Research Paper

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Face Recognition Capability of Global Feature and Local Feature Recognition Based Algorithms

Engineering

KEYWORDS : Database images, compression, reconstruction algorithms, probe images, approximation, results.

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ABSTRACT

In this work, 100 images were taken from the FERET data base and stored as data base compressed images using several compression levels. Then this compressed data base images reconstructed back to the original size using two algorithms, one based on global feature recognition that is PCA and the other based on the local feature recognition that is LBP. These reconstructed data base images compared with the probe images. These re reconstructed images will not be the same quality as that of the original image even though they are the same size. This is because, the re reconstructed images are only an approximation. 8 different approximation methods are used to reconstruct the data base images. In this work, it is tested that which reconstructing algorithm produces good results compared to the others.

Introduction:

Image recognition relies on the quality of image and image processing plays a key role in producing or modifying the required quality of the image. Of the image recognition applications available, face recognition is one of the important applications and others include pattern recognition and object recognition [1-4]. Face recognition is getting popular these days due to the growing usage of social networking sites by the public.

Face recognition is also important in the national security related applications. For example, at airports security personal need to pull the files of the people when an image is presented to the face recognition system. The quality of the image that is going to be presented to the user can be varied to the required quality by using suitable hardware and software applications. But the images that are already stored in the database have a predetermined quality and it cannot be varied to suit the application. Hence the images that are stored in the databases should be of good quality. But as the quality of the images increases, then the storage requirements also increases. Hence, for increasing the number of images that can be stored on a fixed memory, one can reduce the size of the image. That means, if the image is 200x100 originally, it can be stored by compressing it to 100x50 or even smaller. But as the size is decreased, the quality is lost when the image is reconstructed back to its original size. When images are compressed to say, 10% of its original size, and after the image is reconstructed, the quality of the image will be so poor that it will not be possible for a naked eye to recognize the face in the image.

Sometimes it is required to map a file to an image instead of a name. But, when some wants to access the file, it can be accessed only if someone knows the face that is present the associated image. Then it is possible connect the file to the name of the person whose face is present in the image. For security reasons, it is required to have the associated image to have the face with very poor quality in the image or it is intentionally blurred so that one cannot recognize who is the person that is present in the image.

It should be possible only for the face recognition system to identify the face in the image when presented with a probe image. In order to build such a system, the original images can be saved to smaller size and then reconstructed back to the original size. The features in the face are lost and naked eye cannot determine who the personal that is present in the image is.

In this work, it is verified to check if the face recognition algorithms, one based on the global feature recognition and the other based on local feature recognition can recognize the faces [5-9]. If so, to what level of compression these two algorithms can recognize the faces. For this purpose, PCA is chosen for the global feature recognition, and LBP is chosen for local feature recognition.

2.0 Image compression and reconstruction:

In this work, one hundred images were considered for the face recognition test to verify the abilities of the two algorithms, one based on global feature recognition i.e. PCA and the other based on the local feature recognition i.e. LBP. For this purpose, images were taken from the FERET database. The images are indexed in this research article based on the position of the images in Fig. 1. For example, 5^{th} image is the one which is 5^{th} in row 1 and 36^{th} image is the one which is 6^{th} in the 3^{rd} row and so on.

Figure 1: Images from FERET Database
The original images are of size 192x128 pixels.

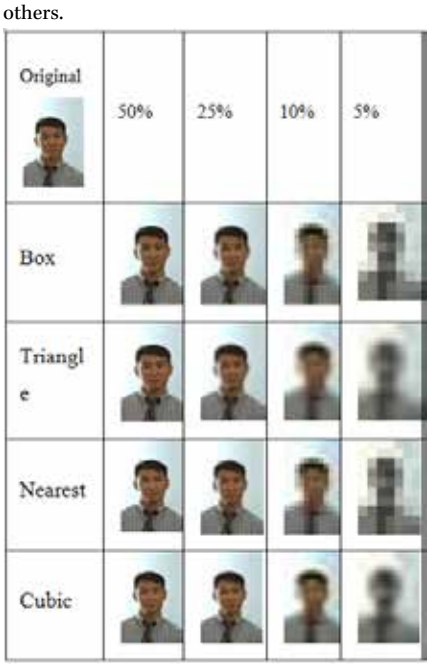
These images are compressed to 4 different compression ratios based on their size. They are:

