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Report On Pyramidal Enhancement Algorithm for Air Images

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Abstract— Laplacian image pyramids based on the bilateral filter provide a good framework for image detail enhancement and manipulation. The difference images between each layer are modified to exaggerate or reduce details at different scales in an image. Some image compression file formats use the Adam7 algorithm or some other interlacing technique. These can be seen as a kind of image pyramid. Because those file format store the "large-scale" features first, and fine-grain details later in the file, a particular viewer displaying a small "thumbnail" or on a small screen can quickly download just enough of the image to display it in the available pixels so one file can support many viewer resolutions, rather than having to store or generate a different file for each resolution.

Keywords— PCA, Gaussian, PSNR, haze

I. INTRODUCTION

Image enhancement is basically improving the interpretability or perception of information in images for human viewers and providing `better' input for other automated image processing techniques. The principal objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and a specific observer. During this process, one or more attributes of the image are modified. The choice of attributes and the way they are modified are specific to a given task. Moreover, observer-specific factors, such as the human visual system and the observer's experience, will introduce a great deal of subjectivity into the choice of image enhancement methods. There exist many techniques that can enhance a digital image without spoiling it.

II. APPROVED OBJECTIVES

1. To purpose a new methodology for image fusion transformation.
2. To Analyse and Design purposed image fusion based upon pyramidal scheme.
3. To implement Laplacian pyramid and PCA for preserving edges in image fusion approach based upon pyramidal scheme.
4. To draw comparison between existing and proposed technique using various objective parameters such as Correlation, PSNR, MSE, STANDARD DEVIATION and ENTROPY.

III. OBJECTIVE ACHIEVED

1. To purpose a new methodology for image fusion transformation.
2. To analyse and Design purposed image fusion based upon pyramidal scheme.
3. To implement Laplacian pyramid and PCA for preserving edges in image fusion approach based upon pyramidal scheme.

III.1 OBJECTIVE 1

To purpose a new methodology for image fusion transformation. The prime objective of image enhancement is to modify attributes of an image to make it more appropriate for a given task and a specific observer. During this process, one or more attributes of the image are reformed. The choice of attributes and the way they are modified are specific to a given task. Moreover, observer-specific features, such as the human visual system and the observer's experience, will introduce a great deal of subjectivity into the choice of image improvement methods. There exist many techniques that can enhance a digital image deprived of spoiling it.

Gaussian Pyramid:A Gaussian pyramid is a method used in image processing, especially in quality synthesis. The method involves creating a series of images which are weighted down using a Gaussian average (Gaussian haze) and scaled down. When this method is used multiple times, it creates a stack of consecutively smaller images, with each pixel containing a local average that corresponds to a pixel neighbourhood on a lower level of the pyramid

Figure(Gaussian pyramid)

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III.2 OBJECTIVE 2

To Analyse and Design purposed image fusion based upon pyramidal scheme. The main scope of the proposed algorithm is to improve the accuracy of the flying image enhancement techniques. Different kind of the images will be taken for experimental purposes to evaluation the efficiency of the image improvement methods. Different kind of image quality metrics will be used to find the significant improvement of the proposed technique over the available techniques. The design and implementation of the proposed enhancement policy the MATLAB tool will be used. Various image quality metrics will also be considered to enhance the results further.

Laplacian Pyramid:A Laplacian pyramid is a method in image processing and uses the perception of pyramids. It is very similar to Gaussian pyramid with the alteration that it uses a Laplacian transform as a substitute of a Gaussian.A Laplacian pyramid can be used in image compression. In direction to reduce the large number of redundant evidence from Gaussian pyramid, it needs to find the difference between the head-to-head two images and get the band-pass filtered images; this set is the Laplacian Pyramid

Principle of Laplacian Pyramid: One effective and pellucid structure used to label image with multi-resolution is the image pyramid suggested by Burt and Adel son in 1983. The basic principle of this method is to decompose the inventive image into pieces of sub-images with different spatial resolutions through some mathematical operations. The Laplacian pyramid is derived from the Gaussian pyramid, which is a multi-scale representation obtained through a recursive low-pass filtering and decimation.

