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A Review Paper On Different Corner Detection Technique

Vineeta Vishwakarma M. Tech. Scholar, Mrs. Jigyasha Maru Asst. Professor

***Abstract*- In present era every multimedia device are require fast and good quality image/video. Due to Machine to machine & Internet of Things, there is rapid demand of real time transmission applications so for those applications there is need of some application specific processing unit which also make justice with better power consumption. As we know in present stage there are some area where we need to find the corners point those are related to Defense, Aeronautics, Traffic. In this type of application there is need of some device which will detect the corner points and fast processing unit which is not possible by pure accurate unit so for reduction of those issue in work we need to present a Novel algorithm which involve both 2D Gaussian smooth filter & Corner detection algorithm. In this paper we study about the previous existing corner detection techniques.**

***Keywords*: DTCWT, Memory, Sub pixel, Harris algorithm, corner point, corner detection, 2D Gaussian smooth filter**

I. INTRODUCTION

A digital image is a representation of a two dimensional image as a finite set of digital values, called picture elements or pixels. Pixel values typically represent gray levels, colors, heights; opacities etc.
Remember *digitization* implies that a digital image is an *approximation* of a real scene. Common image formats include:

- sample per point (B&W or Grayscale)
- samples per point (Red, Green, and Blue)
- samples per point (Red, Green, Blue, and “Alpha”)

Digital image processing focuses on two major tasks

- Improvement of pictorial information for human interpretation
- Processing of image data for storage, transmission and representation for autonomous machine perception some argument about where image processing ends and fields such as image analysis and computer vision start

Image registration is an important step of remote sensing image processing, and it is pre-processing of image mosaic, image fusion, relative radiometric normalization, land use classification, and land use change detection, etc. Primary task of the remote sensing image registration is to find correct ground control point correspondences on the base image and the warp image. However, it is low efficient to select ground control point by manual work and the final precision is unstable. With the development of the computer science, pattern recognition, artificial intelligence, and image processing technology, many kinds of full-automatic or semi-automatic image registration algorithms are proposed, the key procedures including two aspects: one is to detect ground control point automatically.

RGB Color Model

The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors. RGB is a device-dependent color model: different devices detect or reproduce a given RGB value differently, since the color elements (such as phosphors or dyes) and their response to the individual R, G, and B levels vary from manufacturer to manufacturer, or even in the same device over time. Thus an RGB value does not define the same color across devices without some kind of color management. Typical RGB input devices are color TV and video cameras, image scanners, video games, and digital cameras. Typical RGB output devices are TV sets of various technologies (CRT, LCD, plasma, etc.), computer and mobile phone displays, video projectors, multicolor LED displays, and large screens such as Jumbo Tron. Color printers, on the other hand, are not RGB devices, but subtractive color devices (typically CMYK color model).

II. LITERATURE REVIEW

A. Overview Previous Research

Feature extraction has always been an important direction in computer vision, image processing and machine vision, whiles the corner as an important feature of the image has long been a concern, it also made a lot of research results. Corner is the two-dimensional point of rapid change image brightness, or curve maximum curvature point in image edge. Corner is an important local feature of the image, it focused on a number of important information of the shape of the image to reflect the image of the local features, it can match images more reliable. Corner has such rich feature information, so that it hold important features of graphic images and effectively reduced the amount of data information, it improves the speed of operation, it makes easy to a image reliable matching, makes real-time processing possible. It has the rotational invariance and does not change with the light conditions change, so it has important applications in many fields such as matching the images, camera calibration, 3D reconstruction, moving object tracking and pattern recognition.

B. Previous Works

In the year 2007 Xinting Gao, Farook Sattar and Ronda Venkateswarlu "a novel corner detection method for gray level images based on log-Gabor wavelet transform(WT)". has proposed that The input image is decomposed at multi scales and along multi-orientations. The magnitudes of the decomposition are formulated into the second moment matrix. The smaller Eigen value of the second momentum matrix is used as the "cornerness" measurement. Compared with the most famous Harris detector, SUSAN detector and the recently published detector - Gabor wavelet transform based detector, the proposed method shows good localization and single response to the higher order corner structures. The simulation result also shows the higher detection rate of the proposed method. The localization is improved by utilizing the optimal localization property of the log-Gabor WT. To achieve isotropic response, the proposed method exploits the multi-orientation decomposition of log-Gabor WT and constructed the second moment matrix. The smaller eigenvalue of the second moment matrix is used to detect corners. The proposed method provides a unique response for the corner of higher order structure. Simulation results compare the proposed methods with one recently presented method and two existing well-known approaches and demonstrate the better performance of the proposed method. The proposed method can be evaluated objectively through application based method, e.g. stereo matching. Due to the limit of the length of the paper, the quantitative evaluation results have not shown in this paper, which further demonstrate the better performance of the proposed method.