Table 1: Size of images tested in this work

Model	Actual size with respect to original size	Number of rows	Number of columns
Original	100%	192	128
50%	50%	96	64
25%	25%	48	32
10%	10.40%	20	13
5%	5.20%	10	7

Images which were reduced in size using Box method to 50%, 25%, 10% and 5% are reconstructed back to the original size when it is being tested against the probe images which are of size 192x128 pixels. When the images are reconstructed, there are several options available how these images can be reconstructed back to the original size. But the reconstructed images will not of the same quality as that of the original image even though they are same size.

This is because, when the images re reconstructed back to original size, it is only an approximation. This approximation can be achieved through several ways. They are: Box, Triangle, Nearest, Cubic, Bilinear, Bicubic, Lanczos2 and Lanczos3. Each of these 8 methods produces different qualities of the images when the reconstruction takes place. In this work, it is tested that which reconstructing algorithm produces good results compared to the others.



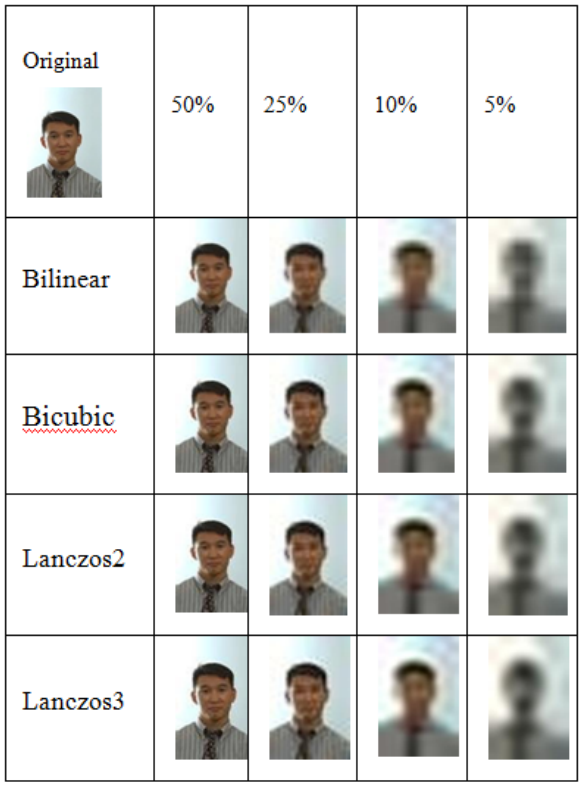
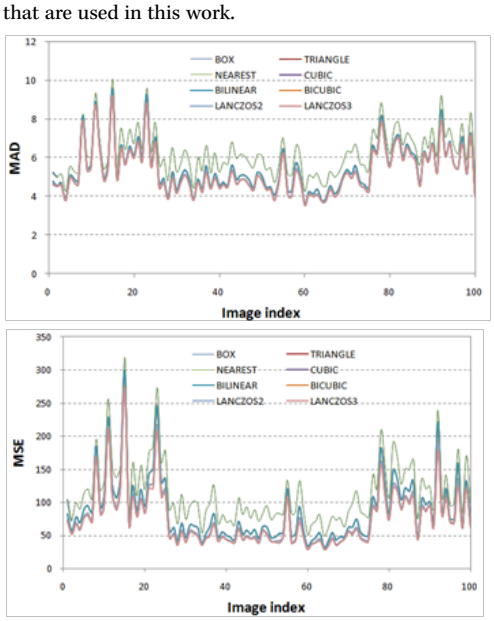


Figure 2: Reconstructed images of Image 10 after compressing it to 50%, 25%, 10% and 5% and reconstructing back to original size using several reconstruction method

Fig. 2 shows reconstructed images of Image 10 after compressing it to 50%, 25%, 10% and 5% and reconstructing back to original size using several reconstruction methods. It can be noticed from the Fig. 2 that there is severe loss of information in the reconstructed images and it impossible to visually recognize the images when the compression is less than 25%. In this work it is tested that how the PCA and LBP recognize these images. The loss of information from the reconstructed images is measured with four different metrics, namely, MAD, MSE, RMSE and PSNR. These metrics are plotted for all the four levels of compressions that are used in this work.



