Global Image Denoising Improved with PDE and Canny Edge Detection Technique

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***Abstract* – Image denoising is one of the fundamental problems in image processing. In this paper, a novel approach to suppress noise from the image is conducted by applying the Nystrom extension as existing method, which is order-statistics filter and simpler. The disadvantage of applying Nystrom extension in the existing system which causes the reduced quality in the image like sharpness, and edge cut.**

To overcome the disadvantages of existing system here we proposed a new technique by including canny edge detector and PDE filter. The essential advantage of applying canny filter is to preserve edge sharpness better of the original image. The experimental results on standard test images demonstrate this filter is simpler and better performing in improving the quality of image.

Keywords – Image Denoise, Noise Removal, Canny Edge Detector, PDE, Noise Filter, Edge Detection.

I. INTRODUCTION

Image quality improvement has been a concern throughout the field of image processing. Images are affected by various type of noise. One of the most important areas of image restoration is that cleaning an image occurring by noise. The goal of reducing noise is to eliminate noisy pixels. Noise filtering can be used as replacing every noisy pixel in the image with a new value depending on the neighboring region. The filtering algorithm varies from one to another by the approximation accuracy for the noisy pixel from its surrounding pixels. Image de-noising is a vital image processing task i.e. as a process itself as well as a component in other processes. There are many ways to de-noise an image or a set of data and methods exists.

The proposed algorithm in this paper focuses on how to effectively detect the noise and efficiently restore the quality of image. Once pixel is detected as noise in previous phase, their new value will be estimated and set in noise reduction phase. The Canny filters are used in the process of identifying the image by locating the sharp edges which are discontinuous. These discontinuities bring changes in pixels intensities which define the boundaries of the object. Edge detection is a problem of fundamental importance in image analysis. The purpose of edge detection is to identify areas of an image where a large change in intensity occurs. Edges are basically discontinuities in the image intensity due to changes in the image structure. These discontinuities originate from different features in an image. In typical image, edges characterize object boundaries and are useful for segmentation, registration and identification of objects in a scène. Edges are classified into step, line, ramp and roof edge.

II. SCOPE OF THE PAPER

The scope of the paper is to overcome the disadvantages of global image denoising by applying a new approach of canny edge detector with a PDE filter for the effective improve in the quality of the image and to increase the enhancement of the image. Here the step which follows as, the denoised global image which merge or superimpose with the resultant edge detected image using PDE to smoothen the edges of image.

Thus the output which results in high end sharpened and reduced edge cut with lesser blur appearance.

III. IMAGE DENOISING

Image denoising is the process of finding unusual values in digital image, which may be the result of errors made by external effects in image capturing process. Identifying these noisy values is an essential part of image enhancement. In the past three decades, a variety of deposing methods have been proposed in the image processing. In spite of these methods are very different, but they tried to remove the noisy pixels without affecting the edges, as much as possible. One of the most common filters is the median filter. Median filter is very effective in removing salt and pepper and impulse noise while preserving image details. In particular, the median filter performs well at filtering outlier points while leaving edges unharmed. One of the undesirable properties of the median filter is that it does not provide sufficient smoothing of non impulsive noise.

IV. NYSTROM APPROXIMATION

The Nystrom method is an efficient technique to generate low-rank matrix approximations and is used in several large-scale learning applications. A key aspect of this method is the procedure according to which columns are sampled from the original matrix. In this work, we explore the efficacy of a variety of fixed and adaptive sampling schemes. We also propose a family of ensemble-based sampling algorithms for the Nystrom method. We report results of extensive experiments that provide a detailed comparison of various fixed and adaptive sampling techniques, and demonstrate the performance improvement associated with the ensemble Nystrom method when used in conjunction with either fixed or adaptive sampling schemes. Corroborating these empirical findings, we present a theoretical analysis of the Nystrom method, providing novel error bounds guaranteeing a better convergence rate of the ensemble Nystrom method in comparison to the standard Nystrom method.

In numerical analysis, the Nystrom method or quadrature method seeks the numerical solution of an integral equation by replacing the integral with a representative weighted sum.

The continuous problem is broken into ***n*** discrete intervals; quadrature or numerical integration determines the weights and locations of representative points for the integral. The discrete problem to be solved is now a system of linear equations with n equations and ***n*** unknowns.

From the n solved points the function value at other points is interpolated consistent with the chosen quadrature method. Depending on the original problem and the choice of quadrature the problem may be ill-conditioned. Since the linear equations require $O(n^3)$ operations to solve, hence high-order quadrature rules perform better because low-order quadrature rules require large ***n*** for a given accuracy. Gaussian quadrature is normally a good choice for smooth, non-singular problems.

