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Digital image processing: A review

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Abstract
The edge detection process is used to find the strong edge feature of an image. The edge feature is used to denote the image and provides space for extra opportunities to reveal corners, lines and shapes etc. Corner detection is the foremost step of various computer vision system building tasks such as real-time tracking, simultaneous localisation and mapping, image matching and recognition. The design and efficiency of a corner detector is important as it determines the scope whether the detector if combined with further data processing tools can operate at a particular frame rate. For real-time frame rate applications, it appears necessary to deploy a fast speed detector that overcomes the computational complexity of traditional detectors like Harris, Moore's and SUSAN.

Keywords: Digital image processing, corner detection, featured from adaptive accelerated segment test

1. Introduction
1.1 Digital image processing
Digital Image processing (DIP) is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. Digital image processing is the use of computer algorithms to perform image processing on digital images as shown in Figure 1 [2]. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing.
Digital Image Processing makes use of more complex algorithms and thus attempts to render more refined results in simple way as compared to the analog means. This yields a high possibility of applying advanced algorithms with the input data. The major advantageous characteristic of digital image processing is the abundance of methods to avoid noise factor while processing the input signals [1]. In a broader view, digital image feature processing is one technology that can be implemented for

- Object Recognition
- Pattern Classification
- Motion Tracking
- 3D Reconstruction
- Robot Navigation

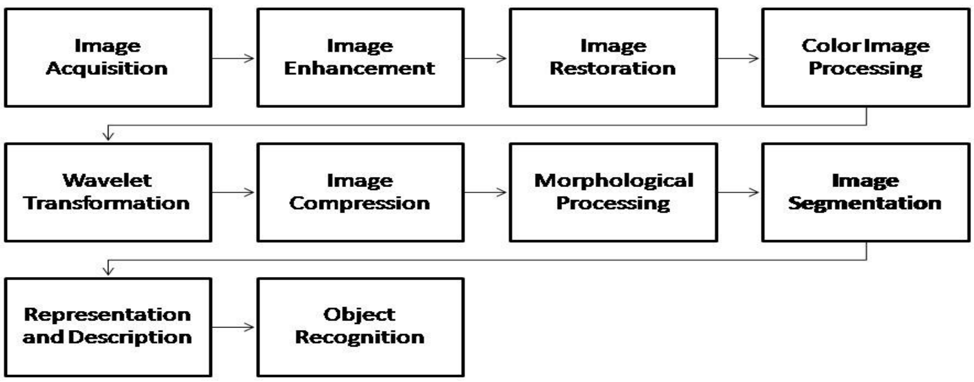

Fig 1: Sequence of Stages in Digital Image Processing

1.2 Image segmentation
Before the object in an image is recognized with all desired attributes, the image is partitioned into multiple segments, featuring a set of pixels called super pixels. Image segmentation is generally applied to allocate space coordinates to objects and boundaries in an image. The most prominent application of image segmentation is found in the domain of shape analysis and location mapping whereby feature detection technique is used to reduce the amount of existing resources consumed in the description of a large set of data [2].
The resultant segments produced in image segmentation collectively span the view area of the entire image. Image segmentation is pivotal to every digital image processing lifecycle stage since it acts as a central point to relate other stages and elements of image that need to be processed according to color model scheme [3].

1.3 Feature detection
A sturdy method of image segmentation can result in thriving solutions that attempt to identify the objects in an explicit manner and lead to flourishing research development further in the problem domain.
Feature detection is the activity that involves uncovering of the vital characteristic attributes of objects present in an image. It follows a procedural algorithm to detect the gray level statistics and further extends to finding the distinguished edges and corners of the target object. This technique of image segmentation finds its wide applications in the field of image restoration and registration, 3d shape analysis, face recognition and object motion tracking [5].

1.3.1 Edge Detection
One of the most significant and fundamental steps in digital image processing for computer vision system is Edge Detection. This method forms the primary stage of corner detection algorithms and is used in image partitioning and registration, where image filtration is done before detecting the edges having a diminished or nil content of noise.
Edge detection simplifies the process of image analysis by significantly screening unwanted information in the form of noise, while preserving the desirable structural characteristics of an image [6]. The edge is a one dimensional object, and its detection method tracks the points of fine intensity variations across an object under consideration [4].
Edge detection involves three fundamental steps as mentioned below
1. Image Filtering
2. Image Quality Enhancement
3. Image Edge Detection

To obtain an edge, the noise in the image grayscale break-offs at a point, known as grayscale discontinuity are measured. The series of these points form an edge in continuous boundary of a line segment. The final edge is taken as the serial dimension deduced by taking the difference in the location of break offs.
An optimal operator used for edge detection should fulfil the following criteria- Good Detection, Good Localization and Unique Response.

1.3.2 Corner detection
Corner detection (CD) is a technique in feature detection terminology that is used to extract the individual, yet distinct feature of an image or object known as corner. The method used in corner detection is executed using an algorithm that traces and detects the characteristic component of image, known as the points of interest with specific pixel position [8].
This involves the extraction of particular attributes of the segments partitioned from within an image. Corner detection is widely used in the domain of motion field tracking, image combining, structural panorama building and other 3-D graphic modeling applications.

2. Literature review
FAST algorithm is suggested as the backbone of SIFT technique by Wu Lifang, Gao Yuan and Zhang Jingwen in [4] that relies on accelerated segment test algorithm. The modified Featured from Adaptive Accelerated Segment Test (FAAST) has been introduced by Yenewondim Biadgieand Kyung-Ah Sohn in [3] that reduces the time complexity of FAST algorithm and improves the output of the unique response. A brief review of An Improved Canny Algorithm based on adaptive threshold selection was carried out in [1]. Here, J. Duan and X. Gao, Y. Wang and Jiangyun Li throw light on the comparison and performance analysis of traditional Canny Operator and adaptive filtering method for Canny edge detection. Further in literature [2], Miaomiao Zhao, Hongxia Liu and Yi Wan have proposed the scope of improvement in Canny Edge Detection algorithm practices using DCT techniques. Amruta L Kabade and Dr. VG Sangam in [7] Introducing the performance analysis of edge detection using improved block level Canny algorithm, five threshold values are considered to implement block level Canny method. This methodology is implemented to remove false edges in the image and smooth the region so it can meet the VLSI requirements as desired. The final edge map of the various edge detectors *viz*., Prewitt, Robert, Canny and Sobel has been compared with the proposed block level Canny edge detector on the ground of the perceptual analysis. Dharampal and Vikram Mutneja in [8], an explanatory organization of edge detection methods is found that also motivates the proposed research work in the field of digital image processing. The authors have provided deep insights of edges and edge detection. The document offers an inclined review of characteristic types of edges and fundamental steps involved in edge detection. The methods of edge detection are further classified into three categories- gradient based edge detection, Laplacian edge detection algorithm and fuzzy logic based edge detection method. Shravani S. Rao and co-authors in [9] have described the implementation of sobel edge detection technique using Matlab-Xilinx co-simulation. The research work contributes to solving the problem of image recognition using HDL. Here, the team has advocated in favor of application of Sobel detector in the field of medical imaging, video surveillance, and departure warning system for its peculiar property of less deviation at high levels of impulse noise.

3. Conclusion
The previous work introduces subjective estimation of comparative performance of the edge and corner detection algorithms. The feature detection methods implemented were Harris, Susan, Laplace, and Canny. The conclusion of that research work suggested Canny and Susan as near optimal detectors for edge and corner detection. Also, their performance is observed better than other detection methods

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