

AN APPLICATION TO HUMAN FACE PHOTO-SKETCH SYNTHESIS AND RECOGNITION

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ABSTRACT

Today in Modern Society Face Recognition has gained much attention in the field of network multimedia access. After the 9/11 tragedy in India, the need for technologies for identification, detection and recognition of suspects has increased. One of the most common biometric recognition techniques is face recognition since face is the convenient way used by the people to identify each other. In this paper we are going to study a method for representing face which is based on the features which uses geometric relationship among the facial features like mouth, nose and eyes. Feature based face representation is done by independently matching templates of three facial regions i.e eyes, mouth and nose. Principal Component Analysis method which is also called Eigen faces is appearance based technique used widely for the dimensionality reduction and recorded a greater performance in face recognition. Here we are going to study about PCA followed by Feed Forward Neural Network called PCA-NN.

KEYWORDS: Face Recognition, PCA, Neural Network.

I. INTRODUCTION

Face is a very important part of the human body through which and individual can be identified. The Face is a primary focus in the society and it plays a major role in conveying identity and emotions of an individual. Other than identical twins every individual has unique facial features. Facial recognition is a form of computer vision which uses human faces to attempt to identify an individual or verify a person's claimed identity.

Face recognition has become an important issue in many applications such as security systems, credit card verification, criminal identification etc. Even the ability to merely detect faces, as opposed to recognizing them, can be important. Although it is clear that people are good at face recognition, it is not at all obvious how faces are encoded or decoded by a human brain. Human face recognition has been studied for more than twenty years. Developing a computational model of face recognition is quite difficult, because faces are complex, multi-dimensional visual stimuli. Therefore, face recognition is a very high level computer vision task, in which many early vision techniques can be involved. In Face recognition, there are two techniques-verification and identification. During verification the system compares the individual with who they say they are and gives the decision yes or no. and in Verification the system compares the individual with all other individual present in the database and gives the ranked list matches.

This paper will gives introduction about literature analysis, how the system will work, working of PCA algorithm, working of Neural N/w system, comparison of PCA & NN, & Result of the system.

II. LITERATURE ANALYSIS

Face recognition has attracted great attention in recent years. An important application of face recognition is to assist law enforcement. Automatic retrieval of photos of suspects from police mug-shot database can help the police narrow down potential suspects quickly. However, in most cases, the photo image of a suspect is not available. The best substitute is often a sketch drawing based on the recollection of an eyewitness.

However, due to the great difference between sketches and photos, and the unknown psychological mechanism of sketch generation, face sketch recognition is much more difficult than the normal face recognition based on photo image. During the past three decades, many face recognition techniques have been proposed, however, few face sketch recognition systems can be found effective.

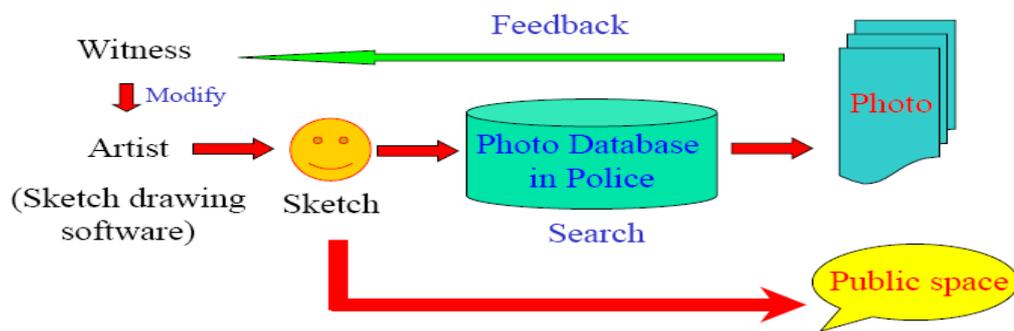
There are so many methods to do face recognition like PCA, LDA, and NN etc. Now a day's important of face recognition and application on face recognition goes on increasing. Literature says that market of Bio-metric application is now in huge demand.eg. Multimedia management, Security, Smart card, Banking etc. each and every sector have great importance of face recognition. The attractiveness of NN is due to its non linearity in the n/w hence the feature extraction method will be more effective than LDA. One of the first artificial (ANN) technique use for face recognition is single layer adaptive network called WISARD. Face recognition is an important research problem spanning numerous fields and disciplines. This because face recognition, in addition to having numerous practical applications such as bankcard identification, access control, Mug shots searching, security monitoring, and surveillance system, is fundamental human behavior that is essential for effective communications and interactions among people.