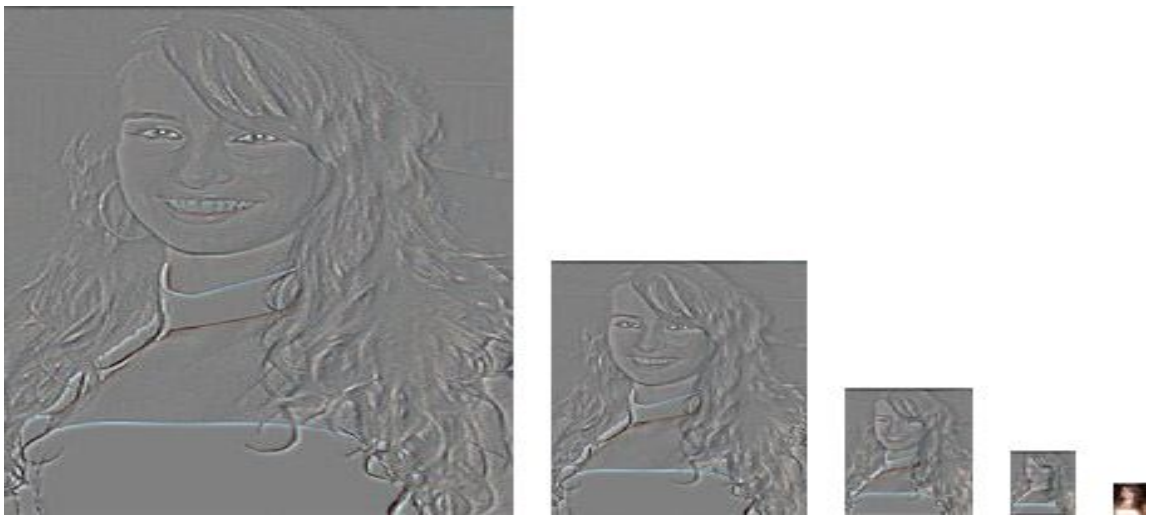

Figure (Laplacian pyramid)

Laplacian pyramid method contains different level of original image .These levels are achieved recursively by filtering the low level image with low-pass filter.

Before applying this approach we have to apply Gaussian pyramid for filtering each level of image by using low-pass filter and down sampling is done and as the level rises image is getting smaller and smaller. The equation of achieving upper level of Gaussian pyramid from the lower level is as follows:

$$GK = [\, w * GK\text{-}1]\downarrow 2$$

III.3 OBJECTIVE 3

To implement Laplacian pyramid and PCA for preserving edges in image fusion approach based upon pyramidal scheme. Image enhancement is basically improving the interpretability or perception of information in images for human viewers and providing `better' input for other automated image processing techniques.

PRINCIPAL COMPONENT ANALYSIS (PCA) FUSION METHOD

PCA is a scientific tool which transforms a number of correlated variables into a number of uncorrelated variables. The PCA is used widely in image compression and image classification. The PCA involves a mathematical procedure that transforms a number of correlated variables into a quantity of uncorrelated variables called principal components. It computes a compact and optimal description of the data set.

The PCA fusion scheme is similar to the Intensity Hue Saturation (HIS) fusion scheme:

(1) Perform IR to PAN and MS, and resample MS.
(2) Convert the MS bands into PC1, PC2, PC3… by PCA transform.
(3) Match the histogram of PAN to the histogram of PC1.
(4) Replace PC1 with PAN.
(5) Convert PAN, PC2, PC3 … back by reverse PCA.

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IV. IMPLEMENTATION OF OBJECTIVES

A new algorithm has been designed to remove the problem of shift variant, not preserve the edges of the object in the image, unsmoothens of image .The aim of image fusion is to combine relevant information from two or more source images into one single image such that the single image contains most of the information from all the source images. In this thesis previously we have used wavelet transformation but because of some problems like shift variant, not preserve the edges of the object in the image so to remove such kind problems we have designed a new algorithm. In this algorithm we have implemented laplacian pyramid with PCA. Laplacian pyramid smoothens the image and PCA to fuse the image.

