Aspects of Contour Let Transforms In Digital Image Edge Detection

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Abstract - Images taken with both digital cameras and conventional film cameras will pick up noise from a variety of sources. Further use of these images will often require that the noise be (partially) removed – for aesthetic purposes as in artistic work or marketing, or for practical purposes such as computer vision. The defining characteristic is that the value of a noisy pixel bears no relation to the color of surrounding pixels. Generally this type of noise will only affect a small number of image pixels. When viewed, the image contains dark and white dots, hence the term salt and pepper noise. Typical sources include flecks of dust inside the camera and overheated or faulty CCD elements. In reduced-reference (RR) image quality assessment (IQA), the visual quality of distorted images is evaluated with only partial information extracted from original images. In this paper, by considering the information of textures and directions during image distortion, we propose a new reduced reference IQA metric to calculate the diversifications based on contourlet transform. Experimental result illustrate that even with low data rate; the presented metric has still good consistency with the subjective perception.

Keywords- Edge detection; Contour let algorithms; Image gradient.

I. INTRODUCTION

In Gaussian noise, each pixel in the image will be changed from its original value by a (usually) small amount. A histogram, a plot of the amount of distortion of a pixel value against the frequency with which it occurs, shows a normal distribution of noise. While other distributions are possible, the Gaussian (normal) distribution is usually a good model, due to the central limit theorem that says that the sum of different noises tends to approach a Gaussian distribution.

In either case, the noise at different pixels can be either correlated or uncorrelated; in many cases, noise values at different pixels are modeled as being independent and identically distributed, and hence uncorrelated.

Review of literature:-

Zuofeng Zhou et.al; (2009) “Contourlet-based Image Denoising Algorithm usingAdaptive Windows” proposed contourlet-based image denoising algorithm using adaptive windows which utilize both the captured directional information by the CT (contourlet transform) and the intrinsic geometric structure information of the image.

Liu Xia, Yu Fangfei, Sun Ligang,(2014) “New artificial life model for image enhancement” In this work, a strategy to enhance pictures in light of another counterfeit life model is introduced. The model is inspired on the conduct of a herbivore living being, the point at which this life form is in a specific domain and chooses its nourishment.

J. Fridrich,(2004) This thesis presents an image denoising algorithm based on dyadic CT (contourlet transform). Using the feature of NSCT translation invariance, multiresolution, multi-direction, and can according to the energy of NSCT in all directions and in all scale, adaptive denoising threshold.

M. N. Do and M. Vetterli(2005) “Image Denoising with the CT (contourlet transform)” Use a common approach involves transform-domain coefficients manipulation, followed by the inverse transform. This approach is highlighted by recently-developed methods that model the inter-coefficient dependencies. However, these methods operate on the transform domain error rather than on the more relevant image domain one.

J.-L. Starck, E. J. Candes, and D. L. Donoho(2002) “The CT (contourlet transform): An Efficient Directional Multiresolution Image Representation” The limitations of commonly used separable extensions of one-dimensional transforms, such as the Fourier and wavelet transforms, in capturing the geometry of image edges are well known. In this thesis, we pursue a “true” two dimensional transform that can capture the intrinsic geometrical structure that is key in visual information.

B. Matalon, M. Elad, and M.Zibulevsky(2005) “Contourlet-based image adaptive watermarking” Observe that the CT (contourlet transform) (CT), the Laplacian pyramid (LP) decomposes an image into a low-frequency (LF) subband and a high-frequency (HF) subband. The LF subband is created by filtering the original image with 2-D low-pass filter. However, the HF subband is created by subtracting the synthesized LF subband from the original image but not by 2-D high-pass filtering the original image.

H. Sajedi and M. Jamzad,(2008) “Improved Denoising of Images Using Modelling of a Redundant CT (contourlet transform)” In this work we investigate the image denoising problem. One common approach found in the

literature involves manipulating the coefficients in the transform domain, e.g. shrinkage, followed by the inverse transform. Several advanced methods that model the inter-coefficient dependencies were developed recently, and were shown to yield significant improvement.

N. Kaewkamnerd and K. R. Rao(2000) "A Comparison of Wavelet, Contour let and Contourlet based Texture Classification Algorithms for Characterization of Bone Quality in Dental CT" The objective of this thesis is to design and implement classifier framework to assist the surgeon for preoperative assessment of bone quality from Dental Computed Tomography images.

C. Liu and S. Liao(2008) "Image Compression Using Discrete Wavelet Transform" Image compression is a key technology in transmission and storage of digital images because of vast data associated with them. This research suggests a new image compression scheme with pruning proposal based on discrete wavelet transformation (DWT).

