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DESIGN OF IMAGE RESOLUTION ENHANCEMENT BY USING DWT AND SWT

G SANTHI KUMARI [1], D RAHUL KHANNA[2], V SRINIVAS[3]

[1]G SANTHI KUMARI: Dept. of Electronics and Communication Engineering, SIET College, AP, India.
[2]D RAHUL KHANNA: Asst. Prof., Dept. of Electronics and Communication Engineering, SIET College, AP, India.
[3]V SRINIVAS: Assoc. Prof., Dept. of Electronics and Communication Engineering, SIET College, AP, India.

Abstract - *Now a day resolution of image is an important issue in almost all image and video processing applications. An image resolution enhancement technique is based on interpolation. In picture dispensation to increase number of pixels in digital image is called as interpolation. The Discrete Wavelet Transform (DWT) and Stationary Wavelet Transform (SWT) are applied on the input image and these techniques are applied to decompose an image into high frequency sub bands. DWT is applied in instruct to decompose an input image into dissimilar sub bands. Then the elevated frequency sub bands as well as the input image are interpolated. By using SWT technique the estimated high frequency sub bands to generate a new high resolution image by using Inverse Discrete Wavelet Transform.*

Key Words: **Discrete Wavelet Transform, Stationary Wavelet Transform, High Resolution Image, Inverse Discrete Wavelet Transform.**

1. INTRODUCTION

The principle objective of enhancement is to process an image so that the result is more suitable than the original image for a specific application. Image enhancement approaches fall into two categories i) spatial domain methods ii) frequency domain methods. Image enhancement is solitary of the difficult issues in image processing. The aim of image enhancement is to process are presentation so that result is more suitable than innovative image for specific application. Digital image enhancement techniques make available a lot of choice for getting better the visual quality of images. Appropriate choice of such techniques is very important.

Image resolution has been always an important issue in many image-processing and video-processing applications. For example, an image resolution enhancement is also widely useful for satellite image applications which include bridge recognition, road construction and building construction in GPS technique and geographical information system. Descriptions are being process in order to get hold of more enhanced resolution. Solitary of the frequently used techniques for reflection resolution enhancement is Interpolation. Illustration interpolation can be used for reflection resolution enhancement and lots of interpolation techniques have been urbanized to increase the excellence of the image. Freshly, an assortment of interpolation methods are planned to improve the performance of image declaration enhancement, such as bilinear interpolation, bicubic interpolation, nearest neighbour interpolation. Interpolation has been generally used in countless images processing application such as facial reconstruction, multiple descriptions coding, and supper resolution.

Picture resolution enhancement in the wavelet sphere is a relatively new investigate topic and freshly many new algorithms have been planned. Discrete Wavelet Transform (DWT) is one of the topical wavelet transforms used in image processing. DWT decomposes an image into different sub band images, namely low-low (LL), low-high (LH), high-low (HL), and high-high (HH). One more recent wavelet transform which has been second-hand in several image processing applications is Stationary Wavelet Transform (SWT). In short, SWT is similar to DWT but it does not use down-sampling, hence the sub bands will have the same size as the input image.

2. LITERATURE SURVEY

In this employment, we are proposing a likeness resolution enhancement technique which generates sharper high resolution representation. The proposed technique uses DWT to decay a low resolution image into dissimilar sub bands. Then the three high frequency sub bands obtain by SWT of the input icon are being incremented into the interpolated high frequency sub bands in instruct to correct the rough and ready coefficients. In corresponding, the input image is also interpolated independently. Finally, correct interpolated high frequency sub bands and interpolated input likeness are shared by using inverse DWT (IDWT) to achieve a high resolution amount produced image. The proposed method to achieve a high resolution output image. The proposed technique has been compare with conventional and state-of-art representation resolution enhancement techniques. A common attribute of these is the assumption that the low-resolution (LR) image to be enhanced is the low pass filtered sub band of a decimated-wavelet-transformed high resolution (HR) image. The conventional techniques used are the following:

Interpolation Techniques:
- Bilinear Interpolation;
- Bicubic Interpolation;
- Wavelet zero padding (WZP).

The state-of-art techniques:
- RPII, NEDI, HMM, HMM SR, WZP-CS,WZP-CS-ER, DWT SR, SWT SR, AND CWT SR.

Regularity-Preserving Image Interpolation (RPII), New Edge-Directed Interpolation (NEDI), Hidden Markov Model (HMM), HMM-based Image Super Resolution (HMM SR), WZP and Cycle-Spinning (WZP-CS), WZP, CS, and Edge Rectification (WZP-CS-ER), Discrete Wavelet Transform based Super Resolution (DWT SR), Stationary Wavelet Transform based Super Resolution (SWT SR), and Complex Wavelet Transform Based Super Resolution (CWT SR)these are also used for improve the resolution of an image.

3. PROPOSED IMAGE RESOLUTION ENHANCEMENT

Traditional interpolation methods work in the time domain. The regularity-preserving interpolation technique synthesizes a new wavelet sub band based on the know wavelet transform coefficients decay. The original image can given as input to a single wavelet synthesis stage along with the corresponding high frequency sub bands to produce an image interpolated by a factor of two in both directions. The formation of unknown high-frequency sub bands is essential in the regularity-preserving interpolation strategy.

Two-step process is carried out to obtain the unknown high-frequency sub bands separable. In first step, in each row boundaries with momentous correlation across scales are recognized. Then near these edges the rate of decay of the wavelet coefficients is extrapolated to resynthesize a row of twice the original size. In second step, the same procedure as in first step is then applied to each column of the row-interpolated image.