III. PROPOSED SYSTEM

Face Photo Sketch Recognition & Synthesis was proposed for recognizing face in straightforward way. This technique is used to overcome the difficulty of matching photos & sketches in 2 different *modalities*. It was developed mainly for *security purposes* thus used in *LAW ENFORCEMENT*.

Automatic retrieval of photos of suspects from police mug-shot database can help the police narrow down potential suspects quickly. However, in most cases, the photo image of a suspect is not available. The best substitute is often a sketch drawing based on the recollection of an eyewitness. Therefore, automatically searching through a photo database using a sketch drawing is very useful. It will not only help the police to locate a group of potential suspects, but may also help the witness and the artist to modify the sketch drawing of the suspect interactively based on the similar photos retrieved.

The key objective for sketch-based face photo recognition is to reduce the difference between the two modalities i.e. to bring photo & sketch into same mode so that recognition process become easier. It can also be used in many other fields where photo is not available but we can describe the details of the photo. This method significantly reduces the difference between photo and sketch. We show that the synthesized sketch by the any of this method transformation is a good approximation to the real one when the transformation procedure can be approximated as linear.



Search for suspects from photo database using sketch drawing

Fig1: Task Done By the Witness for Face Recognition

STEPS INCLUDED IN TASK DESCRIPTION

- Step 1: Here, the witness gives his description about the criminal to the artist
- Step 2: The Artist draws the sketch as per the witness description.
- Step 3: The Sketch obtained is compared with the photos present in the police database.
- Step 4: Average of all photos matching with the sketch is taken out.
- Step 5: Those Photos are given to witness so that he/she can exactly find out the criminal

IV. GENERAL FRAMEWORK OF FACE RECOGNITION SYSTEM

Face recognition software is based on the ability to recognize a face and then measure the various features of the face.

Regardless of any specific method, face recognition comprises of five steps

1. Acquiring the image of individual face using photograph or live picture of the individual.
2. Location the face in the image
3. Analysis of facial image according Eigen face.
4. Comparison of face by average of Eigen faces.
5. Declaration of match or no match

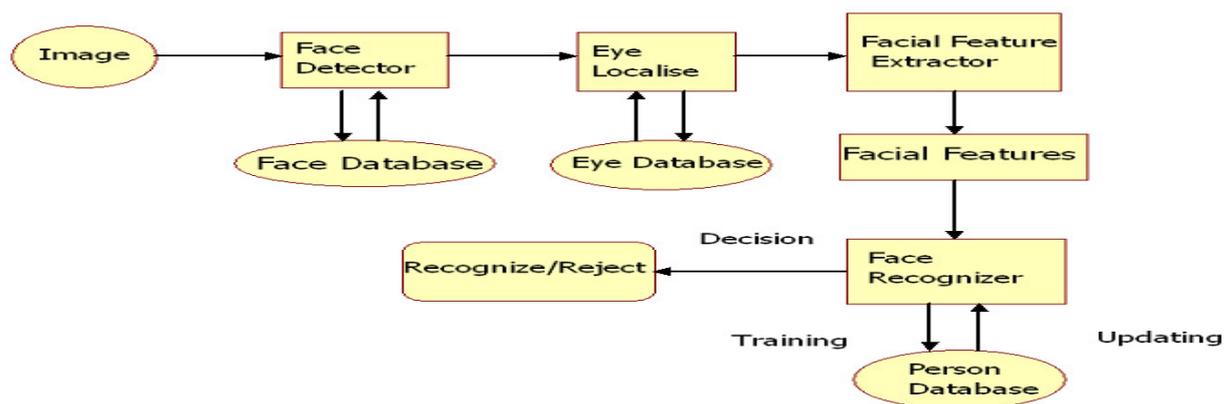


Fig2: General Framework of Face recognition System

V. SYSTEM BLOCK DIAGRAM

System Block Diagram for face recognition using PCA is as shown in fig. In to this architecture we convert data base photo in to sketch by using PCA algorithm (by using above steps).Then this sketch is converted into train sketch. The Train sketch is then compare with sketch drawn by the Artist. Then find out the maximum match that will be our result.Fig.3 gives the system block dig. of system.

