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Lifting Bi-orthogonal Wavelet Transform Based Edge Feature Extraction

S.Devendra[1], P.M.K.Prasad[2]
[1] Student (M.Tech) DECS,Dept. of ECE,GMRIT, Rajam, India.
Email : devendrasatyavarapu@gmail.com
[2]Associate Professor, Dept. of ECE, GMRIT, Rajam, India.
Email : mkprasad.p@gmrit.org

Abstract— An edge is often interpreted as one class of singularities and they can be characterized easily as discontinuities where the gradient approaches infinity. An edge detector is basically a high pass filter that can be applied to extract the edge points in an image. It significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. The current widely used edge detection algorithms are Sobel, Roberts, Laplacian etc. The core idea of these algorithms is that the edge points correspond to the local maximal points of original image's gray-level gradient. However, when there are noises in images, these algorithms are very sensitive to noises, and may detect noise points as marginal points, and the real edge may not be detected because of the noises' interference.

Keywords— Edge detection; lifting biorthogonal wavelet transformation; Haar Wavelet transformation.

INTRODUCTION

In digital Image processing edge plays a vital role. So the edge extraction is important content in image processing[1]. Now-a days edge detection algorithms have so many operators like Sobel, Roberts, canny, Laplacian etc[2]. The main idea of using these algorithms is finding edges where is the change in intensity value corresponding to the gray level images[3]. When there is the noise components in the images these algorithms may or may not detect the edges accurately as the marginal points and treated the noise components as the edges[4]. So, the concept of wavelet transform have been introduced due to the property of good local quantity and multi scale identity. It can detect the edges in multi scales. Wavelet transform uses the function to transform images into multi scale in which it detect local maximum points, uses the given threshold value to avoids the noise components and gain value in the image edges. In this paper bring us the edge detection based on the lifting bi-orthogonal wavelet property[5].

One edge detection method can only obtain edge information from one content, methods fused two edge detection algorithms can get more edge information and the effect is better[6-7]. In our paper, an edge detection method based on lifting biorthogonal wavelet transform is proposed. Firstly, the original image is decomposed by lifting wavelet transform to obtain a series of high-frequency and low-frequency sub-images; secondly, the edges of low-frequency sub-image are detected by biorthogonal wavelet method and the edges of high-frequency sub-images are detected by the wavelet transform method; the two edge images obtained respectively from low-frequency sub-image and high-frequency sub-image are fused based on some rules at last. This method can get better performance than either the one based on wavelet transform[8-9].

PROCESS OF LIFTING WAVELET

The resolution of signal wavelet transform in time-space field is self-adjusted with the magnitude of frequency, low-frequency is coarse and high-frequency is precise, it is very sensitive to the singular characteristic, so it is more suitable for detecting the edges and details of the image. The lifting wavelet transformation basic arithmetic is through a female wavelet to construct a better nature new wavelet gradually. Consider a signal s_j with 2^j samples which we want to transform into a coarser signal s_{j-1} and a detail signal d_{j-1}. A typical case of a wavelet transform built through lifting consists of three steps: split, predict and update.

A) Split:

This stage does not do much except for splitting the signal into two disjoint sets of samples.

In our case one group consists of the even indexed samples s_{2l} and the other group consists of the odd indexed samples s_{2l+1}. Each group contains half as many samples as the original signal. The splitting into evens and odds is called the lazy wavelet transform. We, thus, built an operator so that

$$(even_{j-1}; odd_{j-1}) = Split(s_j) \qquad (1)$$

Remember that in the previous example a was an even sample while b was an odd sample.

B) Predict:

The even and odd subsets are interspersed. If the signal has a local correlation structure, the even and odd subsets will be highly correlated. In other words, given one of the two sets, it should be possible to predict the other one with reasonable accuracy. We always use the even set to predict the odd one. An odd sample $s_{j,2l+1}$ will use its left neighboring even sample $s_{j,2l}$ as its predictor. We then let the detail $d_{j-1,l}$ be the difference between the odd sample and its prediction:

$$d_{j-1,l} = s_{j,2l+1} - s_{j,2l} \qquad (2)$$

which defines an operator P such that

$$d_{j-1,} = odd_{j-1} - P(even_{j-1}) \qquad (3)$$

As we already argued, it should be possible to represent the detail more efficiently. Note that if the original signal is a constant then all details are exactly zero.