In the year 2011Yang Bai, Hairong Qi "A corner detection from dual-tree complex wavelet transform (DTCWT)" proposed that in this design author use 2D-DWT technique. 2-D DWT decomposes an image into multiple scales. The orthogonal wavelet based decomposition is non-redundant, thus incurring no additional storage overhead. By using the 2-D DWT decomposition, we can find the edges by examining the local extremes of wavelet coefficients along the horizontal, vertical or diagonal directions. Then we can find a corner point by looking at the coordinates where two or three wavelet coefficients along different directions both/all reach a local extreme. The DWT is not isotropic, meaning the edge detection is not rotationally invariant, and so does the corner detection The DTCWT is directional selective, therefore making the corresponding corner detector rotational invariant However, the DTCWT analysis is redundant, specifically, the data volume of the decomposition structure doubles the size of the original image, and thus incurs additional computational cost and data storage. The additional overhead to compensating the rotational variance, sometimes could be hazardous, especially for the computer vision algorithms running on low end systems.

In the year 2013 Yang Qiao,Yanchao Tang, and Junshi Li "a sub-pixel corner detection based on improved Harris algorithm" proposed that is improved version of Harris algorithm. According to the two basic conditions of demand of sub pixel positioning technology, first, target is not an isolated single point that has some geometric characteristics of the gray; secondly, we should know the specific location of target positioning datum point. Determine the calibration image to meet above two fundamental conditions, and we will have a fair chance of obtaining sub-pixel positioning. The Harris comer detection operator can accurately obtain the coordinates of the corner point in the case of image rotation, gray change and noise interference; therefore it has a good stability and high robustness. But the Harris operator can only detect the comer points of the pixel coordinates, so we need to make improvement to the Harris operator, to realize sub-pixel detection, proposed a robust edge and corner detection using noise identification and adaptive thresholding techniques. In the first step, an image de-noising algorithm is used to remove noise. Over the past decades, many image de-noising algorithms have appeared in the literature. They usually work very well for the types of noise they have been designed for. For instance, Wiener filter works well for removal of additive uniform or Gaussian distributed white noise, Kalman filter works fine for additive Gaussian noise, homomorphic filter works well for multiplicative speckle noise, and median filter works very well for removal of salt-and-pepper noise. If the noise type can be identified automatically and then the filter, which is known to work best for a robust two-step edge and corner detection algorithm is proposed. The novelty of the proposed method includes usage of a pattern classification based noise identifier in the first step and a fuzzy k-means clustering based adaptive threshold estimator in the second step. The performance of the proposed method is evaluated using extensive simulation studies. removing this type of noise, can be used to restore it. The noise classifier proposed here uses some statistical properties of typical noises to identify the noise type so that the best proved-filter is always used to assure best image de-noising. For edge or corner detection, a fuzzy k-means algorithm calculates adaptive thresholds for edge/non-edge or corner/non corner classification. The combination of the two algorithms allows us to get robust edge and corner detection results.

In the year 2007Xinting Gao, Farook Sattar, Ronda Venkateswarl "A multiscale corner detection of gray level images based on log-Gabor wavelet transform" proposed that Gabor wavelets have the optimal localization in time-frequency plane. They transform the input images along multi-orientations. The magnitudes along the orientations provide more intuitive and useful information to describe the shape of the 2D structures. However, the maximum bandwidth of it is limited to approximately one octave. Furthermore, Gabor wavelets are not optimal for broad spectral information with maximal spatial localization. The log-Gabor wavelets that solve the problems existing in Gabor wavelets. Log-Gabor filters can be constructed with arbitrary bandwidth and the bandwidth can be optimized to produce a filter with minimal spatial extent Gabor functions have Gaussian transfer functions when viewed on the linear frequency scale. While log-Gabor functions have Gaussian transfer functions when viewed on the logarithmic frequency scale. Log-Gabor function has the following transfer function if viewed in the linear frequency scale .$G(f) = e-$ $(log(f/f0))2/2$ $(log(\sigma/f0))2$ where, $f0$ is the filter's center frequency. $\sigma/f0$ controls the shape ratio of the filter. The localization is improved by utilizing the optimal localization property of the log-Gabor WT.