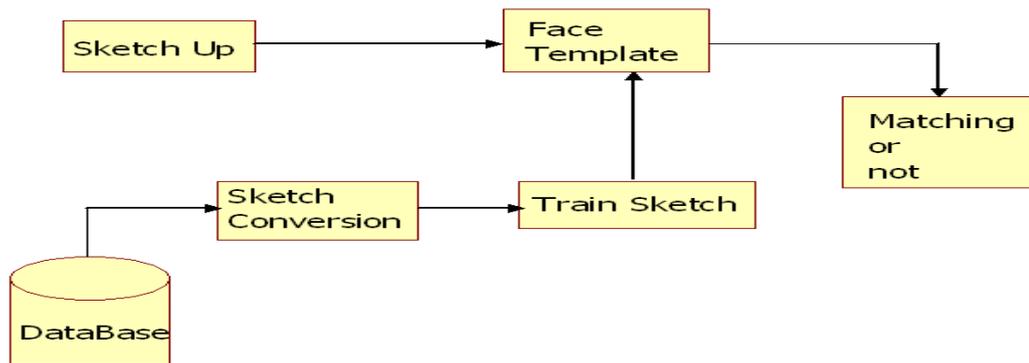


Fig3: System block diagram

VI. PRINCIPAL COMPONENT ANALYSIS (PCA)

Now let us see how PCA algorithm works. Here faces from database are selected one by one. Then face image is removed from photo excluding background detail. Then face image is converted into sketch, by using PCA sketch is then converted into Eigen Face by considering the intensity of image. In this way average of all Eigen faces is found out. Now convert artist sketch into Eigen face & mix it with average of all faces from databases. Now find out the maximum match of two faces which will be the output. Here sketch is converted into Eigen face which is then compared with the sketch which is generated from photo from the criminal record of police. The face region is divided into overlapping patches. During sketch synthesis, for a photo patch from the face to be synthesized, we find a similar photo patch from the training set and use its corresponding sketch patch in the training set to estimate the sketch patch to be synthesized. Underlying assumption is that, if two photo patches are similar, their sketch patches should also be similar.

As we can see in Fig.4 first the sketch which is to be compared is converted into Eigen face & parallel images in the database are converted into sketches, & sketches are then converted to Eigen faces. Now the Eigen faces are mixed up with the sketch which is to be compared & find the average of this which two images we get is the result of this PCA framework.

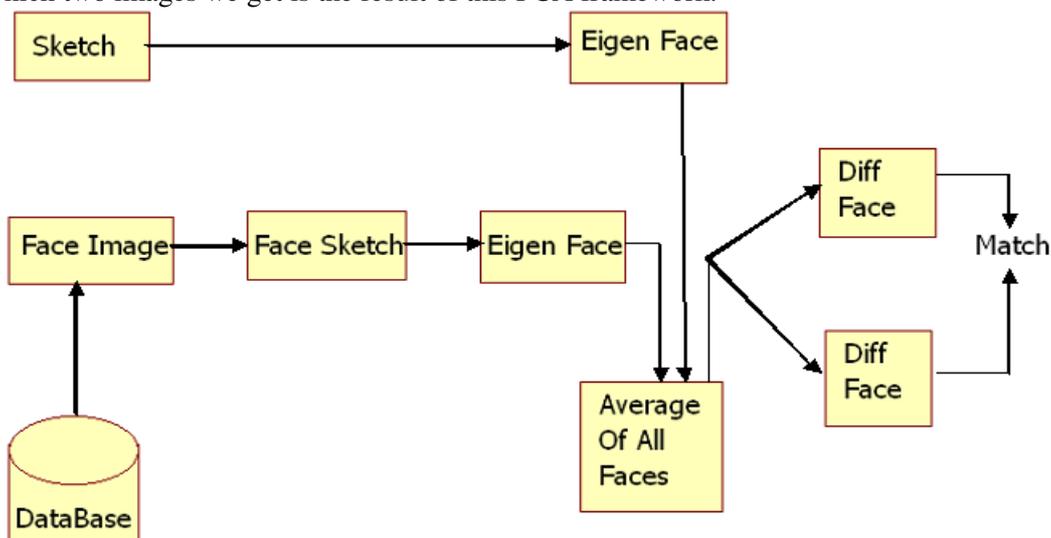


Fig4: Face recognition with eigenface.

