An Efficient Cum Improved Resolution Enhancement Using Zero Padding and Curvelet Transforms

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ABSTRACT: The main objective of this thesis is to design an enhanced and efficient resolution enhancement technique using zero padding and curvelet transforms. In the existing paper the authors proposed a combination of SWT and DWT for edge refinement and to improve lossless resolution which is stated by the PSNR values as a development in the edge detection and calculating the PSNR values CURVELETS were proposed in this paper. So, through all the transformations a high PSNR value is obtained and spatial frequency, MSE were also calculated and stated in the table along with the results.

KEYWORDS: PSNR, CURVELETS, ZERO PADDING, DWT, MSE

INTRODUCTION: ALTHOUGH the field of image enhancement has been active since before digital imagery achieved a consumer status, it has never stopped evolving. The present work introduces a novel multi-resolution denoising method, tailored to address a specific image quality problem that arises when using image enhancement algorithms based on random spray sampling. Image resolution enhancement in the wavelet domain is a relatively new research topic and recently many new algorithms have been proposed [4]–[7]. Discrete wavelet transform (DWT) [8] is one of the recent wavelet transforms used in image processing. DWT decomposes an image into different subband images, namely low-low (LL), low-high (LH), high-low (HL), and high-high (HH). Another recent wavelet transform which has been used in several image processing applications is stationary wavelet transform (SWT) [9]. In short, SWT is similar to DWT but it does not use down-sampling hence the subbands will have the same size as the input image. While inspired by the peculiar problem of such methods, the proposed approach also works for other image enhancement methods that either introduce. The interpolated high frequency subbands and the SWT high frequency subbands have the same size which means they can be added with each other. The new corrected high frequency subbands can be interpolated further for higher enlargement. Also it is known that in the wavelet domain, the low resolution image is obtained by lowpass filtering of the high resolution image [16]. In other words, low frequency subband is the low resolution of the original image. Therefore, instead of using low frequency subband, which contains less information than the original high resolution image, we are using the input image for the interpolation of low frequency subband image. Using input image instead of low frequency subband increases the quality of the super image resolution.
EXISTENCE IMAGE RESOLUTION ENHANCEMENT:

In image resolution enhancement by using interpolation the main loss is on its high frequency components (i.e., edges), which is due to the smoothing caused by interpolation. In order to increase the quality of the super resolved image, preserving the edges is essential. In this work, DWT has been employed in order to preserve the high frequency components of the image. The redundancy and shift invariance of the DWT mean that DWT coefficients are inherently interpolable.

In this correspondence, one level DWT (with Daubechies 9/7 as wavelet function) is used to decompose an input image into different sub-band images. Three high frequency sub-bands (LH, HL, and HH) contain the high frequency components of the input image. In the proposed technique, bi-cubic interpolation with enlargement factor of 2 is applied to high frequency subband images. Down-sampling in each of the DWT sub-bands causes information loss in the respective sub-bands. That is why SWT is employed to minimize this loss.

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INTERPOLATION

One of the commonly used techniques for image resolution enhancement is Interpolation. Interpolation has been widely used in many image processing applications such as facial reconstruction, multiple description coding, and super resolution. There are three well known interpolation techniques, namely nearest neighbor interpolation, bilinear interpolation, and bicubic interpolation. Interpolation is the process of using known data values to estimate unknown data values. Various interpolation techniques are often used in the atmospheric sciences.

Nearest neighbor interpolation:

Nearest-neighbor interpolation (also known as proximal interpolation or, in some contexts, point sampling) is a simple method of multivariate interpolation in one or more dimensions. Interpolation is the problem of approximating the value for a non-given point in some space when given some colors of points around (neighboring) that point. The nearest neighbor algorithm selects the value of the nearest point and does not consider the values of neighboring points at all, yielding a
piecewise-constant interpolation. The algorithm is very simple to implement and is commonly used (usually along with mipmapping) in real-time 3D rendering to select color values for a textured surface.

**Bilinear interpolation:** In computer vision and image processing, bilinear interpolation is one of the basic re-sampling techniques. In texture mapping, it is also known as bilinear filtering or bilinear texture mapping, and it can be used to produce a reasonably realistic image. An algorithm is used to map a screen pixel location to a corresponding point on the texture map. A weighted average of the attributes (color, alpha, etc.) of the four surrounding pixels is computed and applied to the screen pixel. This process is repeated for each pixel forming the object being textured.

**Bi-cubic interpolation:** In mathematics, bi-cubic interpolation is an extension of cubic interpolation for interpolating data points on a two dimensional regular grid. The interpolated surface is smoother than corresponding surfaces obtained by bilinear interpolation or nearest-neighbor interpolation. Bi-cubic interpolation can be accomplished using either Lagrange polynomials, cubic splines, or cubic convolution algorithm. In image processing, bi-cubic interpolation is often chosen over bilinear interpolation or nearest neighbor in image re-sampling, when speed is not an issue.

**PROPOSED IMAGE RESOLUTION ENHANCEMENT:** As the curvelet transformation consists of four part i.e., Sub-band decomposition, Smooth partitioning, Normalization, Ridgelet transformation. Mostly useful to find the edges of the images, where every frequency component is being tested under this process. For multi resolution analysis it is advanced one compared to Wavelet transformations. To implement the image resolution enhancement we adopt for zero padding fast curvelet transformations. The value indicates that the proposed scheme is most elaborate and easy to say most effective and efficient to work on. The results were discussed in the next section. Curvelet transformation to decompose a low resolution image into different sub-bands. Then the three high frequency sub-band images have been interpolated using bi-cubic interpolation. The high frequency sub-bands obtained by dct of the input image are being incremented into the interpolated high frequency sub-bands in order to correct the estimated coefficients. In parallel, the input image is also interpolated separately. Finally, corrected interpolated frequency sub-bands and interpolated input image are combined by using inverse curvelet transformation (idct) to achieve a high resolution output image.

**RESULTS:**

(c) Original low resolution Baboon’s image. (b) Bicubic interpolated image. (c) Super resolved image using WZP. (d) Proposed technique. (e) Curvelet With Zeropad
Comparison analysis:

<table>
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<th>TECHNIQUES/IMAGES</th>
<th>LENA</th>
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CONCLUSION:

This work proposed an image resolution enhancement technique based on the interpolation of the high frequency sub bands obtained by Discrete Curvelet Transformation, correcting the high frequency sub band estimation by FDCT frequency sub bands, and the input image. The proposed technique uses FDCT to decompose an image into different sub bands, and then the high frequency sub band images have been interpolated. Afterwards all these images have been combined using IFDCT to generate a super resolved image. The proposed technique has been tested on well-known benchmark images, where their PSNR and visual results show the superiority of proposed technique over the conventional and state-of-art image resolution enhancement techniques.

REFERENCES:


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