumar, D. "Constructive Learning for Human-Robot Interaction", *IEEE Potentials*, 2013; 32(4): 13 – 19.
- [5] McDuff, D. Kaliouby, R.E. Picard, R.W. "Crowdsourcing Facial Responses to Online Videos." *IEEE Trans Affective Computing*, 2012; 3(4): 456 – 468.
- [6] Y. Rahulamathavan, R. C.-W. Phan, J. A. Chambers, D. J. Parish. "Facial Expression Recognition in the Encrypted Domain Based on Local Fisher Discriminant Analysis", *IEEE Tran. Affective Computing*, 2013; 4(1): 83-92.
- [7] Ping Liu, Shizhong Han, Zibo Meng, Yan Tong. "Facial Expression Recognition via a Boosted Deep Belief Network", CVPR 2014.
- [8] Y. Rahulamathavan, R. C.-W. Phan, J. A. Chambers, D. J. Parish. "Facial Expression Recognition in the Encrypted Domain Based on Local Fisher Discriminant Analysis", *IEEE Tran. Affective Computing*, 2013; 4(1), 83-92.
- [9] T. Honda, Y. Murakami, Y. Yanagihara, T. Kumaki, T. Fujino. "Hierarchical image-scrambling method with scramble-level controllability for privacy protection," Proc. IEEE 56th International Midwest Symposium on Circuits and Systems (MWSCAS), 2013, pp.1371-1374.
- [10] Lin Y Y, Liu T L, Fuh C S. "Multiple kernel learning for dimensionality reduction. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2011, 33(6): 1147-1160.
- [11] Z. Erkin, M. Franz, J. Guajardo, S. Katzenbeisser, I. Lagendijk, T. Toft, "Privacy-Preserving Face Recognition," Proc. Ninth Int'l Symp. Privacy Enhancing Technologies (PETS '09), 2009, pp.235-253.
- [12] Jayatilake, D.; Isezaki, T.; Teramoto, Y.; Eguchi, K.; Suzuki, K. "Robot Assisted Physiotherapy to Support Rehabilitation of Facial Paralysis", *IEEE Trans Neural Systems and Rehabilitation Engineering*, 2014; 22(3): 644 - 653.
- [13] J. Wright, A. Yang, A. Ganesh, S. Sastry, Y. Ma. "Robust Face Recognition via Sparse Representation," *IEEE Trans. Pattern Analysis and Machine Intelligence*, 2009; 31(2): 210-227. Also see CVPR 2014.
- [14] A. Melle, J.-L. Dugelay. "Scrambling faces for privacy protection using background self-similarities," Proc. 2014 IEEE International Conference on Image Processing (ICIP), 2014: 6046-6050.
- [15] Fleck, S.; Strasser, W. "Smart Camera Based Monitoring System and Its Application to Assisted Living", Proceedings of the IEEE, 2008; 96(10) Oct: 1698 – 1714.
- [16] Y. Wang, T. Li, "Study on Image Encryption Algorithm Based on Arnold Transformation and Chaotic System." Proc. 2010 International Conference on Intelligent System Design & Engineering Application, 2010: 449-451.