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Curvelet Image Fusion using Decision Tree Algorithm a Review

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ABSTRACT: This paper presents image fusion method which is suitable for pan-sharpening of multispectral (MS) bands and based on multiresolution analysis. This paper introduces new method based on the Curvelet transform using Decision Tree which represents edges better than wavelets. Edges play a fundamental role in image understanding one good way to enhance spatial resolution is to enhance the edges. Curvelet-based image fusion method provides richer information in the spatial and spectral domains simultaneously. Perform image fusion using Curvelet Transform with Decision Tree Algorithm. This new method has reached an optimum fusion result. For the implementation of this proposed work use the Image Processing Toolbox under Matlab Software**.**

KEYWORDS*:* Edge detection, Fusion, Multi resolution analysis, IKONOS, Wavelet transform, Curvelet transform.

I. INTRODUCTION

Image fusion techniques allow the integration of different information sources. The fused image can have complementary spatial and spectral resolution characteristics. However, the standard image fusion techniques can distort the spectral information of the multispectral data while merging. In satellite imaging, two types of images are available. The panchromatic image acquired by satellites is transmitted with the maximum resolution available and the multispectral data are transmitted with coarser resolution. This will usually be two or four times lower. At the receiver station, the panchromatic image is merged with the multispectral data to convey more information. Many methods exist to perform image fusion. The very basic one is the high pass filtering technique. Later techniques are based on Discrete Wavelet Transform, uniform rational filter bank, and Laplacian pyramid. Multi-sensor data fusion has become a discipline which demands more general formal solutions to a number of application cases. Several situations in image processing require both high spatial and high spectral information in a single image. This is important in remote sensing. However, the instruments are not capable of providing such information either by design or because of observational constraints. One possible solution for this is data fusion. The process of image fusion is used to comb inetwoor more images. The mainideabe hind image fusion is that different images contain different information. For example the image of the scene which is focused to the left contains different information than the one which is focused on to the right. By fusing these two images we can retain the best features of the two images. Similarly lower resolution multispectral images can be fused with higher resolution panchromatic images to get high resolution images which can provide in sightful information about the scene under consideration. This type of image fusionis most commonly used in remote sensing. Thus there can be different sources for image fusion.

Image fusion can be divided into signal level fusion, pixel level fusion, feature level fusion and decision level fusion. In signal level fusion the main idea is to improve the signal to noise ratio by combining the information from different sources. In pixel level fusion the pixel set from all the source images is fused. This process is repeated for all the pixels. In feature level fusion salient features are extracted from a given set of images and then these features are fused together. Finally decision level fusion involves the extraction of information from the given set of images. The extracted information is then combined using decision rules. For image fusion to take place the set of source images needs to be registered i.e.the images needs to be aligned spatially. Conventional

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Histogram equalization is used for the purpose of equalization. An expression to obtain a fused image *if* with two source images is given as

$$If = w*I1 + (1 - w)*I2$$

Where I1and I2are the two imagesand0 ≤w≤ 1….

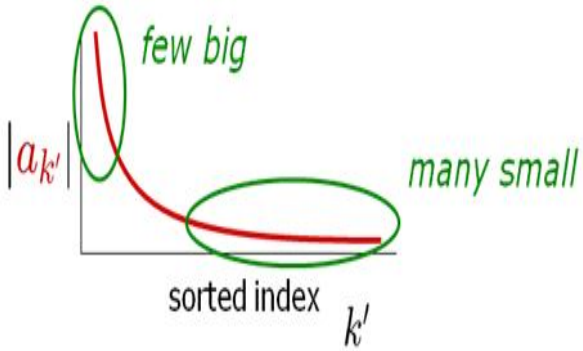
Curvelet transform

The time frequency analysis is decomposed a signal to several orthogonal bases. We can quantize the signal to the summation of different basis with different coefficient:

