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Hiding information by using Discrete Laguerre Wavelet Transform with new algorithms

Asma Abdulelah Abdulrahman[1], Fouad Shaker Tahir Al-azawi[2]
Department of Applied Sciences University of Technology / Baghdad/ Iraq
100243@uotechnology.edu.iq
11015@uotechnology.edu.iq

Abstract

In this work, the focus was on embedding images and hiding image information in another image by mixing the two images analyzes using the new Discrete Laguerre Wavelets Transform (DLWT) by Approximate and Details coefficients. This method is used for the first time in this field to embedding two images and hide submerged image features. The results were compared with other waveforms indicating that the new wavelet transform proved efficient during the application of two simple examples, including immersing two mysterious images, the other example being the mask and the face.

Keyword

Discrete Laguerre Wavelets Transform (DLWT), embedding images, Multi Resolution Analyses (MRA), Details coefficients, Approximate coefficients.

1- Introduction

Intermittent waveguides have gone a long way in the field of image processing, such as image compression, noise reduction and image enhancement, where images are analyzed [6],[7],[8].

One of the major issues in the transport and storage of large quantities through international communication networks, where the compression of images synonymous with the application of wavelets in the treatment of image. In this work the image will be embedded in another image to hide the image information and obtain a new image using new wavelet is built from Laguerre polynomial and converted into discrete wavelet , programmed and added in the program Matlab to take its place in the table waveforms such as Haar and other wavelet [5].

A theoretical presentation of the theoretical framework in applications has been presented quickly 2D(DLWT) by clarifying the concepts of decomposition, approximation and detail of the image, which plays an important role in edge detection where its role is evident in the ability of the new wavelet to analyze local gray gradients and gradients through which edges can be isolated [1],[3], [9], [10].

2. Preliminaries

In this section all important information will benefit the recipient so that he can understand this paper

2.1. Discrete Laguerre wavelet transform

The construction of the new wave for use in this work has been derived from multiple borders and converted into intermittent waves because they have certain qualities that qualify them to be able to use in the image processing of these qualities they belong to space all square functions in trigonometric space $\left(L^2\right)$, The character of dependence and approach, Multi Resolution Analysis (MRA) of Laguerre wavelet and proved approximation in different spaces as we have seen in our previous work, [2],[3].

$\left\{\rho_{n,m}\right\}_{(n,m)\in Z^2}$ orthonormal basis of $L^2(R)$ and MRA, with finite energy is a sequence $\{V_n\}_{n\in Z}$

$\ldots \subset V_2 \subset V_1 \subset V_0 \subset V_{-1} \subset V_{-2} \subset \ldots$ of $L^2(R)$,

$$V_0 = \left\{ f \in L^2(R) / f(t) = \sum_{n\in Z} A_{n,m} \vartheta\left(2^k t - 2n + 1\right) \in l^2(Z)\right\}$$

$\left\{\vartheta_{n,m}\right\}_{m\in Z}$ generated by $\{V_n\}_{n\in Z}$, ϑ is the scalar function, ρ , $\left\{\rho_{n,m}\right\}_{m\in Z}$ generated W_n

The coefficients of Laguerre wavelet is approximation

$\gamma_{n,m} = \int_R S(t)\,\vartheta_{n,m}(t)\,dt$ is an approximation of

$$A_n(t) = \sum_{m\in Z} \gamma_{n,m} \vartheta_{n,m}(t)$$

(1)

The function of calculation the coefficients of Laguerre wavelet

$\lambda_{n,m} = \int_R S(t)\rho_{n,m}(t)dt$ is the details of

$$D_n(t) = \sum_{m\in Z} \lambda_{n,m} \rho_{n,m}(t)$$

(2)

2.2. Activation of transfers in the Matlab program

It is natural that the Matlab program is equipped with many waves such as Haar, Daubechies, Symlets, Coiflets, etc.
In order for our built-in guidance to be built through our previous work, we must
create a program to allow the new wave to take its place with the waves supplied by the program.

2.3. The proposed theory in image processing

In our previous work the Multi Resolution Analysis (MRA) of $L^2(R)$ was defined to Discrete Laguerre Wavelets Transform (DLWT), where it becomes clear to us that it is a family of decreasing sub-distances that is related to approximation and expansion of were defined in [4],[5], [6].

