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Image Merging in Transform Domain

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Abstract — This paper presents the three different image merging techniques and there comparative analysis. Idea of our project is to merge two images in transform domain using MATLAB. The various transform domains which are used for merging are Fast Fourier Transform (FFT), Discrete Cosine Transform (DCT) & Discrete Wavelet Transform (DWT). Our main aim would be merging two images using the above three domains. These two images which are to be merged are in actual blurred images. They are blurred in such a way that in first image some part on one side is blurred while in second image the other side is blurred. Image merging is required in several fields such as remote sensing using satellite imagery, biomedical, surveillance, military applications etc.

Keywords — Image Merging, Fast Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform

I. INTRODUCTION

An *image* is a visual representation of an object, a person, or a scene produced by an optical device such as a mirror, a lens, or a camera. This representation is two-dimensional (2D), although it corresponds to one of the infinitely many projections of a real-world, three-dimensional (3D) object or scene. In real sense, image merging can be defined as combination of two images. Merging provides good resolution and better quality of an image. The domains used are FFT, DCT & DWT. The Fast Fourier Transform is an important image processing tool which is used to decompose an image into its sine and cosine components. The output of the transformation represents the image in the Fourier or frequency domain, while the input image is the spatial domain equivalent. In the Fourier domain image, each point represents a particular frequency contained in the spatial domain image. The discrete cosine transform (DCT) helps separate the image into parts (or spectral sub-bands) of differing importance. The DCT is similar to the discrete Fourier transform: it transforms a signal or image from the spatial domain to the frequency domain. The discrete wavelet transform (DWT) is an implementation of the wavelet transform using a discrete set of the wavelet scales and translations obeying some defined rules. In other words, this transform decomposes the signal into mutually orthogonal set of wavelets. This is how these domains are used for image merging [1-8].

II. PROBLEM STATEMENT

Image merging is the process of combining or merging relative information from two or more images into a single image. The resultant image will contain more information than any of the input images. Several situations in image processing require high spatial and high spectral resolution in a single image. Most of the available equipment is not capable of providing such data convincingly. Image merging techniques allow the assimilation of different information sources. The merged image can have good resolution characteristics. However, the standard image merging techniques can distort the spectral information of the multispectral data while merging. Since many methods exist to perform image merging. The methods are as FFT, DCT, DWT, PCA, etc.

III. FLOWCHART

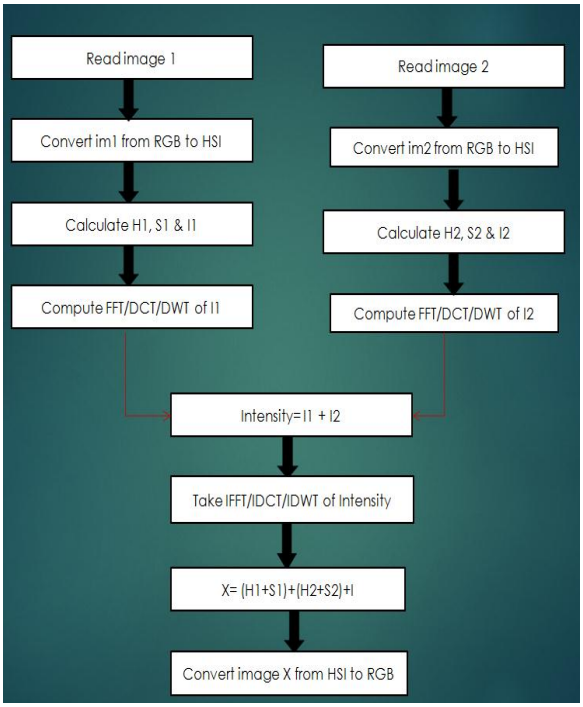

Figure: 1, Flow chart

IV. ALGORITHM

The algorithm of image merging using FFT, DCT & DWT has following common steps applicable to proposed methods of merging:-

1: Read two images which are to be merged.
2: Convert these two images from RGB to HSI.
3: Find FFT/DCT/DWT of intensity of both the images and add them
4: Find the IFFT/IDCT/IDWT of added intensities
5: Add hue & saturation of both the images.
6: Add step 4 and step 5.
7: Now convert back the image obtained in step 6 to RGB.

V. STATISTICS OF AN IMAGE

To measure the quality of fused images different parameters are measured.

1. Entropy (H): The image entropy is an important indicator for measuring the image information richness.
2. Variance: It is used to find how each pixel varies from the neighbouring pixel.
3. Mean: It gives the contribution of each pixel intensity of an entire image.
4. Standard Deviation (σ): It measures the contrast in the fused image. An image with high contrast would have a high standard deviation.
5. Peak Signal to Noise Ratio (PSNR): PSNR measures the quality of a reconstructed image with respect to the reference image.
6. Fusion Factor: The value of fusion factor shows how well the image is merged.

Figure 1. Image 1

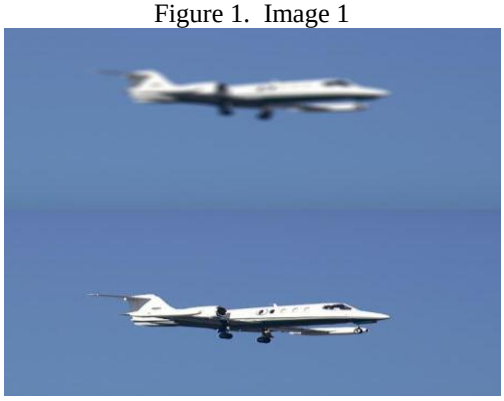

Figure 2. Image 2

Figure 3.Merged Image using figure 1 and 2.

VI. RESULTS AND DISCUSSIONS

We had successfully converted the image from RGB to HSI. Also the values of hue, saturation and intensity had been calculated. Computed the FFT and DCT of intensity. And its inverse FFT and DCT has been calculated. By merging technique we had successfully combined two images. Also we had calculated various statistical parameters like mean value, variance, standard deviation, PSNR, fusion factor, entropy etc.

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