IV.1 STATEMENT OF PROBLEM:

Image Fusion is a process of combining the relevant information from a set of images into a single image, where the resultant fused image will be more informative and complete than any of the input images. It is essentially used to derive or infer more reliable information. However, there is usually a point of diminishing returns after which more information provides little improvement in the final result. Some of the image fusion techniques like discrete wavelet transformation lead to some problems like shift variant and one of the major disadvantages is that it could not properly preserve the edges of the object in the image. So there is a need to use the algorithm to overcome these problem and smoothens the image after fusion.

IV.2 Proposed Algorithm:-

1. As we know that for fusing images we have to select two images which we want to fuse and the images which are to be chosen can be blurred images. So, choose the first image for fusing.
2. Now choose the second blurred image of your choice.
3. For fusing, the Gaussian pyramids of both the images are needed to be known. For that apply Gaussian Pyramids on both the images.
4. Create the different pyramids or level of both the images.
5. The Gaussian pyramid created will further help in creating the Laplacian Pyramids of the images selected. So, with the help of Gaussian Pyramids create Laplacian Pyramid of both the images.
6. From the Laplacian pyramid create the different levels of first image, select the top level of the pyramid for the first image selected.
7. Similarly, select the top level for the Laplacian Pyramid created of the second image selected.
8. The image fusing is done using PCA (Principal Component Analysis), so using this concept based on PCA of the top level of Laplacian Pyramid.
9. As now the blurred part of both the images are removed and a new image is formed which is not blur, so now reconstruct original image from Laplacian Pyramid.
10. Applying all these techniques a finally fused image is now obtained, which is the combination of both the images. The blurred part of both the images is removed in the finally fused image.

FLOW DIAGRAM

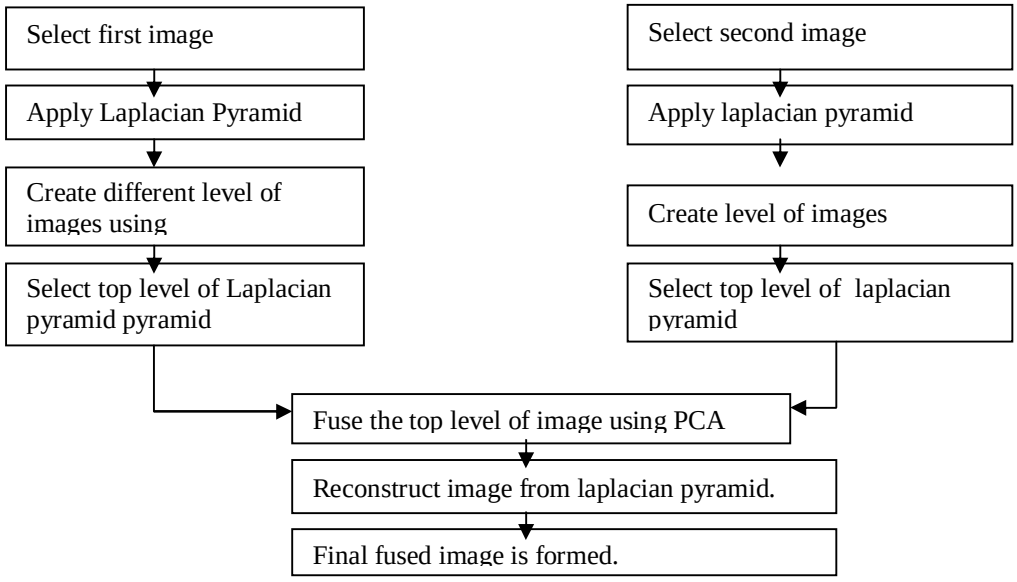

Figure 1:Proposed algorithm based upon the pyramidal scheme.