2.3.1. Multi Resolution Analysis (MRA)

The following points illustrate the process MRA in 1D the approximation space V_j^{1D} and the detail space $W_j^{1D}\ \forall j$ then

$$V_{j-1}^{2D} = \left(V_j^{1D} \otimes V_j^{1D}\right) + \left(V_j^{1D} \otimes W_j^{1D}\right) + \left(W_j^{1D} \otimes V_j^{1D}\right) + \left(W_j^{1D} \otimes W_j^{1D}\right)$$
$$V_{j-1}^{2D} = V_j^{2D} \oplus \left[W_j^{2D}\right]_h \oplus \left[W_j^{2D}\right]_v \oplus \left[W_j^{2D}\right]_d \qquad (3)$$

h: Horizontal
v: Vertical
d: diagonal

which leads to $V_{j-1}^{2D} = V_{j-1}^{1D} \otimes V_{j-1}^{1D}, then \quad V_{j-1}^{1D} = V_j^{1D} \oplus W_j^{1D}$, than we can get V_{j-1}^{2D},

From above we understand in 2D the two sort is find

1- Approximation or detail coefficients in spaces V_j^{2D}, W_j^{2D}

2- Reconstructed of approximation and details to projections on the same spaces.

The image is a matrix of integers as it is known to be three matrices RGB.

If signal is S then

$$S = A_1 + D_1 = ... = A_j + D_j + ... + D_2 + D_1$$

(4)

where S is the sum of orthogonal signals implies in 2D

$$A_{j-1} = A_j + D_j = A_j + \left[(D_h)_j + (D_v)_j + (D_d)_j \right]$$

(5)

Where D_h, D_v, D_d indicate respectively horizontal, vertical, diagonal details.

Using DLWT, will analyze the original image at the first level $(256 \times 256)$and then the second level (Fig.1), the approximate parameters and the detailed transactions in the first level will show the small image after decomposition. The size changes as follows $(256 \times 256) = 4 \times (128 \times 128)$where the absolute value of the coefficients and the intensity of the color in the suit and the order ascending in terms of intensity of light from the smallest to the darkest and the largest in the light.

The colorization of small images of the transactions is independent and there are two points that can be observed in the second level

1 - Details coefficients in the first level conservative

2 - Approximate coefficients in the first level are to be analyze

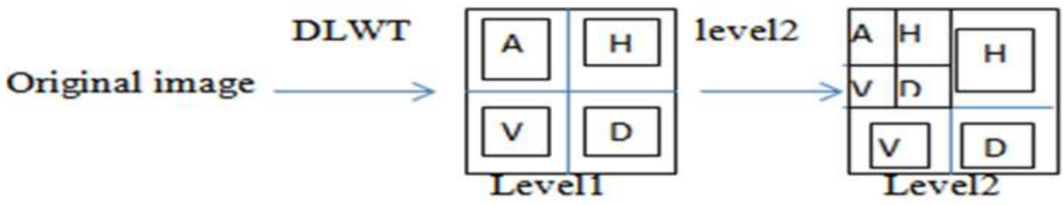

Fig.1 Analyses image by DLWT at level1 and level2

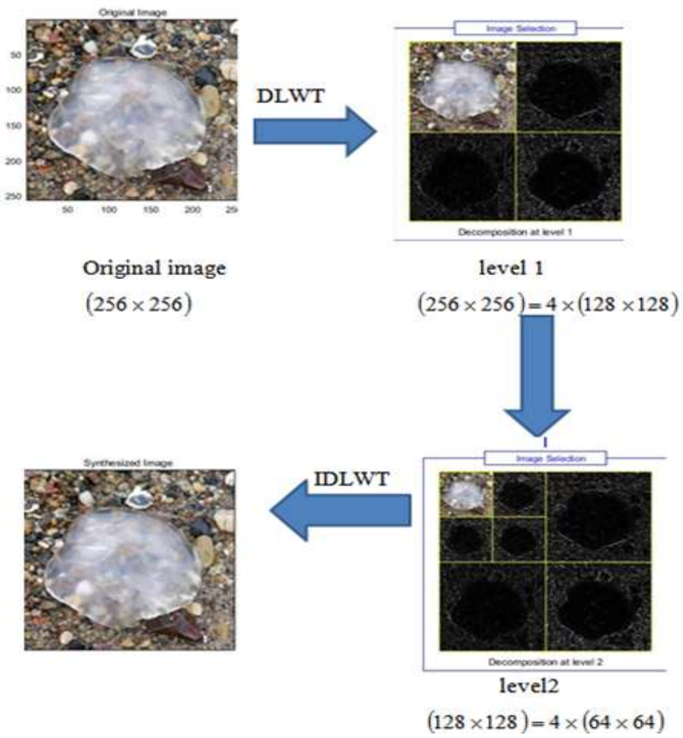

Fig.2 Chart of the previous format

3. Proposed Embedding Images with DLWT

In this section we will explain the role of the proposed technique in the integration of the images after taking the original two different images where the two images in the same size , the wavelet is used after the analysis of the original images on the approximations coefficients and details