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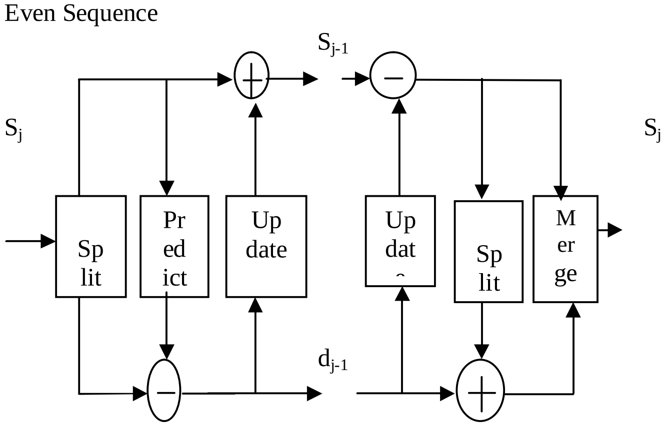
C)Update:

One of the key properties of the coarser signals is that they have the same average value as the original signal, i.e., the quantity is independent of j

Even Sequence



Odd Sequence

Fig 1: Lifting algorithm diagram

METHOD FOR IMAGE EDGE DETECTION BASED ON BI-ORTHOGONAL LIFTING WAVELET TRANSFORM

The main reason and advantage for applying the wavelet transform to the detection of edges in an image is the possibility of choosing the size of the details that will be detected. How many edges we want to get is set by the wavelet scale. In the case of the discrete wavelet transform, the choice of the scale is performed by multiple signal passage through the wavelet filter. When processing a 2-D image, the wavelet analysis is performed separately for the horizontal and the vertical directions. Thus, the vertical and the horizontal edges are detected separately.

The 2D discrete wavelet transform (DWT) decomposes the images into sub-images, 3 details and 1 approximation. The approximation looks similar to the input image but only 1/4 of original size. The 2-D DWT is an extension of the 1-D DWT in both the horizontal and the vertical direction. We label the resulting sub-images from an octave (a single iteration of the DWT) as LL (the approximation or we say the smoothing image of the original image which contains the most information of the original image), LH (preserves the horizontal edge details), HL (preserves the vertical edge details), and HH (preserves the diagonal details which are influenced by noise greatly), according to the filters used to generate the sub-image. For example, HL means that we used a high pass filter along the rows, and a low pass filter along the columns. This process can repeat continuously by putting the first octave's LL sub-image through another set of low pass and high pass filters. These iterative procedures construct the multi-resolution analysis. The diagram is shown in Fig 2.

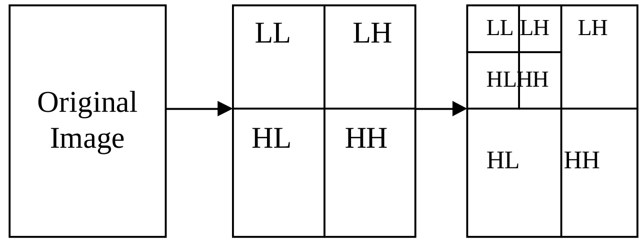


Fig. 2: Image decomposition based on the wavelet transform

S_j

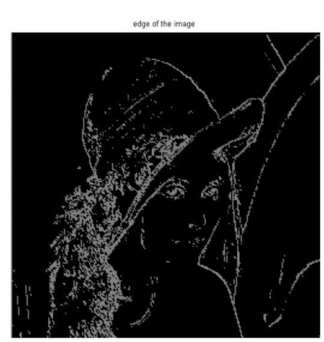
SIMULATION AND EXPERIMENT RESULT

This section presents the results of lifting wavelets. The bi-orthogonal lifting wavelet for edge detection, lifting haar edge detection are compared by using Matlab2012 version.

A) Edge Detection Using Wavelets

Taking image and apply wavelet transform to that picture, the results is below in figure 3. The normal wavelets are applied to image by using bi-orthogonal and haar wavelets. By bi-orthogonal wavelet finding edge points in a image is more accurately and by haar wavelet also edge points finding is more similar to bi-orthogonal. But in haar it cannot finds some edge points and it cannot display clearly than bi-orthogonal.