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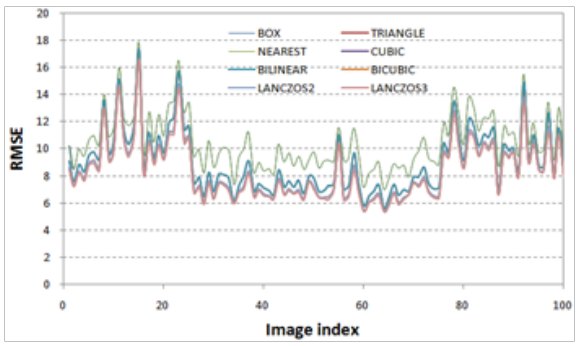


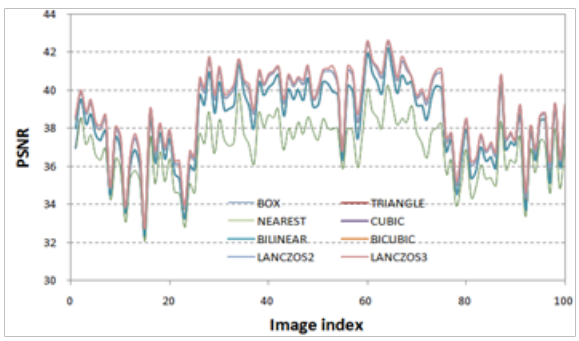
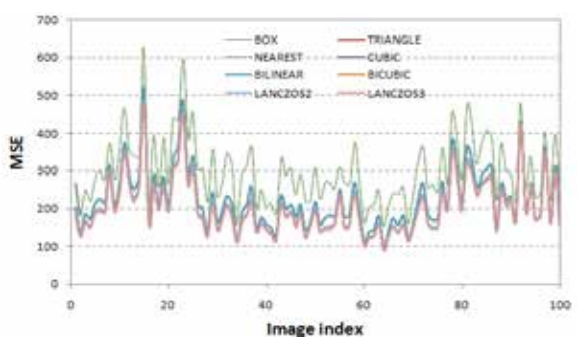
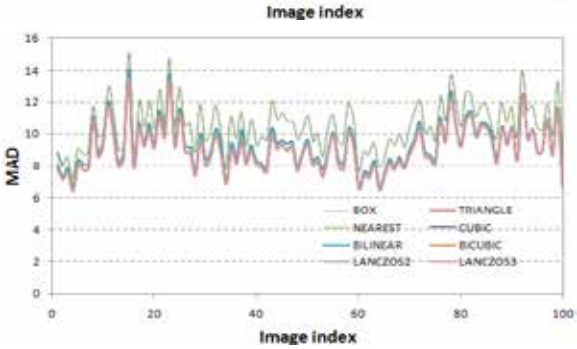
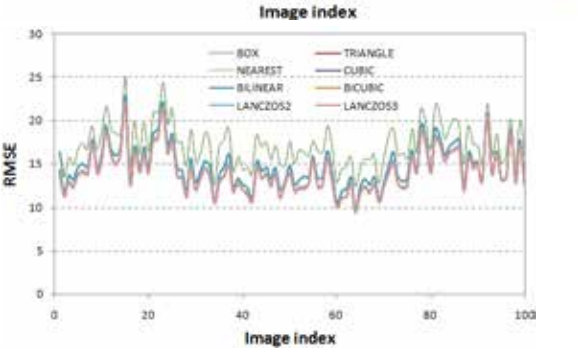


Figure 3: Metrics that show the comparison of the loss information with respect to their original images for 50% compression.







