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A New Algorithm for Image Fusion to reduce computational Time

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Abstract- Image fusion is a process to combine two or more images so that fused image becomes more informative than input images. Fusion process provides the spectral and spatial information of image. But main problem occurs of computational time when high resolution images are fused. So this paper describe a new algorithm that is based on wavelet transform in which transform is applied after forming the image into different Groups. This algorithm divides the complete image into different Groups and then comparing the images by finding the mean square error. By using the threshold value wavelet transform is applied to require groups. The transformed Groups are fused by using different fusion algorithms like averaging method, maximum or minimum pixel replacement fusion algorithm. By applying inverse of wavelet transform fused image is constructed which is more informative than the input images. The quality of fused image is find out by comparing the fused image by the original image by finding mean square error and peak signal to noise ratio. The whole process of fusion is applied on the complete image and also by using Grouping method then by finding the time parameters it can be conclude that the proposed algorithm reduces the computational time by 10 times to the existence method.

Keywords-DWT (Discrete Wavelet Transform), MSE (Mean Square Error), PSNR (Peak Signal to Noise Ratio).

Introduction

Image fusion is a process of combining two or more images to get one image which is more clear and informative than the input images. The fused image is more suitable for human vision and also for computer vision. Image fusion is a technique of combining data from remote sensing through image processing. The main purpose of image fusion is to improve the definition of image, enhancement of images and classifications. Image fusion has many applications such as object identification [1]. There are number of methods to fuse the images. The very basic method is high pass filtering but now a day wavelet transformation technique and Laplacian pyramid decomposition are mainly used. On the basis of fusion level fusion is of three types: Pixel level fusion, feature level fusion and decision level fusion. In pixel level fusion, fusion is done pixel by pixel manner and used to merge the different parameters. Feature level is used to recognize the object from various data sources. In

decision level data is extracted from different images separately and then decision is done. But pixel level fusion is mainly used because of its simplicity and linearity and used to detect undesirable noise, low complexity and fuses different images directly pixel by pixel to enhance the image. This method gives the more trueness of image and supply the information in details as compared to other methods. The basic principle of image fusion is to increase the required information only that's why by using different wavelet transforms low and high frequency components are split from the image so that the high frequency components can be neglected. By applying different wavelets each has their own advantages and disadvantages. Wavelet transform has a long series and can be applied for higher levels by which unwanted information can be reduced to large extent [2]. Fusion of images also reduce the data for storage so the memory requirement also reduces. But the main problem is to fuse two or more images is of computational time for the satellite or high resolution images because they requires high processing. In this paper the complete focus is on to reduce the computational time. The proposed algorithm becomes efficient in the reduction of computational time and the complexity.

Wavelet Transform

Wavelet transform is used to transform the image form time domain to frequency domain. So that Time and frequency both information are analysed [3]. Wavelet is nothing but the continuous signal which dies up after a particular time that is a waveform of limited duration and have zero average value.

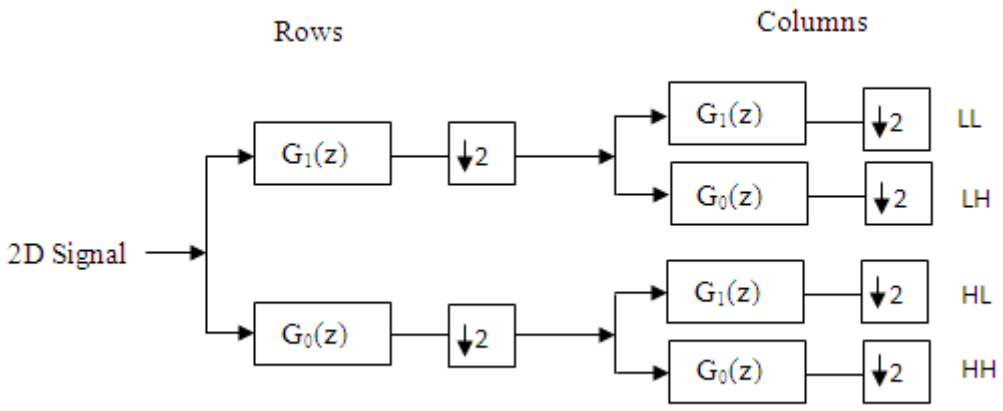


Fig. 1 Group diagram of Wavelet Transform

Wavelet transform is used to decompose the frequency components. In wavelet transform first row operation is applied on the image and then decimation factor is applied for down-sampling. By performing column operations approximation part LL is calculated. Similarly detail parts are calculated that are LH, HL and HH [4].

Fusion Algorithms

After applying wavelet transform fusion algorithms are used. For the fusion purpose averaging method, maximum pixel replacement method and minimum pixel replacement method are used. In averaging method just average of both the images has taken and in case of maximum pixel replacement method that pixel is considered for fusion whose value is greater and same as in minimum pixel replacement method. Maximum pixel replacement method can only be used for white shades images while minimum pixel replacement method can only be used for dark shades images [5].