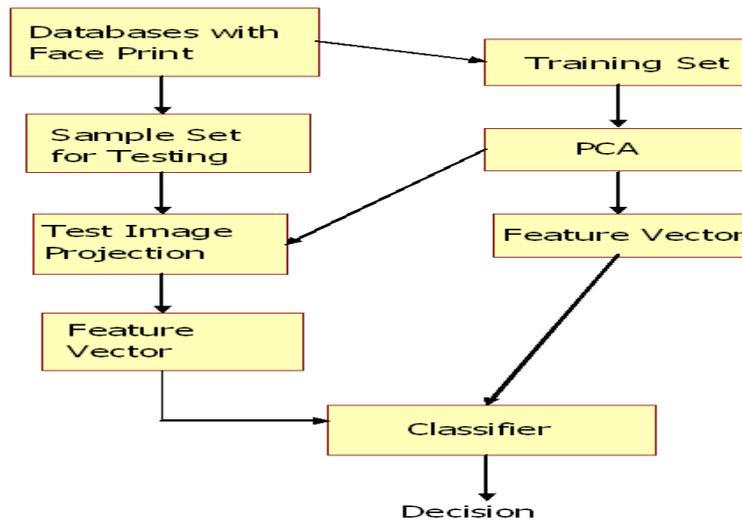


FIG 5: PCA Approach for Face Recognition

VII. NEURAL NETWORKS

Neural networks importance has increased due to massive parallelism in its structure. It has a high computation rates and it provides a great alternative with other conventional classifiers and decision making systems. A successful face recognition method depends heavily on the choice of the features used by the pattern classifier. The back propagation is the best known and widely used learning algorithm in training multilayer perceptions (MLP). The MLP refer to the network consisting of a set of sensory units that constitute the input layer, one or more hidden layers of computation nodes and an output layer of computation nodes. The input signal propagates through the network in a forward direction from left to right and layer by layer. For even an image of moderate size however the network can be very complex and difficult to train.

A Feed forward Neural Networks is suitable structure for nonlinear separable input data. In FFNN model the neurons are organized in the form of layers. The neuron n one layer gets the input from the previous layer and feed their output to the next layer. In this type the neurons in the same or previous layers are not permitted for network connections. The training is performed by n poses from each subject and the performance testing is performed by $10n$ poses of same subject. After calculation the Eigen Faces using PCA the projection vectors are calculated for the training set and then used to train the neural networks. This architecture is called PCA-NN.

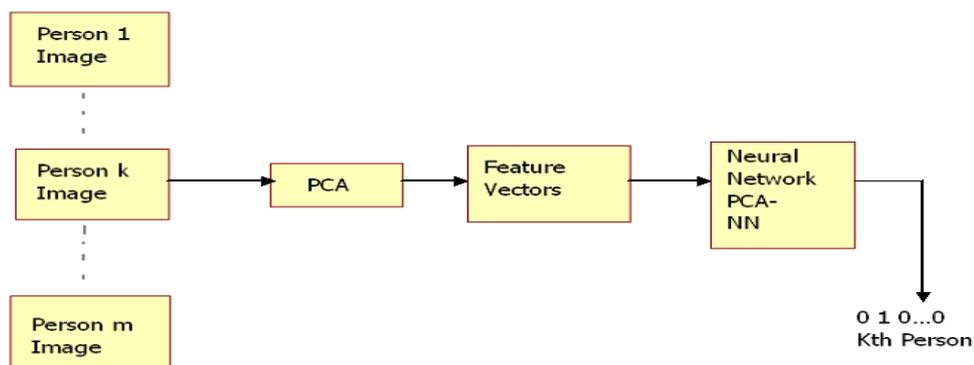


Fig6: Training Phase of Neural Networks

During the face sketch recognition stage, there are two options to reduce the modality difference between photos and sketches:

- 1) All of the face photos in the gallery are first transformed to sketches using the sketch synthesis algorithm and a query sketch is matched with the synthesized sketches, and
- 2) a query sketch is transformed to a photo and the synthesized photo is matched with real photos in the gallery.