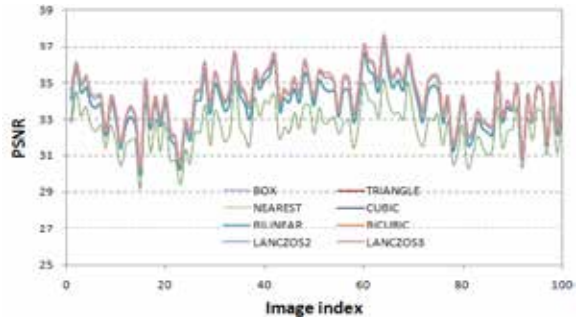
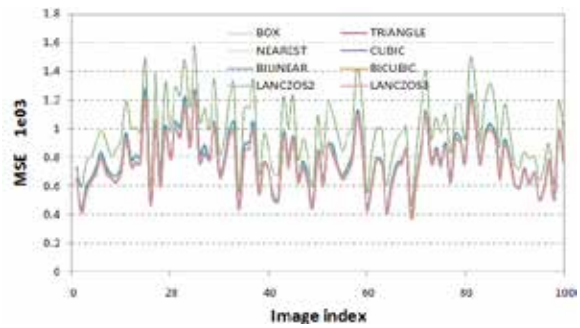
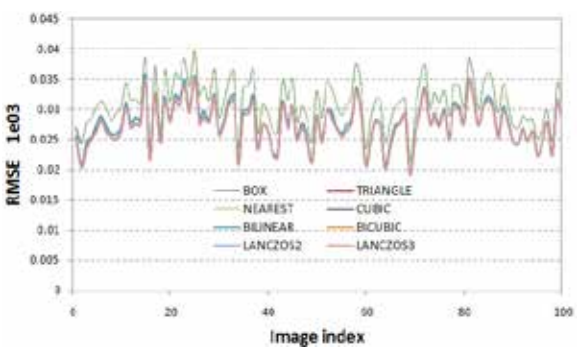
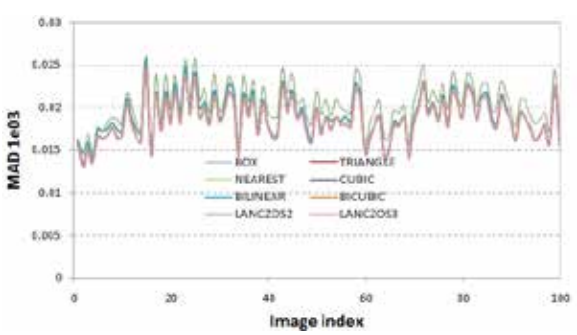


Figure 4: Metrics that show the comparison of the loss information with respect to their original images for 25% compression.







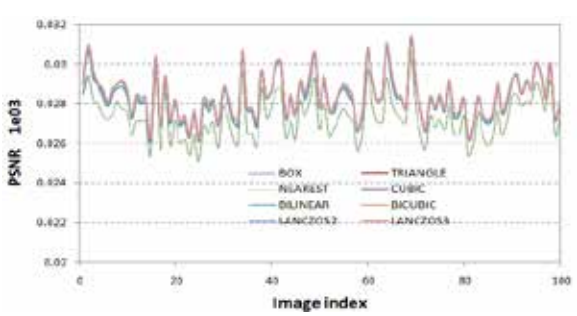


Figure 5: Metrics that show the comparison of the loss information with respect to their original images for 10% compression.