Proposed Algorithm

As the name suggests grouping it means in this algorithm the complete process occurs on the Groups of images instead of the complete image. In this algorithm first the complete image is converted to the Groups of size m*m. Now each group of image react as different image and n number of Groups are constructed. For the further processing DWT is applied on each and every group and also the fusion rules that is each group of first image is fused with the corresponding group of second image. This method is mainly used to reduce the computational time and complexity as instead of processing single pixel it will process the m*m pixels at a time. The steps of grouping algorithm are given below:

I. Take two input images of size m x n, both the images are of same scene.
II. Convert the images in grey scale image as this is done on grey scale images only.
III. Convert both the images to the size which is multiple of 8 or 16.
IV. Convert both the images to the Groups with group size 8 * 8 or 16 * 16 and store images to cells.
V. Find mean square error of all the Groups of both the images.
VI. Apply a threshold value on calculated MSE of each group.
VII. Check the condition for MSE that is if MSE is less than threshold value then no need of fusion.
VIII. If MSE is greater than the threshold value then apply wavelet transform to those particular Groups.

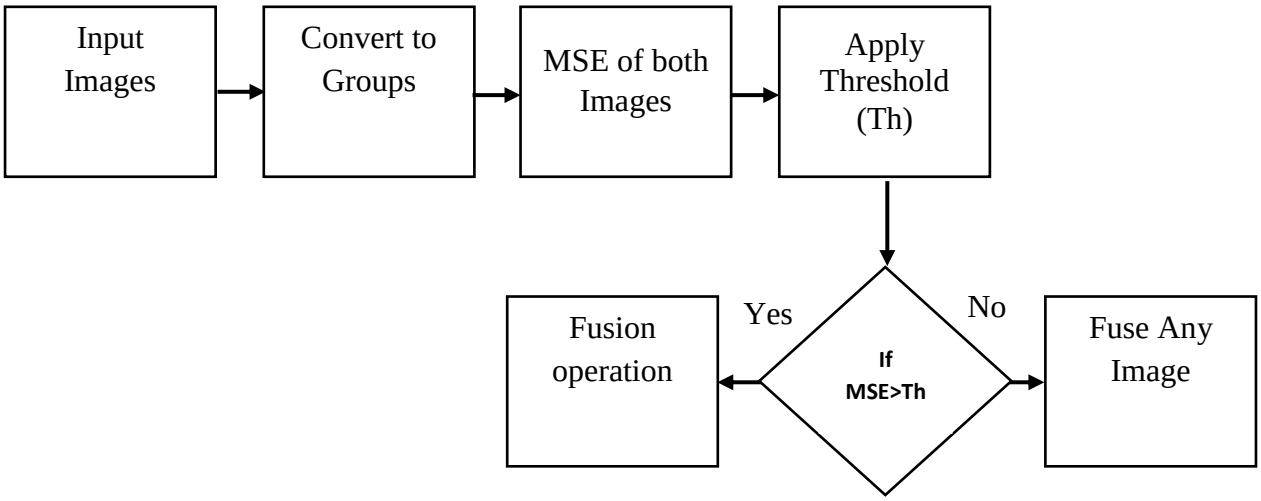
IX. Apply the fusion methods to each transformed Groups.

X. Take inverse wavelet transform of fused Groups.

XI. Store each group to the cell.

XII. Convert the image from cell to complete image.

XIII. Get the final fused image which is more informative then the input images.



Group Diagram of Grouping Algorithm

Results

Fusion Method	MSE	PSNR	Time(Sec.)	f_t	f_p	f_n
HaarGroup(8*8) Average	10.3822	37.9679	0.1920	5625	4590	1035
HaarGroup(8*8) MAX	11.8166	37.4059	0.1822	5625	4590	1035
HaarGroup(8*8) MIN	16.3605	35.9928	0.1896	5625	4590	1035
HaarGroup(16*16) Average	9.0037	38.5866	0.1276	1369	1094	275
HaarGroup(16*16) MAX	10.4275	37.9490	0.1261	1369	1094	275
HaarGroup(16*16) MIN	14.7585	36.4404	0.1309	1369	1094	275
Daub4(8*8) Average	10.1888	38.0496	0.2426	5625	4590	1035
Daub4(8*8) MAX	11.7179	37.4423	0.2701	5625	4590	1035
Daub4(8*8) MIN	16.2630	36.0188	0.2049	5625	4590	1035
Daub4(16*16) Average	8.6646	38.7533	0.1495	1369	1094	275
Daub4(16*16) MAX	10.2347	38.0300	0.2276	1369	1094	275
Daub4(16*16) MIN	14.7189	36.4521	0.1544	1369	1094	275
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Where f_t=total Groups, f_p= unfused Groups, f_s= fused Groups

Conclusion

After giving the brief theory and results it can be easily conclude that the proposed algorithm that is work on the Groups of images perfectly implemented to reduce the computational time for high resolution images. From all the above discussions it is clear that the image fused by Grouping algorithm can have low quality as compared to the complete image fusion method but it occurs to very low extent and also it can be reduce either by using high level

transformation or by increasing the group size. So the quality of fused image can be further improved but the problem of computational time reduces to large extent. The computational time acquired by proposed method is only 1msec, while existence methods acquirednear about 66sec.

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