VIII. RESULT

For testing purpose we have use ORL Face database. To convert the photo into sketch we used the 20 as edge parameter value and 30 as threshold value. For gating the result I used so many images stored in to data base & compare it with sketches. First I compare by using PCA algorithm then I used NN. & finally I got that result through NN is more reliable as compare to PCA.

Table:1 shows True acceptance & rejection Ratio.

No. of Faces used per person	Method	True Acceptance in %	True Rejection in %	False Acceptance in %	False Rejection in %
1	PCA	61.93	33.51	66.49	38.07
	NN	52.29	34.77	65.23	47.71
2	PCA	63.22	37.66	62.34	36.78
	NN	58.79	41.91	58.09	41.21
3	PCA	68.61	45.06	54.94	31.39
	NN	63.62	47.51	52.49	36.38
4	PCA	70.44	51.16	48.84	29.56
	NN	69.36	54.71	45.29	30.64
5	PCA	73.55	63.16	36.84	26.45
	NN	74.87	67.57	32.43	25.13
6	PCA	77.26	67.92	32.08	22.74
	NN	80.53	70	30	19.47
7	PCA	81.40	72.9	27.1	18.6
	NN	84.80	75.02	24.98	15.2
8	PCA	82.26	80.76	19.24	17.74
	NN	86.21	81.75	18.25	13.79
9	PCA	86.32	86.98	13.02	13.68
	NN	91.06	89.26	10.74	8.939

Here are some dig7, 8,9,10. which gives true Acceptance & Rejection of images in PCA & NN system.