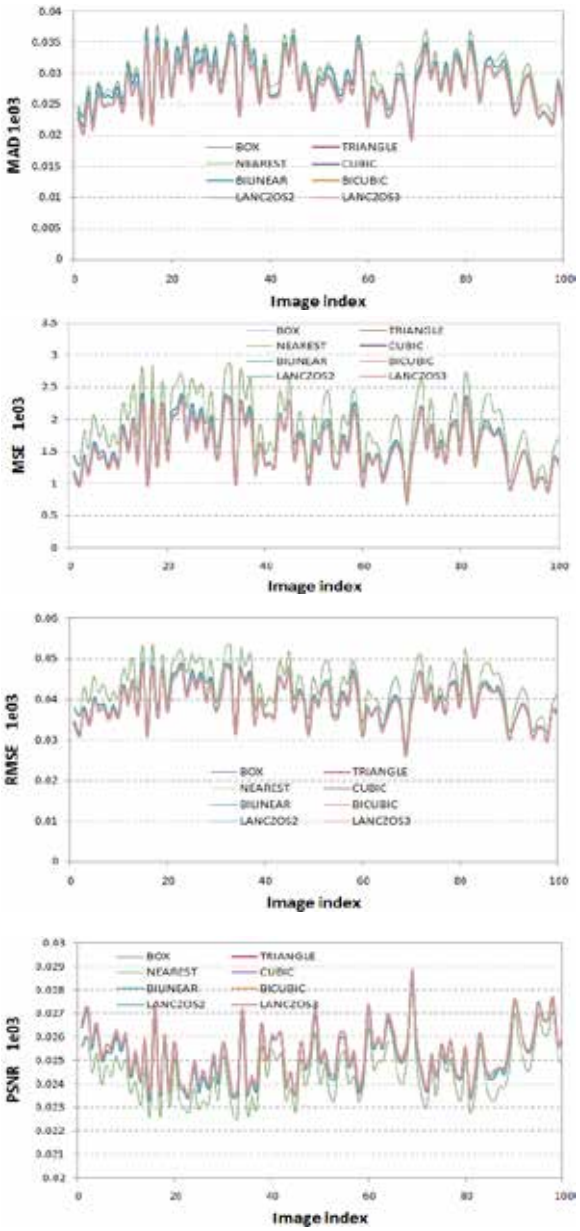


Figure 6: Metrics that show the comparison of the loss information with respect to their original images for 5% compression.

It is clear from the Figs. 3 to 6 that, the MAD, MSE, RMSE and PSNR charts show that the quality of the reconstructed images are getting poorer and poorer as the compression ration increases.

Image recognition: Images of smaller sizes are stored in the databases and those images are

Compared with the probe images which have a size of 192x128. But the smaller images are reconstructed in the algorithm to the size of 192x128 and they are tested against the probe images.

Each image from indices 1 to 100 is tested against its own probe image and verified if it actually recognizes. Based on this test, the following table is derived.

Table 3: Percentage recognition of the images for PCA and LBP algorithms for several reconstruction methods

PERCENTAGE RECOGNITION																
	IMAGE RECONSTRUCTION METHOD															
	BOX		TRIANGLE		NEAREST		CUBIC		BILINEAR		BICUBIC		LANCZOS2		LANCZOS3	
	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP
ORIGINAL	66	100	67	100	67	100	67	100	67	100	69	100	67	100	67	100
50% SIZE	65	100	65	100	65	100	65	100	65	100	66	100	66	100	65	100
25% SIZE	66	89	66	94	66	89	65	94	66	94	65	94	65	95	64	95
10% SIZE	55	25	57	51	55	25	59	52	57	51	59	52	59	52	61	45
5% SIZE	27	5	39	15	27	5	35	20	39	15	35	20	35	19	36	17

Table 3 shows the percentage recognition of the images for PCA and LBP algorithms. For example, images of 50% size are verified for face recognition against the original probe images. It can be seen that when BOX method is used for reconstruction, only 65 out of 100 images are successfully recognized with PCA and hence the percentage of recognition is 65%. Whereas, BICUBIC and LANCZOS2 methods yield 66% for the case of 50% size. Similarly for 25% size, the best yield comes from BOX, TRIANGLE, NEAREST and BILINEAR methods for PCA which is 66%.

For the case of 10% size, the best yield for PCA is from LANCZOS3 with 61%. For 5% size it TRINAGLE and BILINEAR methods for PCA with 39% recognition. One can observe that the PCA recognizes the images with original size itself with a recognition rate of 67%.

For LBP, when the sizes of the images are original size, then there is 100% recognition, which means all images are successfully recognized. Similarly, for images with 50% size are also recognized 100% with all reconstruction methods. When the size is 25% of original size, the recognition rate is 95% with LANCZOS2 and LANCZOS3 reconstruction methods.

When the size of the image is 10% of the original size, then recognition rate falls drastically to 52% with BICUBIC and LANCZOS2 methods. For 5% of the original size, CUBIC and BICUBIC methods yield 20%.

Compared to the PCA, the LBP has higher recognition rate when the size is near the original size and it fall drastically as the size is reduced. Percentage recognition varies from 20 to 100% when the size is varied from 5% to 100%.