Image Denoising for Adaptive Threshold Function Based on the Dyadic Wavelet Transform" Based on the characteristic of dyadic wavelet transform to image denoising, this thesis presents that denoising precision can be improved by the way that adopting different thresholds according to the different scales of the wavelet coefficients of image and noise to establish adaptive layered threshold function which adapts to it and reconstruct the wavelet.

Image Enhancement is one of the most important and difficult techniques in image research. The aim of image enhancement is to improve the visual appearance of an image, or to provide a "better transform representation for future automated image processing. Many images like medical images, satellite images, aerial images and even real life photographs suffer from poor contrast and noise.

II. RESEARCH METHODOLOGY

Image edge detection Based on NSCT:

Here, outcome can be further improved by performing edge detection at multiple resolutions using multi-scale representations. Wavelet strategies are proposed in the writing. Not at all like Fourier-change, WT coefficients are in part limited in both spatial and recurrence spaces and frames a multi-scale representation of the picture [3]. Subsequently the changed coefficients can be effectively chosen as the elements of pictures for arrangement. In any case, it is outstanding that the normally utilized distinguishable expansions of one-dimensional changes, for example, WT, are restricted in catching the geometry of image edges. It cannot effectively represent textures and fine details in images for lacking of directionality. The Contourlet transform (CT) is a flexible multi-resolution, local, and directional image expansion using contour segments. It can provide a multiscale and directional decomposition for images. Due to sub sampling, the CT and WT are lack of shift-variant and result in pseudo-Gibbs distortion and blur edge of pavement cracks. The NSCT is built upon iterated nonsub-sampled filter banks to obtain a shift-invariant directional multi-resolution image representation.

- Captures smooth contours and edges at any orientation
- Filters noise
- Derived directly from discrete domain instead of extending from continuous domain
- Can be implemented using filter banks.

Contourlet transform is one of several transforms developed in recent years, aimed at improving the representation sparsity of images over the wavelet transform. The main feature of this transform is the potential to handle 2-D singularities efficiently, i.e. edges, unlike wavelet, which can deal with point (i.e.1-D) singularities exclusively. Contour-let transform is a directional extension of wavelet transform that fixes the wavelet sub band-mixing problem and improves its directionality.

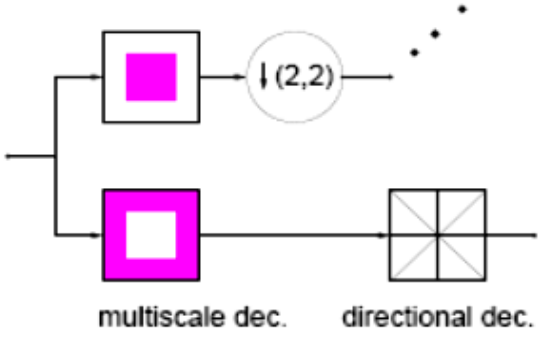


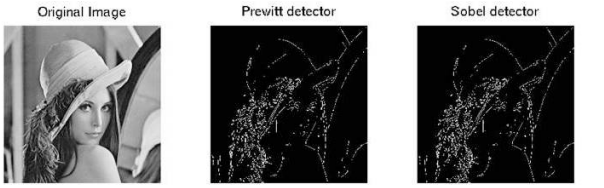
Fig:-Block diagram of CT (contourlet transform)

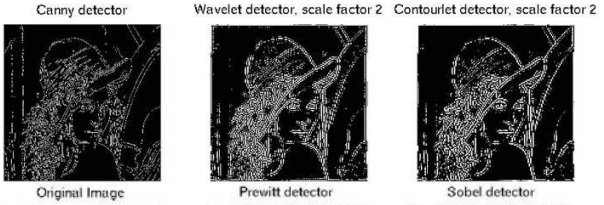
Two-dimensional wavelet transform produces one approximation sub-band, and three details sub-bands, corresponding to the horizontal, vertical, and diagonal directions. The diagonal sub-band mixes the directional information oriented at 45◦and 135◦. The main idea of contour let is to find some directional extensions to divide further each detail sub-band of the wavelet into a number of directions. This transform is based on a double filter bank structure by combining the Laplacian pyramid with a directional filter bank. Figure 2 shows an image that is decomposed into one pyramidal level and sixteen directional sub-bands (higher coefficients are colored white).