In the year 2014 Wei-Chuan Zhang1, Fu-Ping Wang2, Lei Zhu1, Zuo-Feng Zhou3 "a contour-based corner detector using the magnitude responses of the imaginary part of the Gabor filters on contours". proposed that Unlike the traditional contour-based methods that detect corners by analyzing the shape of the edge contours and searching for local curvature maxima points on planar curves, the proposed corner detector combines the pixels of the edge contours and their corresponding grey-variation information. Firstly, edge contours are extracted from the original image using Canny edge detector. Secondly, the imaginary parts of the Gabor filters are used to smooth the pixels on the edge contours. At each edge pixel, the magnitude responses at each direction are normalized by their values and the sum of the normalized magnitude response at each direction is used to extract corners from edge contours. a adaptive threshold discriminating algorithm for remote sensing image corner detection. The probability distribution of gray gradient could be calculated by the following formula: $P(\ k\ )=\sum_{i=1}^{k} f(i)$ and there was better corner detection precision. While calculating gray level difference, this method regards the convolution calculation result of the small neighborhood as the gray level characteristic value of the neighborhood centre, which eliminates the influence of the noise effectively. In addition, to avoid the selected point are crowded, the image can be segmented firstly, then the upper limit threshold t and the lower limit threshold t' could be determined adaptively in each segment, and corner point could be extracted in each segment respectively. With the adaptive threshold discriminating method, corner point of different remote sensing images could be extracted correctly without any manual intervention and there was better corner detection precision.

In the year 2007 Yixin Chen and Manohar Das "Robust Edge and Corner Detection Using Noise Identification and Adaptive Thresholding Techniques" proposed that a robust, two step method for edge and corner detection in noisy images. First it identifies the type of noise using a new pattern classification approach and then restores the image using a good restoration technique suitable for the type of noise identified. The types of noise considered here include uniform white, Gaussian white, speckle, and salt-and-pepper noise. From the restored image, edge and corner strengths are determined using gradient based techniques, and finally, a fuzzy k-means clustering algorithm is used to find adaptive thresholds for detecting the edge and corner points. In conclusion, a robust, two-step edge and corner detection method for noisy images is presented in this paper. The noise classifier proposed here uses some statistical properties of typical noises to identify the noise type so that the best proved-filter is always used to assure best image de-noising. For edge or corner detection, a fuzzy k-means algorithm calculates adaptive thresholds for edge/non-edge or corner/non-corner classification. The combination of the two algorithms allows us to get robust edge and corner detection results.

III. RESEARCH GAPS

In research gaps all previous approaches does not fully satisfy the today multimedia requirements and increases the time complexity issue. Algorithm reduces some amount of time complexity but still it will have issue of image quality and if algorithm reduces the image quality problem, but it will increase the time complexity issue. Because the image quality improver filter uses large processing steps and input data. And researcher firstly Convert color noisy image to gray image as input to the corner algorithm and then apply appropriate method such as Harris algorithm, dual-tree complex wavelet transform (dtcwt) log-Gabor wavelet transform etc as we discussed in literature review. Hence it require additional processing step for color image to gray image converter algorithm. The gradient of corner hardly selective and if some corner gradient have to be missing it can't be determined so that it generate error to identify image.

IV. FUTURE OBJECTIVE

Corner Detection Processor is useful architecture in much application like Multimedia & Graphics but still Corner Detection faces many problems which I discussed in research gap. So there are followings object is which I will cover in my thesis:-

Here we will try to make novel algorithm which is fast as compare to previous algorithm, in terms of time & image quality, and also compare it with all previous algorithm. At algorithm Level we are use error resilient logic. Maintain image quality up to the mark with factor improvement in time complexity with 2D Gaussian smooth filter. We will design our corner detection algorithm directly for RGB color noisy image. Fast novel algorithm that reduce time complexity up to 15% to 25% with some approximation techniques. And that also reduces power requirement. The project will develop in both level means algorithm and architecture level. So for all implementation & simulation will be perform on Matlab 11.

V. APPLICATION

To identify or localize any objects more accurately even when input image is noisy or faded in this condition corner detection algorithm is more suitable by comparing multiple corners.
There are many applications where we have to use corner detection processor and those applications are:

- Discrete Cosine Transform
- Face Recognition
- Object navigation
- Leaf Recognition

VI. CONCLUSION

We conclude that the previous existing approaches are facing issue of time complexity and memory complexity. So there is lots of future scope in this existing area of corner detection. This area also has a good scope in architecture level.

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Vineeta Vishwakarma, M.Tech. scholar specializing in digital communication from Dr. C. V. Raman University Kota, Bilaspur (C.G.). BE competed in 2014 from Govt. Engineering college bilaspur (C.G.)

Mrs. Jigyasha Maru, Asst. Professor Dr. C. V. Raman University, Kota, Bilaspur (C.G.)