The percentage recognition for PCA varies from 39% to 69% when the size of the image is varied from 5% to 100%. LBP yield good results when the size is above 25% of the original size and PCA yields good results when the size is below 25%. That means, global feature recognition algorithm yield good recognition rate when the size is less than 25% and local feature recognition is suitable for sizes more than 25%. This is because of the reason that when the size is less than 25%, the variation in pixels of features are lost when compressed and reconstructed back and hence LBP cannot yield a good success rate. BICUBIC reconstruction method produces good recognition rate if used with LBP and PCA.

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Table 4: Normalized percentage recognition of the images for PCA and LBP algorithms for several reconstruction methods

PERCENTAGE RECOGNITION OF SMALLER IMAGES WITH RESPECT TO ORIGINAL SIZE IMAGES																
	IMAGE RECONSTRUCTION METHOD															
	BOX		TRIANGLE		NEAREST		CUBIC		BILINEAR		BICUBIC		LANCZOS2		LANCZOS3	
	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP	PCA	LBP
ORIGINAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
50% SIZE	98.48	100	97.01	100	97.01	100	97.01	100	97.01	100	95.65	100	98.51	100	97.01	100
25% SIZE	100	89	98.51	94	98.51	89	97.01	94	98.51	94	94.2	94	97.01	95	95.52	95
10% SIZE	83.33	25	85.07	51	82.09	25	88.06	52	85.07	51	85.51	52	88.06	52	91.04	45
5% SIZE	40.91	5	58.21	15	40.3	5	52.24	20	58.21	15	50.72	20	52.24	19	53.73	17

The normalized percentage is computed by dividing the percentage recognition of image of original size with that of smaller size. It can be noticed that for PCA, when the CUBIC method is used for reconstruction, the normalized percentage varies from 100 to 52.24%, where as it is from 100 to 20% for LBP when CUBIC and BICUBIC reconstruction methods are used. The variation of recognition is too high in case of LBP than that of PCA.

Conclusions:

In this work, compared to the PCA, the LBP has higher recognition rate when the size is near the original size and it fall drastically as the size is reduced. Percentage recognition varies from 20 to 100% when the size is varied from 5% to 100%. LBP gives good results when the size is above 25% of the original size and PCA gives good results when the size is below 25%, the variation in pixels of features are back and hence LBP cannot yield a good success rate. BICUBIC reconstruction method produces good recognition for both LBP and PCA.

REFERENCE

[1] Zhao W., Chellappa R., Rosenfeld A., Phillips P.J., Face Recognition: A Literature Survey, ACM Computing Surveys, Vol. 35, Issue 4, December 2003, pp. 399-458 | [2] Zhong D., Defée I., Pattern Recognition in Compressed DCT Domain, Proc. of the 2004International Conference on Image Processing, ICIP'04, Vol. 3, Singapore, 24-27 October 2004, pp. 2031-2034 | [3] Biometric Data Interchange Formats - Part 5: Face Image Data, ISO/IEC JTC1/SC37 N506,ISO/IEC IS 19794-5, 2004 | [4] Face Recognition Format for Data Interchange, ANSI INCITS 385-2004, American NationalStandard for Information Technology, New York, 2004. | [5] Blackburn D.M., Bone J.M., Phillips P.J., FRVT 2000 Evaluation Report, 2001, available at: http://www.frvt.org/FRVT2000/documents.ht | [6] Brooks R.R., Grewe L., Iyengar S.S., Recognition in the Wavelet Domain: A Survey, Journal of Electronic Imaging, Vol. 10, No. 3, July 2001, pp. 757-784 | [7] Feng G.C., Yuen P.C., Dai D.Q., Human Face Recognition Using PCA on Wavelet Subband, Journal of Electronic Imaging, Vol. 9, No. 2, April 2000, pp. 226-233 | [8] Fonseca, P.; Nesvadha, J., Face detection in the compressed domain, Proc. of the 2004 International Conference on Image Processing, Vol. 3, 24-27 Oct. 2004, pp. 2015- 2018| [9] Moon H., Phillips P.J., "Computational and Performance Aspects of PCA-based Face recognition Algorithms", Perception, Vol. 30, 2001, pp. 303-321 |