(a)



(b)

(c)

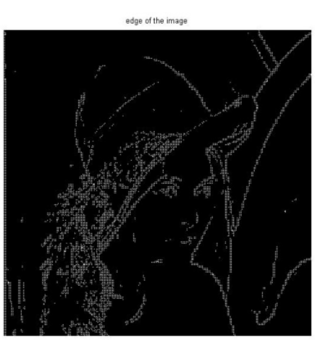
Fig3: (a) Original Image, (b) Edge of Image using Bi-orthogonal 1.1wavelet,(c) Edge of an Image using Haar Wavelet

The above results is that finding edge detection using different wavelets. The figure 3(a) is the original image, to that original image apply Bi-orthogonal wavelet 1.1 at 0.09 to 1.0 range for finding edges of original image is shown in figure 3(b). The Haar wavelet is apply to original image to detects the edges of an image that results shown in figure 3(c). By that both results Bi-orthogonal wavelet is better than haar to detects the edge of an image.

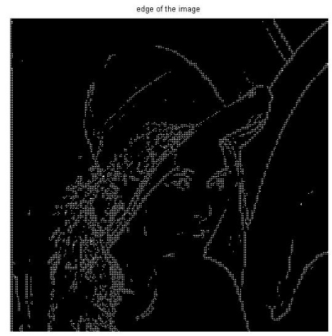
B) Image edge detection using lifting wavelets

In this paper use haar lifting wavelet and bi-orthogonal lifting wavelet for detecting the edges of an image. Below figures shows edge detection experiment results of an image.

(a)



(b)



(c)

Fig 4: (a) Original Image, (b) Lifting Bi-orthogonal edges, (c) Lifting Haar edges

The above results is that finding edge detection using different lifting wavelets. The figure 4(a) is the original image, to that original image apply lifting Bi-orthogonal 1.1wavelet and lifting haar in range between 0.09 to 1.0 for finding edges of original image. The test results shown in figure 3(b) and 3(c) continuously. By test results clearly understanding that lifting bi-orthogonal1.1 is better than lifting haar.

CONCLUSION

This paper study the image edge detection based on lifting bi-orthogonal wavelet transform through theory and experiment, carried on the comparison based on the lifting wavelet image edge detection effect, and wavelet image detection effect. Through the experiment, we can see us bi-orthogonal wavelet of lifting can be used to accurately detect the integrity and continuity, a clear edge. By comparing test results for detects edges lifting wavelets is better than normal wavelets. At the same time it have a short time and less memory. Therefore, edge detection based on lifting wavelet transform is a practical edge detection method. The fine nature of the method so that it will have a good prospect, could be applied to vehicle identification and tracking, computer vision and other fields.

REFERENCES

[1] Image edge detection based on lifting wavelet,Xiu-bi Wang,sichuan university of science & engineering,SUSE,china,,2009.
[2] An edge detection method based on lifting wavelet and mathematical morphology, Rong Wang, china at 2011 International Conference on Multimedia and Signal Processing
[3] Hu Changhua ,Zhang junbo, Xia jun,zhang fei. Based on MATLAB system analysis and design——Wavelet analysis [M]. Xi an: Xidian University Publishing,1999.
[4] Song ping, Liu Bo.Image compression Based on fast lifting wavelet transform [J]. Science technology and Engineering, 2002, 5(19). pp.68–73.
[5]W.Sweldens.The lifting scheme:A construction of second generation wavelets[J].SIAM J.Math.Anal.,1997,29(2):511-546.

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[6] M. Maslen, P. Abbott. Automation of the lifting factorization of wavelet transforms[J]. Compute Physics Communications., 2000,127:309-326.

[7] H.Moon,R.Chellappa and A.Rosenfield.Optimal Edge-Based Shape Detection[J]. IEEE Trans.On Image Processing,2002, Ⅱ(Ⅱ):1209-1227.

[8] C.J.Vianna , E.A.DeSouza , Combining Marr and Canny operators to detect edge[C].Mirowave and Optoeleetronies Conference, 2003, 2(9):695-699 .

[9] Hongjian Shi , R.Ward. Canny edge based image expansion[J]. Circuits and Systems, 2002(l):785 一788.