$$f = \sum_k a_k \mathbf{b}_k$$

coefficients basis, frame

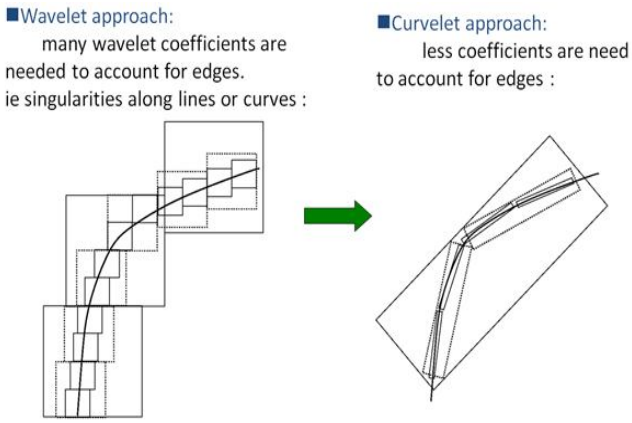
With the approach, it is easy to analysis the signal as below. And there are some benefit :



(1) **Data compression:** Few coefficient with correspond basis dominant the signal. Quantize with those dominant coefficient can reach data compression.

(2) **Feature extraction:** Basis with large coefficient is the feature of the signal. Checking those basis is usful in pattern recognition.

(3) **Image restoration:** For all bases are all orthogonal, it is easy to restoration image without effect of dependent.



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Curvelets are designed to handle curves using only a small number of coefficients. Hence the Curvelet handles curve discontinuities well.Curvelet decomposition is the sequence of the following steps.

1. Subband Decomposition.
2. Smooth Partitioning.
3. Renormalization.
4. Ridgelet Analysis.

II. LITERATURE REVIEW

Vishal P.Tank, Divyang D. Shah,Tanmay V. Vyas, Sandip B. ChotaliyaManthan S. Manavadaria in 2013where proposed Image Fusion Based on Wavelet and Curvelet Transform. In this paper we have put forward an image fusion algorithm based on wavelet transform andsecond generation Curvelet transform. The wavelet transform does not represent the edges and singularitieswell. So the second generation Curvelet transform is performed along with the wavelet transform and the imagefusion is done. Their proposed algorithm holds useful information from source multiple imagesquite well.

Myungjin Choi, Rae Young Kim, Moon-Gyu Kim in 2009. They proposed a new method based on the Curvelet transform which represents edges better than wavelets. Since edges play a fundamental role in image understanding one good way to enhance spatial resolution is to enhance the edges.

Jianwei Ma and GerlindPlonka in 2012. He proposed A Review of Curvelets and Recent Applications. Multiresolution methods are deeply related to image processing, biological and computer vision, scientific computing, etc. The Curvelet transform is a multi scale directional transform, which allows an almost optimal non adaptive sparse representation of objects with edges. In this paper, he presented a review on the Curvelet transform, including its history beginning from wavelets, its logical relationship to other multi resolution multidirectional methods like contour lets and shear lets, its basic theory and discrete algorithm. Further, we consider recent applications in image/video processing, seismic exploration, quid mechanics, simulation of partial different equations, and compressed sensing.

NavneetKaur, JaskiranKaur in 2013 proposed A Novel Method for Pixel Level Image fusion Based on Curvelet Transform where proposed method is compared both subjectively as well as objectively with the other image fusion methods. The experimental results show that the proposed method is better than other fusion methods and increases the quality and psnr of fused image. To see the qualitatively as well as quantitatively performance of the proposed algorithm, some experiments are conducted on several medical images.

III.PARAMETERS USED

There are many parameters given which are used in previous research papers.

MSE: Mean Squared Error is essentially an image fidelity measure. The goal of an image fidelity measure is to compare two images by providing a quantitative score that describes the degree of difference and errors between them. The MSE between two images is given by the following formula:

$$MSE = (1/N)\Sigma i|x(i)- e(i)|^2$$

Here x and e are the input and compressed image respectively and N is the size of image.