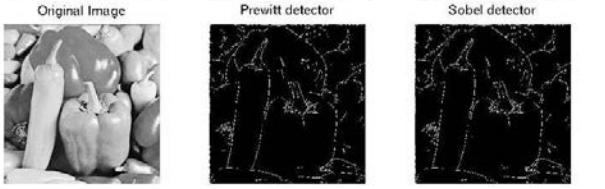
III. RESULT & DISCUSSION

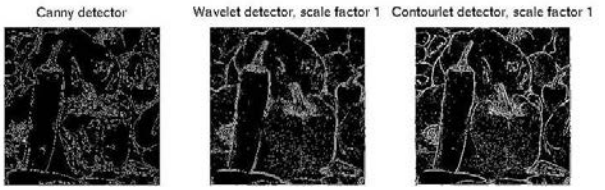
To validate the invisibility an d the robustness of the CIAW scheme, we conducted the experiments on the different images (''Lena'', ''Barbara'', and ''Pepper s'' images of size 512512) and simulated some image processing operations, which may remove the inserted

watermark. The 5/3 bi-orthogonal filters are used for both the multi resolution pyramidal filtering and the directional decomposition. Firstly, we transform the image into contour let representation with S¼3. Subsequently, we embed the watermark into four largest detail sub bands by adjusting their strength based on the calculated watermark visual mask. It is deemed that the watermark at the HF sub bands of an image is sensitive to many image processing method s such as low-pass filtering, lossy compression, noise, and geometrical distortion. On the other hand, the watermark at LF sub bands of an image is sensitive to other image processing methods such as gamma correction, histogram equalization, and crop ping. We attempt to check the robustness of our watermarking scheme and the validity of our detect ion algorithm for both the HF and the LF signal processing.

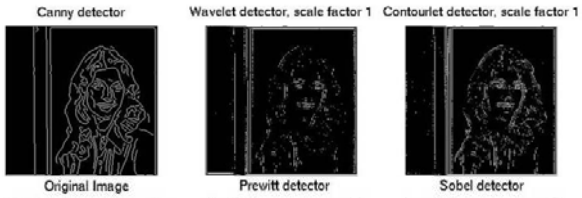


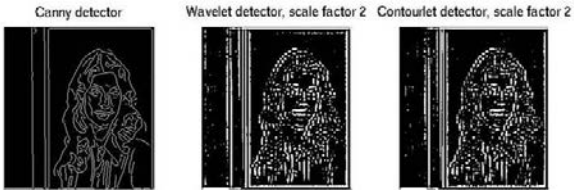






The existing algorithms of image edge detection based on space domain can effectively detect the edge of the image in limited direction. In order to solve this problem, according to the direction information and gradient direction information obtained from each directional sub band of the Contour let transform sub band, this paper proposes a new algorithm of Based on Contour let transform combined with anisotropic receptive field model of image edge detection. This algorithm firstly carries Contour let transform on the original image, and detects the edge on each scale. It compensates and corrects the image edge with high and low frequency respectively. Finally, the edge image is obtained by choosing the coefficient of absolute value maximum. The experimental results show that this algorithm is a new way with continuous edge and accurate positioning, which reduces the false edge.





- Focus will be on edge detection
  - Gradient operators (Sobel, Roberts)
  - Laplacian operators
  - LoG (Laplacian of Gaussian)
  - DoG (Difference of Gaussians)
  - Canny method
  - Anisotropic diffusion

An algorithm for image edge detection based on non-subsampled contourlet transform (NSCT) is proposed. NSCT is multi-resolutional, localized, multidirectional and anisotropic so it can more effectively capture high dimensional singularity. Firstly, the coefficients at different scales and in different directions are obtained by image decomposition using the NSCT, then with these coefficients thresholds are adaptively set and the generalized nonlinear gain function is used to enhance the edge features with low contrast while protecting the strong contrast features from over enhancing in the NSCT domain. The experiment results show that the algorithm achieve a good effect than other algorithms.

IV. SUMMARY & CONCULSION

Using the characteristics of multi-scale, multi-direction and translation invariance, we proposed a new approach for image edge detection. Compared with other algorithms the method proposed in this paper can not only effectively enhance weak edge signals but also suppress noise while preserving the rich details of the image edge, and can well inhibit the edge blurring caused by the pseudo-Gibbs distortion. Experimental results show the effectiveness of the algorithm, but how to improve the timeliness and efficiency of the algorithm is issue to further study.

- Contourlet transforms can be used for edge detection
- Results can vary based on the type of image
- Evaluation is only useful given what the feature extracted is to be used

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