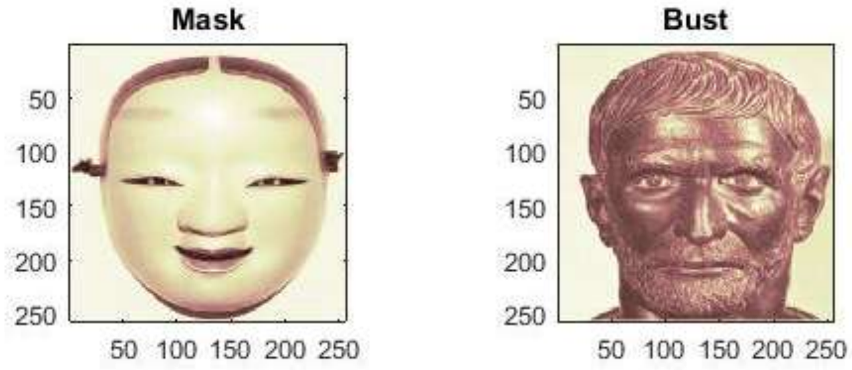

Fig.3 the two original images in example1

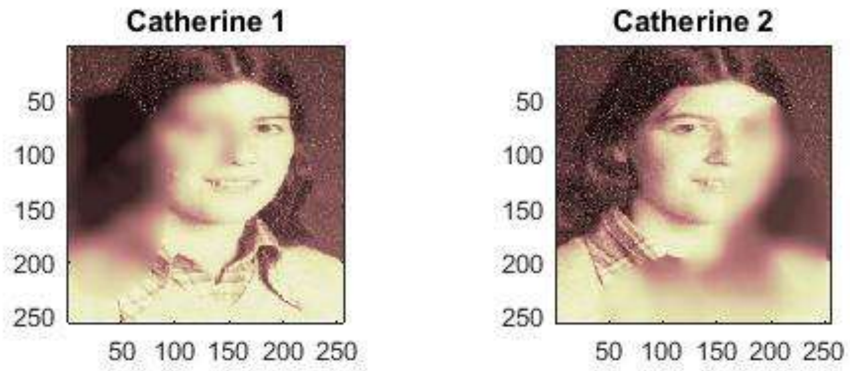

Fig.4 the two original images in example2

3.1. Algorithm: The process of embedding of images together to hide information one of them

To implement the image immersion algorithm using the proposed theory

It is completed in the following steps:

Step 1: Load two original images for example

```
load mask; X1 = X;
load bust; X2 = X;
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Step 2: Embedding the two images from wavelet decompositions at level 2 using DLWT of two original images with approximations coefficients and details

Step 3: Plot original and synthesized images.

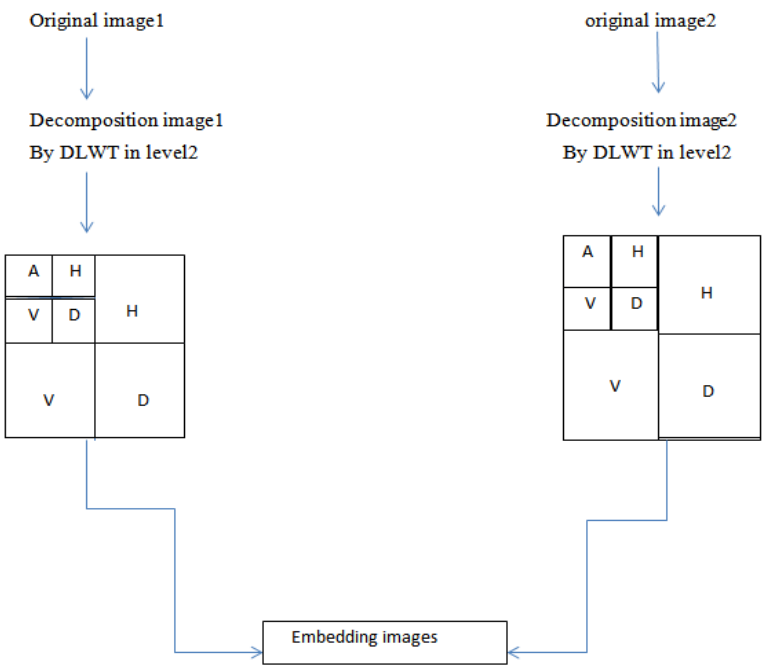

Fig.5: Demonstrates the process of decomposition of the two images before merging and obtaining one image

4.2- Example1: In this example we will take two different images The images are then flooded to hide the first image behind the second image. The two images are of the same size (256×256). The two images are analyzed for the second level using DLWT where the details are more regular in the first picture than in the second image. Then we follow the different bases as we will see later to construct the new decomposition at the same time as the B and detail factors Fig.6 will represent the new decomposition and immersion of the two images together.

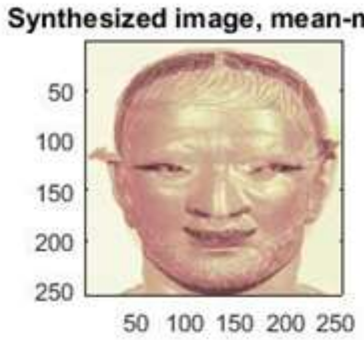

Fig.6: Combines the two images together by mean the transactions

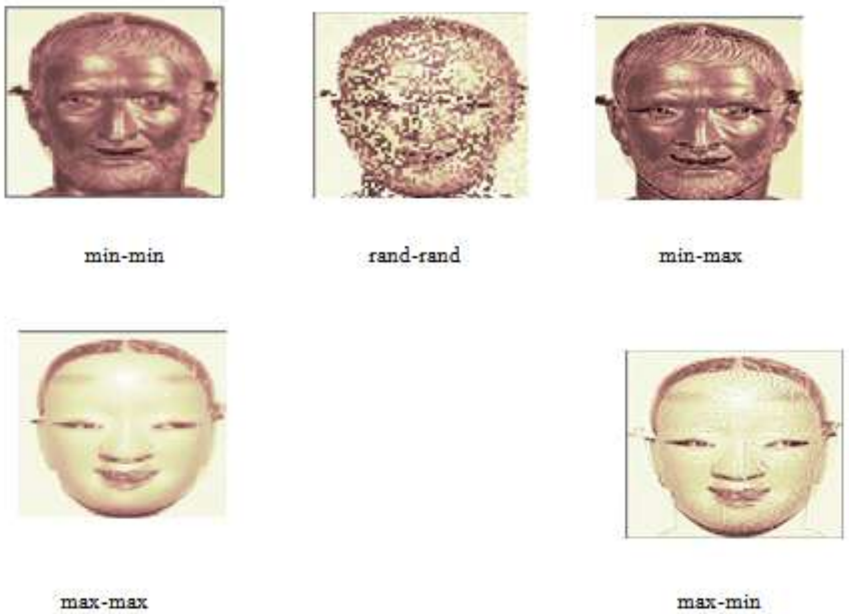

Fig.7: Shows the types of mergers for coefficients

From Fig.6, the coefficients of the details in the analyzes are certain that in the first picture, the larger coefficients are greater than in the second image, thus reducing the distinguishing features of the two images in the image which will be reconstructed such as beard, hair, etc.

We followed the process of

1- minimum for both approximations and details

2- the random for both approximations and details

3- the minimum for approximations and maximum for the details coefficients

4- the maximum for both approximations and details

5- the maximum for approximations and minimum for the details coefficients

The above strategies are used to immerse and mix the two analyzes, after which many images were obtained as in Fig. 6

4.2.1 The results

1. Transactions (A,B) are pairs related to approximations and details.
2. A global strategy has been applied for the selection of original transactions Through the previous analysis we conclude.

Let's L be the matrix of coefficients for decomposition, A, B are the matrices treated to decompose the two images

In the matrix L we will get the

$$L_{i,j} = (1 - t_i)A_{i,j} + t_i B_{i,j} \qquad (6)$$

is a varies, t_i is linear function of i with value 0 for the first row and 1 for the last row, then in L .

The first line in L = the first line in A, last line in L agree correspond with the last line of B.

If linear group weights are adjusted we get a variety of merged images as shown in Fig.7

4.3. Example2

Merge of fuzzy images, the best example of this technique is the image of Catherine where the two images have a defect or fog in the opposite side of the other and hide this defect by combining the images using DLWT will be hidden defects of others as shown in Fig.8

Fig.8: Shows the types of mergers for coefficients

The two images are the same size so the size of the analyzes is equal. The idea here is to immerse the analyzes so that a new analysis can be constructed where the new transactions will be obtained by combining the two transactions.

How this process?

The choice of a linear array is an example of a medium or a maximum.

To illustrate this strategy, for example, the maximum level 2, we will choose the approximate coefficients and the details, which are important so that the images are complementary, we will choose the type of local analysis.

The built-in image is invers conversion of IDLWT.

We get the new image after the merger and from the first look we find that the result is acceptable where the picture is free of ambiguous areas and any other defects or exist but are difficult to identify.

5. Conclusion

In this work, the process of immersion of images within each other was used conversion DLWT, which proved its efficiency for other transfers and through the above examples where they were used using other conversions and can be compared through Fig. 9.

Fig.9: Shows the types of mergers for coefficients by using db wavelet

In the above figure a different transformation was used and we can compare it with the wave used in the two examples above, the resulting images are using DLWT better than using db.

6. References

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