An interpolation the main loss is on their high frequency component (i.e., edges) which is used in image resolution enhancement, which is due to the smoothing caused by interpolation. In instruct to augment the quality of the wonderful resolved image, preserving the boundaries is essential. In this work, DWT have been in employment in instructed to preserve the elevated frequency components of the image.

The redundancy and shift invariance of the DWT mean that DWT coefficients are inherently interposable. In this correspondence, one level DWT (with Daubechies 9/7 as wavelet transform) is used to decompose an input image into different sub band images. Three elevated frequency sub bands (LH, HL, and HH) surround the elevated frequency machinery of the input image. In the future technique, bicubic interpolation with enlargement factor of 2 is applied to far above the ground frequency sub band images. Down-sampling in each of the DWT sub bands causes information loss in the respective sub bands. With the purpose of is why SWT is in employment to minimize this defeat. The interpolated elevated frequency sub bands and the SWT elevated frequency sub bands have the similar size which resources they can be added with every one other. The new corrected elevated frequency sub bands can be interpolated additional for higher enlargement. Also it is known that in the wavelet domain, the resolution image is obtained by low pass filtering of the high resolution image.

4. IMPLEMETATION

The procedure in the illustration domain employ the statistical and arithmetical data in a straight line extracted use transformations such as decimate discrete wavelet transform (DWT) to accomplish the picture resolution enhancement. The decimate DWT has been generally used for amateur dramatics image resolution enhancement.

The SWT is an inherently redundant scheme as the output of every level of SWT contains the same amount of samples as the input- so for a putrefaction of N levels readily available is a redundancy of N in the wavelet coefficients. The interpolated elevated frequency sub bands and the SWT elevated frequency sub bands contain the same size which means they can be extra with each other.

In former words, near to the ground frequency sub band is the low resolution of the inventive image. Therefore, as an alternative of using low frequency sub band, which contain smaller amount of information than the original elevated resolution image, we are using the contribution image for the interpolation of low frequency sub band image. With input image in its place of low frequency sub band increases the excellence of the super resolved image. Fig 1 illustrates the block diagram of the proposed illustration resolution enhancement method.

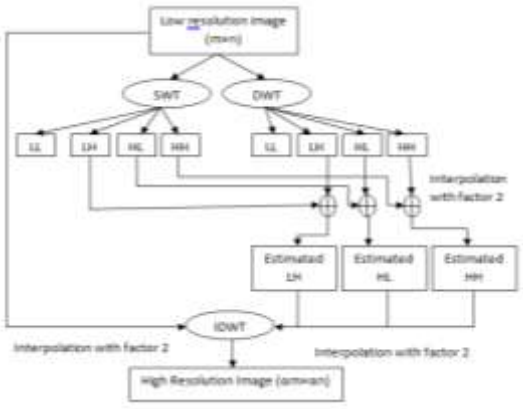

Fig (1): Block diagram of the Inverse DWT

By interpolating input image by, and high frequency sub bands by 2 and in the intermediate and final interpolation stages respectively, and then by applying IDWT, as illustrated in Fig 4.1. The production image will surround sharper boundaries than the interpolated illustration obtained by interpolation of the input picture directly. This is due to the piece of information that, the interpolation of inaccessible high frequency components in far above the ground frequency sub bands and using the corrections obtain by adding together high frequency sub bands of SWT of the input image will preserve more high frequency components after the interpolation than interpolating input image directly.

5. RESULTS AND DISCUSSIONS

PSNR values are used to measure the quality of an image. Peak Signal-to-noise ratio (PSNR) has been implemented in order to obtain some quantitative results. Fig (2). Shows that super resolved image of building's picture using proposed technique in (f) are much better than the low resolution image in (a), bilinear image by using interpolation (b), bicubic image (c), super resolved image using WZP (d), and DWT technique (e).

Memorandum that the contribution low resolution images contain be obtained by down sampling the original elevated resolution images. Within instruct to show the effectiveness of the planned method over the conventional and state-of-art image resolution enhancement techniques; four well known experiment images (Lena, Elaine, Baboon, and Peppers) with different features are used. The PSNR performance of the proposed technique using bicubic interpolation with conventional and stat-of-art resolution enhancement techniques: bilinear, bicubic, WZP, NEDI, HMM, HMM SR, WZP-CS, WZP-CS-ER, DWT SR, CWT SR, and regularity-preserving image interpolation. As well, in instruct to have extra comprehensive comparison, the presentation of the super resolved representation by using SWT only (SWT SR). The results are indicating that the proposed technique over-performs the aforementioned conventional and state-of-art image resolution enhancement techniques.

Fig (2): a) Original low resolution image b) Bilinear Interpolation image c) Bicubic Interpolation image d) Super Resolved image using WZP e) DWT based technique f) Proposed technique.

6. CONCLUSION

This paper proposes image resolution enhancement technique by DWT and SWT decomposition by using interpolation. By applying DWT and SWT to image taking the interpolation and simultaneously. The proposed technique uses DWT to decompose an image into different sub bands, and then the high frequency sub band images have been interpolated. The interpolated high frequency sub band coefficients have been corrected by using the high frequency sub bands achieved by SWT of the input image. An innovative image is interpolated with short of the interpolation factor second-hand for interpolation the far above the ground frequency sub bands. Sub sequently all this imagery has been joint using IDWT to generate a super resolved imaged. The projected method has been knowledgeable on eminent standard imagery, where their PSNR and optical results show the advantage of projected technique in excess of the conservative and state-of-art image resolution enhancement techniques. In this the PSNR values much better than other enhancement techniques.

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