Review Paper on FPGA Implementation on Runway Extraction using Image Fusion Method

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ABSTRACT
This paper presents the design and implementation of runway extraction.The system is based on image processing, discretewavelet transform algorithm and average image fusion method. It is best for low visibility conditions. With the fusion approach, pilots are able to identify the runway under low visibility conditions.

Keywords
PCA, Wavelet Transform, Lifting Scheme

1. INTRODUCTION
Runway extraction in low visibility is most difficult process. In low visibility pilots have problem to see clear image of platform. Low visibility condition occurs because of environmental problems such as fog, pollution. The image taken from different cameras are blurred. Images are also affected by different lighting conditions. The low visibility is the main cause for flight delay, which reduces transportation system. Under normal conditions, pilot identifies objects visually by looking at the terrain, which greatly depends on environmental factors and pilots flight experience. However, under low visibility, natural view of a pilot would be affected by various conditions like darkness or fog.

The term "image fusion" often refers to the process of combining information from different imaging modalities of a scene in a single composite image representation which is more informative. The goal of image fusion (IF)Is to integrate complementary multisensory, multitemporal or multiview information into one new image containing all information. Image fusion has been used in many application areas; numerous fusion applications have appeared in medical imaging like simultaneous evolution of CT, MRI or PET images

2. RELATED WORK
In this paper [3]Chandra Prakash et. All discuses the fusion technique in medical image is useful for disease diagnosis purpose. This paper illustrates different multimodality medical image fusion techniques and their results assessed with various quantities metrics. Firstly two registered images CT

(Anatomical information) and MRI-T2 (functional information)images are taken as input. Then the fusion techniques are applied onto the input images such as Mamdani type minimum-sum-mean of maximum (MIN-SUM-MOM) and Redundancy Discrete Wavelet Transform (RDWT). In this paper [4] Om Prakash et. All proposed a pixel-level images fusions scheme using multi resolution Biorthogonal

Wavelet Transform (BWT). Wavelet coefficients at different decomposition levels are fused using absolute maximum fusion rule. Two important properties wavelet symmetry and linear phase of BWT have been exploited for image fusion because they are capable to preserve edge information and hence reducing the distortions in the fused image. The proposed method in this paper improves fusion quality by reducing loss of significant information available in individual images.

2.1 SIMPLE AVERAGE
It is a well documented fact that regions of images that are in focus tend to be of higher pixel intensity. The algorithm is a simple way of obtaining an output image with all regions in focus. The value of the pixel P (i, j) of each image is taken and added. This sum is then divided by 2 to obtain the average. The average value is calculated which assigned to the corresponding pixel of the output image which is given in equation (1). This is repeated for all pixel values.

$$K(i,j)=\{X(i,j) + Y(i,j)\}/2 \quad (1)$$

Where X (i, j) and Y (i, j) are two input images.

2.2 SELECT MAXIMUM
The greater the pixel values the more in focus the image. Thus this algorithm chooses the focused regions from each input image by choosing the greatest value for each pixel, gives highly focused output. The value of the pixel P (i, j) of each image is taken and compared to each other. The greatest pixel value is assigned to the corresponding pixel.

2.3 PRINCIPAL COMPONENT ANALYSIS (PCA)
PCA is a mathematical tool which transforms a number of correlated variables into a number of uncorrelated variables. The PCA is used in different image compression method. It involves a mathematical procedure that transforms a number of correlated variables into a number of uncorrelated variables. The components are called as principal components. It computes a compactness and optimal description of the data set. The first principal component accounts the variance in data set and each succeeding component accounts for the remaining variance in data. First principal component is taken to be along the direction of the maximum variance. The second principal component is to lie in the subspace perpendicular of the first. Within this Subspace, this component points the direction of maximum variance. The third principal component is the maximum variance direction in the subspace perpendicular to the first two and so on. The PCA does not have a fixed set of basis vectors such as FFT, DCT and wavelet etc. This basis vectors depend on the data set.

3. PROPOSED WORK

3.1 DISCRETE WAVELET TRANSFORM

This is because the DWT can decompose the signals into different sub-bands with both time and frequency information and facilitate to achieve a high compression ratio.

Wavelets are finite duration oscillatory functions with zero average value. They have finite energy. They are suited for analysis of transient signal. The irregularity and good localization properties make them better basis for analysis of signals with discontinuities. Wavelets can be described by using two functions viz. the scaling function f (t), also known as "father wavelet" and the wavelet function or "mother wavelet". Mother wavelet (t) undergoes translation and scaling operations to give self similar wavelet families.

The wavelet transform decomposes the image into low-high, high-low, high-high spatial frequency bands at different scales and the low-low band at the coarsest scale which is shown in fig: 1. The L-L band contains the average image information whereas the other bands contain directional information due to spatial orientation. Higher absolute values of wavelet coefficients in the high bands correspond to salient features such as edges or lines. The basic steps performed in image fusion given

The wavelets-based approach is appropriate for performing fusion tasks for the following reasons:-

1. It is a multi scale (multi resolution) approach well suited to manage the different image resolutions. Useful in a number of image processing applications including the image fusion.
2. The discrete wavelets transform (DWT) allows the image decomposition in different kinds of coefficients preserving the image information. Such coefficients coming from different images can be appropriately combined to obtain new coefficients so that the information in the original images is collected appropriately.