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V. EXPERIMENTAL SET-UP

In order to implement the proposed algorithm, design and implementation has been done in MATLAB using image processing toolbox. Result showed that our proposed approach gives better results than the existing techniques

Figure 2: The first input image which is uncleared on right side

Figure 3: The second input image which is uncleared on left side

After applying proposed pyramidal technique Figure 4 has shown the output results are quite effective and has much more better results than the available methods. Thus the proposed algorithm has shown quite significant improvement over the available methods.

Figure:4 Final Image

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VI. PERFORMANCE EVALUATION

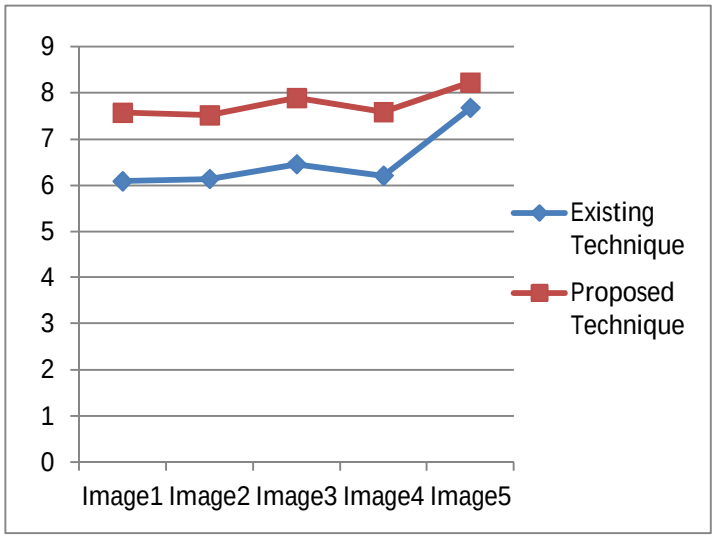
This section contains the cross validation between existing and proposed techniques. Some well-known image performance parameters for digital images have been selected to prove that the performance of the proposed algorithm is quite better than the existing methods.

VI.1 Entropy: Entropy is an index to evaluate the information size confined in an image. If the value of entropy becomes higher after fusing, it indicates that the information growths and the fusion performances are enhanced as shown in Table 1.

Table 1: Entropy Evaluation

Images	Existing techniques	Proposed techniques
1	6.09	7.57
2	6.14	7.52
3	6.46	7.89
4	6.21	7.59
5	7.68	8.23

Images	Existing techniques	Proposed techniques
1	34.12	58.39
2	29.31	52.06
3	31.34	56.12
4	33.54	57.12
5	39.02	60.14



VI.2 Standard Deviation(SD) : Standard Deviation measures the contrast in the fused imge. Fused image having high contrast would have high standard deviation as shown in Table 2.

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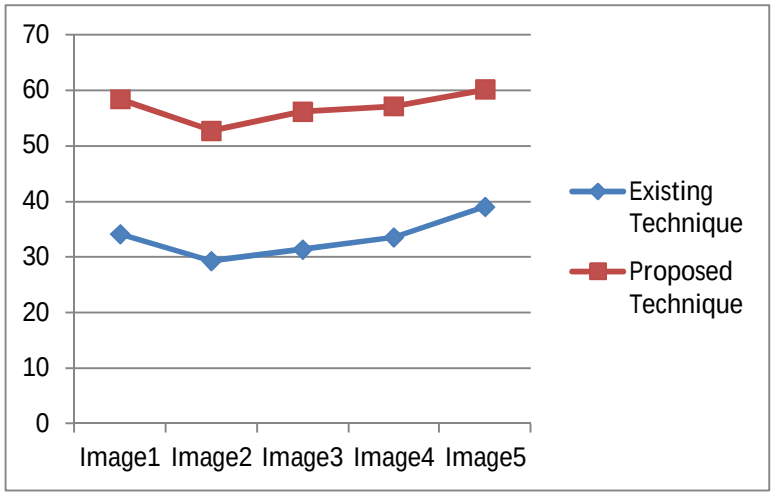
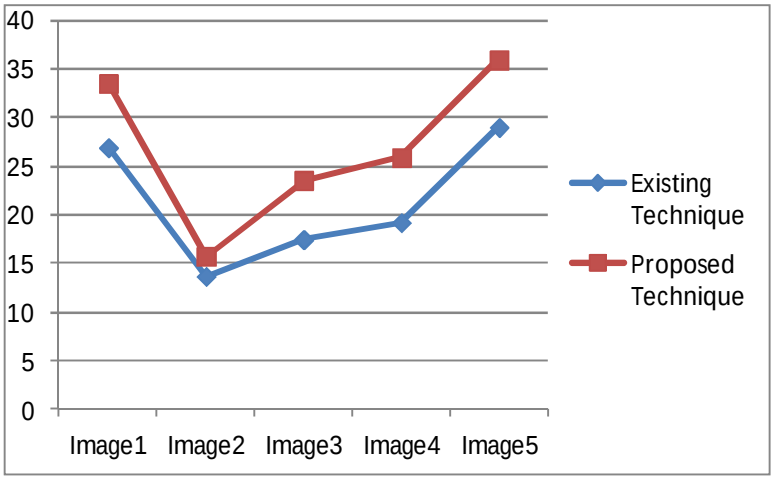


