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Image Resolution Enhancement Using Transform

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ABSTRACT

In this project, interruption based image resolution enhancement technique using Discrete Wavelet Transform (DWT) with high-frequency sub bands obtained is proposed. Input images are decomposed by using DWT in this proposed enhancement technique. Inverse DWT is used to generate a new resolution enhanced image from the interpolation of high-frequency sub band images and the input low-resolution image. Intermediate stage has been proposed for estimating the high frequency sub bands to achieve a sharper image. It has been tested on benchmark images from public database. Peak Signal-To-Noise Ratio (PSNR) and visual results show the dominance of the proposed technique over the predictable and state-of-art image resolution enhancement techniques.

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1. INTRODUCTION

With the recent advances in low-cost imaging solutions and increasing storage capacities, there is an increased demand for better image quality in a wide variety of applications involving both image and video processing. While it is preferable to acquire image data at a higher resolution to begin with, one can imagine a wide range of scenarios where it is technically not feasible.

2. BACKGROUND

Contrast enhancement using minimum mean brightness error bi-histogram equalization is presented in [1]. The conservatory of Bi-Histogram Equalization (BBHE) referred to as least amount of bi-histogram equalization of mean brightness error to give highest brightness conservation. It separates the histogram of input images into two depend on input mean before equalizing them in parallel. Threshold level based partition is performed which would give least amount of absolute mean brightness error.

Contrast enhancement of mammograms based on region is described in [2]. Contrast enhancement of mammographic features of changing size and shape, adaptive method is used. The region is grown by this method using each pixel in the image. The point and shape of the region get used to local image, variations in grey level. By applying an empirical transform, contrast is enhanced based on every regions seed pixel value, its background and its contrast. Inter-sub band correlation based image resolution enhancement in wavelet domain is discussed in [3]. Inter-sub band correlation based resolution enhancement method is measured. Interpolation filters are used to analyze the correlations between sub bands having diverse sampling phases in the lower level, and given to the correlated sub bands in the higher level.

Cycle spinning and edge modeling based wavelet domain image resolution enhancement is explained in [4]. An initial high-resolution estimate to the original image is obtained by means of zero-padding in the wavelet domain. Cycle-spinning methodology is used for further processing which decreases

ringing. Linear regression using a least training set of high resolution originals is lastly engaged to rectify the degraded edges. Adaptive contrast enhancement of medical x-ray images based on region is presented in [5]. Contrast enhancement of X-Ray images and presents here an approach for contrast enhancement based upon adaptive neighborhood technique [6]. An outcome of periodized small side games with and without mental imagery on playing ability among intercollegiate level soccer players is also describes that [6]. Image Super Resolution Using Wavelet Transformation Based Genetic Algorithm explained in [7]. Local Binary Patterns (LBP) and DWT techniques are analyzed for object recognition in [8]. LBP is used to extract the detailed information's of objects from its multi-scale representation. Using the extracted features, the recognition of objects can be done by the classifier known as the nearest neighbour classifier. So DWT can be used for both enhancement and classification type. Text Region Extraction in a Document Image Based on DWT is explained in [9]. Blind Stegnography in Color Images by Double Wavelet Transform and Improved Arnold Transform is presented in [10]. VLSI Architectures for DWT based on lifting –A Survey [11]. Here DWT is also used in VLSI domain works. Frequency Band Suppression and Throughput Enhancement based Image Compression using Discrete Wavelet Transform is discussed in [12].

3. THE PROBLEM

The basic limitations including are that it cannot simultaneously enhance all parts of image very well and it is also difficult to automate the image enhancement procedure. Working of traditional methods of image enhancement is to enhance the appearance of low quality image [6]. It does not contain any high quality background information because in the dark image some areas are so dark that all the information is already lost in those regions.

4. PROPOSED SOLUTION

Low-pass filtered signal having some high frequency information because the analysis filter bank has finite filter taps and also some low frequency information is obtained from high pass filtered signal. Same phase has down sampling the both high-pass and low-pass filtered signals but still remains some correlation though, there will be correlation at low while down sampling by various phases. There are three steps are involved in proposed scheme: filter estimation, band estimation, and reconstruction.

4.1. Filter Estimation

More than complete wavelet transform on the obtained LL00 is applied first to get all various phase cases of every sub band. Four filters are designed in this step: LL1_ 01, LL1_10, HL1_ 00 and LH1_ 00. These are anticipated respectively from LL1_ 00.Linear least-squares regression based filter evaluation approach also utilized.

4.2. Band Estimation

Filters anticipated in this section are used in the lower level to evaluate the associated bands in the higher level. 10 LL, 01 LL, 00 HL and 00 LH of high level from LL00 is obtained by using filters f Ah, f Av, f Bh and f Bv anticipated in the lower level.

5. RECONSTRUCTION

Input image resolution is enhanced by reconstructing the original image from the performance of inverse wavelet transform with LL00 and the predictable 10 HL and 01 LH. The diagonal band of HH11 is supposed to be zero, because HH11 not only belongs to diverse sub band from 00 LL but also has diverse sampling phases.

(a) (b) (c)

Figure 1. Given Input Image: (a) Baboon, (b) Lena, and (c) Mandrill

6. RESULTS AND DISCUSSIONS

Number of well-known test images including Lena, Baboon and mandrill are experimented. Used all the images in the database except one image for evaluation at the training phase for linear regression is repeated. PSNR values for error between the one hand ground truth images and reconstruction is measured. Edge directed interpolation based non-wavelet scheme was also considered to give a comparison with a state-of-the-art method. Our results show that the proposed technique provides reliable improvements.

Table 1. PSNR Value for Proposed Given Image

Parameter	Baboon	Lena	Mandrill
PSNR	28.94	31.46	24.58

7. CONCLUSIONS

Wavelet domain based image resolution enhancement algorithm was presented. Zero padding of high frequency wavelet sub bands is the important elements of this technique. Ringing arising are reduced by cycle spinning from finally edge rectification and zero-padding to improve blurring due to the unavailability of high spatial frequency information. Our results have shown that the proposed method outperforms conservative image interpolation approaches.

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