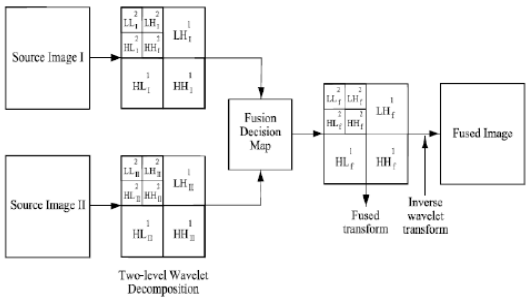

Fig 1: Wavelet Based Method

3. Once the coefficients are merged the final fused image is achieved through the inverse discrete wavelets transform (IDWT), where the information in the merged coefficients is also preserved.

3.2 LIFTING SCHEME

The lifting scheme is an easy tool to construct the second generation wavelets. The scheme consists of three simple stages:split, predict (P) and update (U). In the split stage, the input sequence xj,iis divided into two disjoint set of samples, even indexed samples (even samples) xj,2i and odd indexed samples (odd samples) xj,2i+1. In the predict stage, even samples are used to predict the odd samples based on the correlation present in the signal. The differences between the odd samples and the corresponding predicted values are calculated and referred to as detailed or high-pass coefficients, dj-1,i.

The update stage utilizes the key properties of the coarser signals i.e. they have the same average value of the signal. In this stage, the coarse or low-passcoefficient xj-1,iis obtained by updating the even samples with detailedcoefficient. The block diagram of the lifting based DWT is shown in Fig. 2.

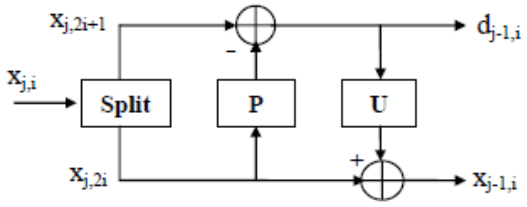

Fig 2: Lifting Scheme Block Diagram

3.3 IMAGE FUSION

The term fusion means in general an approach to extraction of information acquired in several domains. The goal of image fusion (IF) is to integrate complementary multisensor, multi-temporal or multiview information into one new image containing information the quality of which cannot be achieved otherwise. The term quality, its meaning and measurement depend on the particular application.

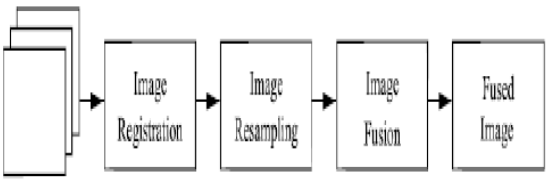

Figure 3: Steps in Image Fusion Method

Here we discuss the fusion based on WAMM . In this method anaverage of the low frequency components is calculated. Whichever obtains the higher values of average are selected as the fusion coefficients among the low frequency components. The main features of this new method are that it preserves the image quality and the edge details of the fused image.The Weighted Average Merging Method (WAMM) is formulated.

We studied various methods for image fusion. But these methods have some disadvantages, to overcome this disadvantages, here we present some work which will give best quality of image.

In our work, we can use following steps:

- Using Wavelet Transform to decompose original images into proper levels.
- One low-frequency approximate component and three high-frequency detail components will be acquired in each level.
- Lifting Transform of individual acquired low frequency approximate component and high frequency detail components from both of images.
- According to definite standard to fuse images, local area variance is chose to measure definition for low frequency component.
- Inverse Transformation is taken to get Original Image

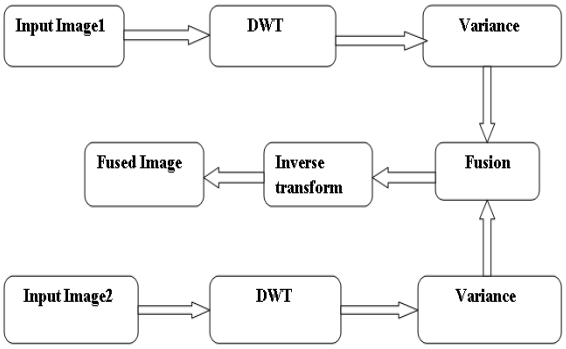

Figure4: BlockDiagram of Proposed System

This fusion method create new fused image, which give more information of original image.

4. CONCLUSION AND FUTURE WORK

In this paper, FPGA implementation of runway extraction using image fusion method, it use Image fusiontechnique which fuses multiple images and create new image. Runway extraction in low visibility is a great problem. Pilot face difficulty to land on platform in low visibility conditions.In this paper average image fusion method is used to get clearer image. Discrete Wavelet transform is used to fast the process. Image fusion is useful for various applications. The future scope of the paper is it can be used for satellite application. It is helpful to find out various areas.

5. REFERENCES

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