Discretization of the integral,

$$\int_a^b h(x)\,\mathrm{d}x \approx \sum_{k=1}^{n} w_k h(x_k)$$

where w_k are the weights of the quadrature rule, and points x_k are the abscissas.

V. CANNY EDGE DETECTION

The **Canny edge detector** is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.

The Canny Edge Detection Algorithm has the following steps,

STEP-1: Apply Gaussian filter to smooth the image in order to remove the noise

STEP-2: Find the intensity gradients of the image

STEP-3: Apply non-maximum suppression to get rid of spurious response to edge detection

STEP-4: Apply double threshold to determine potential edges

STEP-5: Track edge by hysteresis.

Normal Image

Canny Edge Detected Image

The general criteria for good canny edge detection which must include,

Criterion 1: Good Detection: The optimal detector must minimize the probability of false positives as well as false negatives.

Criterion 2: Good Localization: The edges detected must be as close as possible to the true edges.

Criterion 3: Single Response Constraint: The detector must return one point only for each edge point.

VI. PARTIAL DIFFERENTIAL EQUATION

The partial differential equation involves a high dimensional representation of, denoted by, and a projection which is used to convert the high dimensional representation back to an image? The projection, gives the vector of length that best approximates the high dimensional data, denoted. The specific formulation for relates to the linear operator that was used to generate the high dimensional function. A standard fidelity term to the original image is an also present. The vector of length is simply the grayscale pixels values of the original noisy image. The PDE filter which results in smooth of edges in image.

VII. CONCLUSION

In this paper, a new and simple approach of proposed canny filter use statistic in a way that removes outlier from a window of size k×k. It can be seen that canny filter preserves edge sharpness better of the original image than median filter. As a main conclusion by which whenever the window size is increased the preserving of the edges is not affected.

The proposed denoising method can effectively compare data throughout an entire image and incorporate it into an effective denoising result. Very little of the true image is removed as noise and significant denoising occurs in every part of the image. The projection step of the proposed method, which involves Superimposing of canny image with denoised image to improve the quality and enhancement of original image.

Another advantage of this method is that there may be many avenues toward its improvement. The speed and denoising capability of the method depends on several very well studied problems, including selecting local image attributes of interest, partial differential equationss, random nearest neighbor searching, and finding an optimal solution to an over determined system.

REFERENCE

[1]. Canny, J., "A Computational Approach To Edge Detection," IEEE Trans. Pattern Analysis and Machine Intelligence, 8(6):679–698, 1986.

[2]. R. Deriche, "Using Canny's criteria to derive a recursively implemented optimal edge detector, " Int. J. Computer Vision, Vol. 1, pp. 167–187, April 1987.

[3]. Lindeberg, Tony, "Edge detection and ridge detection with automatic scale selection," International Journal of Computer Vision, 30, 2, pp 117-154, 1998.

[4]. Kimmel, Ron and Bruckstein, Alfred M. "On regularized Laplacian zero crossings and other optimal edge integrators," International Journal of Computer Vision, 53(3):225–243, 2003.

[5]. Sanjiv Kumar, Mehryar Mohri, Ameet Talwalkar; "Sampling Methods for the Nystrom Method," International Journal of Computer Vision, 13(Apr):981−1006, 2012.

[6] Orchard, J., Ebrahimi, M., Wong, A, "Efficient Non-Local-Means Denoising using the SVD," Proceedings of The IEEE International Conference on Image Processing ICIP 2008, San Diego, California, USA, October 12-15 2008.

[7]. Hossein Talebi and Peyman Milanfar, "Global Image Denoising," IEEE Transactions On Image Processing, Vol.23, No.2, February 2014.

[8]. Hongmin Cai, Zhong Yang, Xinhua Cao, Member, IEEE, Weiming Xia, and Xiaoyin Xu, Member, IEEE, "A New Iterative Triclass Thresholding Technique," IEEE Transactions On Image Processing, Vol. 23, No. 3, March 2014 in Image Segmentation.

[9]. Akhilesh Bijalwan, Aditya Goyal, Nidhi Sethi , "Wavelet Transform Based Image Denoise Using Threshold Approaches," International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-1, Issue-5, June 2012.

[10]. Peyre, G., "Image Processing with Non-Local Spectral Bases," SIAM Journal on Multiscale Modeling and Simulation 7, 2 (2008) 703-730

[11]. Mahmoudi M., and Sapiro, G., "Fast Image and Video Denoising via Nonlocal Means of Similar Neighborhoods," IEEE Signal Processing Letters, Vol. 12, No. 12, December 2005.

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