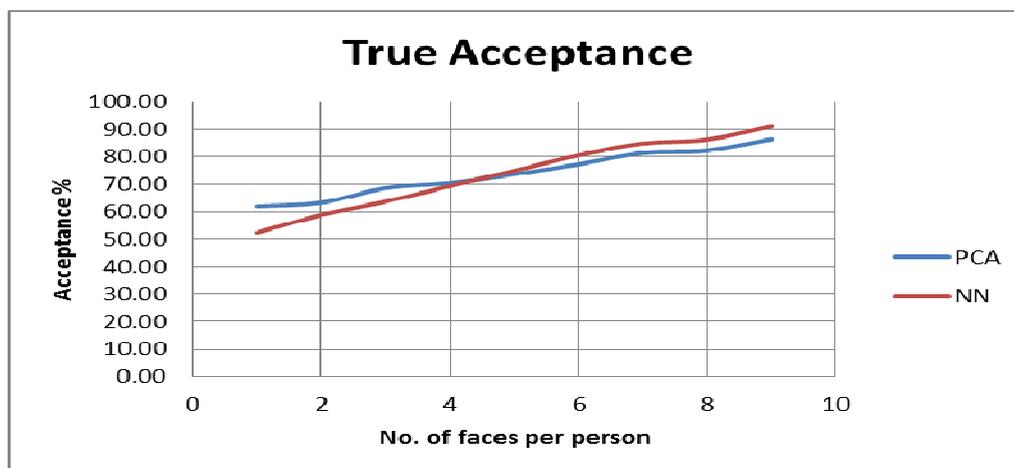


Fig.7. True Acceptance Ratio

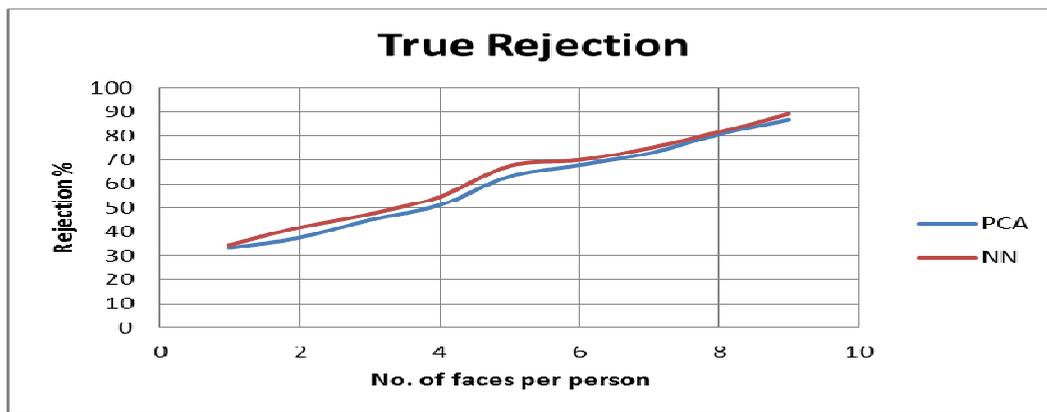


Fig.8. True Rejection Ratio

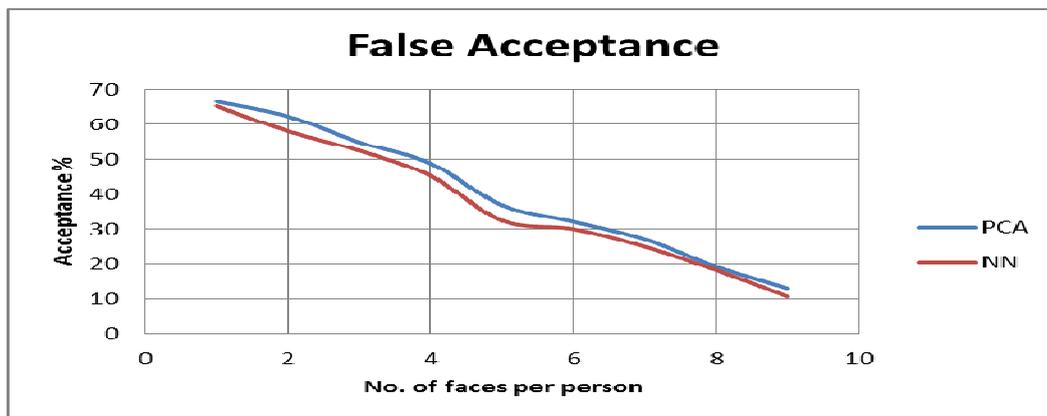


Fig.9. False Acceptance Ratio

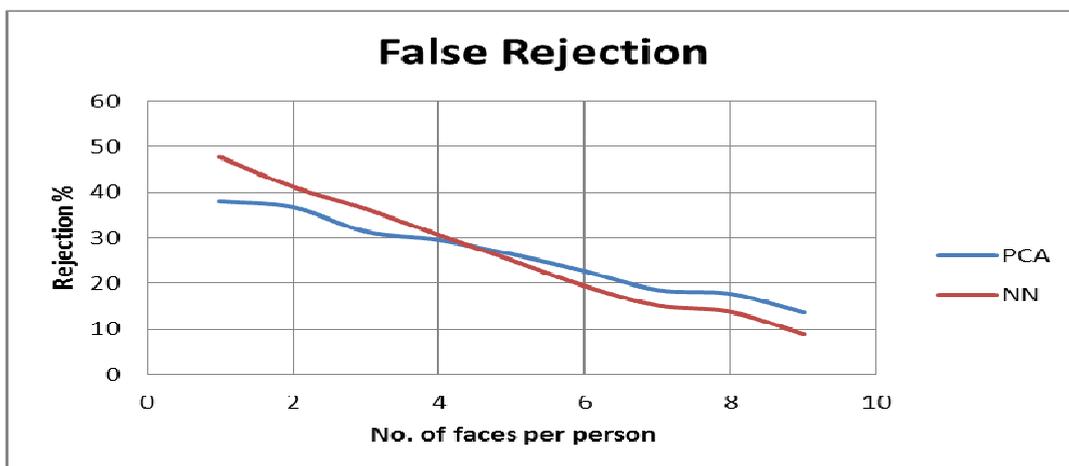


Fig.10. False Rejection Ratio

IX. CONCLUSION

Face Recognition Is a challenging as well as important recognition technique. It has great importance due to its friendliness. In this paper we have given an introductory survey for the face recognition technology, discussed about generic framework for face recognition. We have covered basics of neural networks used in face recognition. We hope this paper can provide the readers a better

understanding about face recognition. Face recognition can be applied in various fields like passport recognition, criminals list verification etc.

For gating the result I used so many images stored in to data base & compare it with sketches. First I compare by using PCA algorithm then I used NN. As we can see in initial phases result through NN was not good but after some time it goes on improving. While in PCA result through PCA in initial few phases was good but after in some later stages of operation it is degrading. Finally I got that result through NN is more reliable as compare to PCA.

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