PSNR:Embedding this extra data must not degrade human perception about the object. Evaluation of imperceptibility is usually based on an objective measure of quality called peak signal to noise ratio (PSNR), or a subjective test with specified procedure. The PSNR between input and compressed image can be obtained using following formula:

$$PSNR=20\log10(PIXEL\_VALUE/MSE)$$

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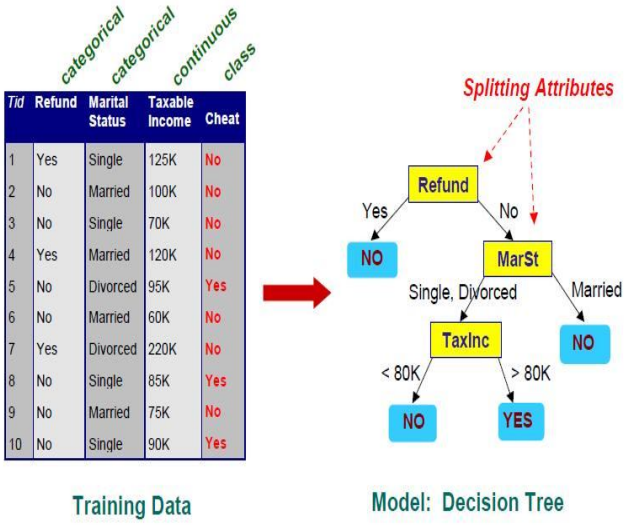
IV. DECISION TREE CLASSIFIER

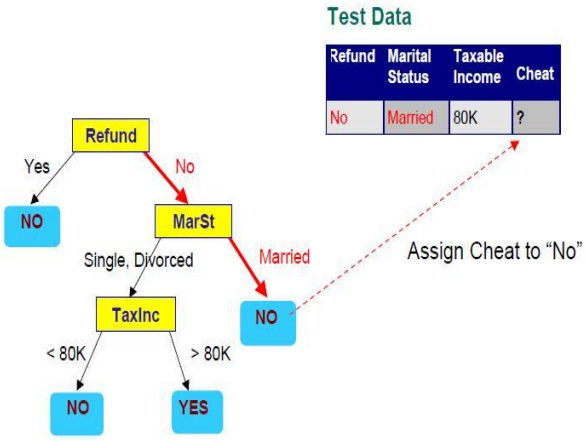
Decision Tree Classifier is a simple and widely used classification technique. It applies a straight forward idea to solve the classification problem. Decision Tree Classifier poses a series of carefully crafted questions about the attributes of the test record. Each time it receives an answer, a follow-up question is asked until a conclusion about the class label of the record is reached.

Decision Tree Based Method

The decision tree classifiers organized a series of test questions and conditions in a tree structure. The following figure shows a example decision tree for prediction whether the person cheats. In the decision tree, the root and internal nodes contain attribute test conditions to separate records that have different characteristics. The entire terminal node is assigned a class label Yes or No.



Once the decision tree has been constructed, classifying a test record is straightforward. Starting from the root node where apply the test condition to the record and follow the appropriate branch based on the outcome of the test. It then leads us either to another internal node for which a new test condition is applied or to a leaf node. When reach the leaf node the class label associated with the leaf node is then assigned to the record in below figure where it traces the path in the decision tree to predict the class label of the test record and the path terminates at a leaf node labelled NO.



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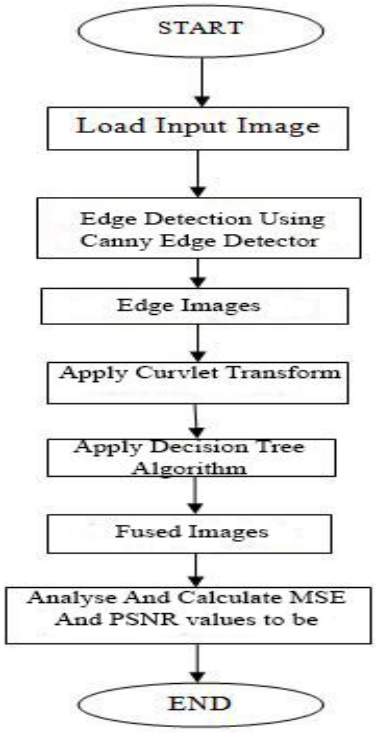
V. PROPOSED METHODOLOGY



Block Diagram Proposed system

The proposed system uses MATLAB software for results and simulation. The proposed system will give enhanced results against the previous algorithms used so for for image fusion.

VI. CONCLUSION

The proposed Image Fusion algorithm will be low cost and more accurate. This Enhanced Image Fusion algorithm assures quality of result. Our Enhanced Image Fusion doesn't degrade the quality of image. It will give the enhanced performance and will have better PSNR and MSE results.

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BIOGRAPHY

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