VI.3 Peak Signal to Noise Ratio: Peak signal-to-noise ratio is the ratio between the maximum possible power of a signal and the power of corrupting noise that affects the fidelity of its representation. As many signals have a wide dynamic range ,PSNR is generally expressed in terms of the logarithmic decibel scale. It is showing the comparative analysis of the Peak Signal to Noise Ratio (PSNR). As PSNR need to be maximized; so the main goal is to increase the PSNR as much as possible.

Table 3: PSNR Evaluation

Images	Existing techniques	Proposed techniques
1	26.92	33.53
2	13.68	15.75
3	17.48	23.56
4	19.21	25.89
5	29.01	35.95



VI.4 Mean Square Error

Mean Square error is a risk function corresponding to the expected value of the squared error loss or quadratic loss. It has shown the comparison among proposed and the existing strategy based on Mean squared error is showing the quantized analysis of the mean square error. As mean square error need to be reduced therefore the proposed algorithm is showing the better results than the available methods as mean square error is less in every case.

Table 4:MSE Evaluation

Images	Existing techniques	Proposed techniques
1	132	28.2
2	2627	1727
3	1178	596
4	784	390
5	874	484

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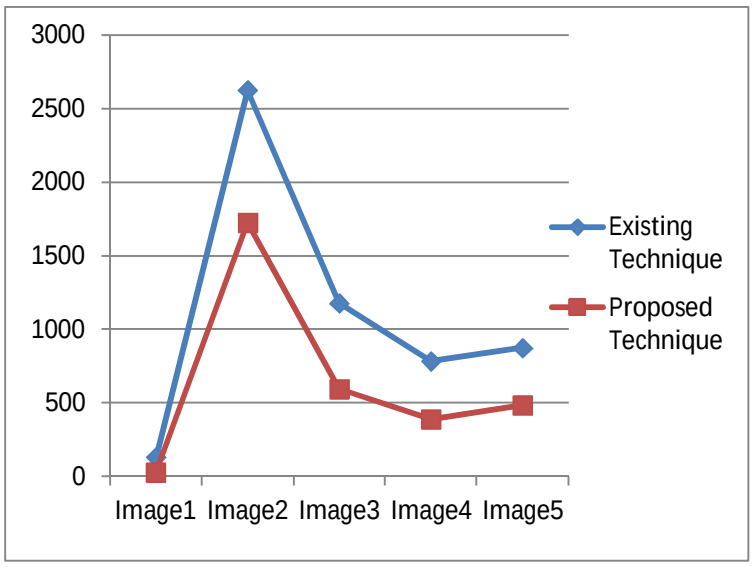

CONCLUSION

In order to implement the proposed algorithm, design and implementation has been done in MATLAB using image processing toolbox. Result showed that our proposed approach gives better results than the existing techniques.

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