# 2D FIR FILTER BASED EDGE DETECTION OF ANGIOGRAM IMAGES

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## ABSTRACT

*The main objective is to detect the edges as well as to enhance the image, such that the medical images can be displayed more clearly. Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further analysis. The proposed algorithm involves the removal of noise using median filter. 2D FIR filter is used to detect the edge of the given input image. It computes the result using a two-dimensional correlation. It improves the results of the detection process.The resultant image will be used for further interpretation for medical analysis. Image Edge detection significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image*

## I. INTRODUCTION

The blood vessels are the part of the circulatory system that transports blood throughout the body. There are three major types of blood vessels: The arteries, which carry the blood away from the heart, the capillaries, which enable the actual exchange of water and chemicals between the blood and the tissues, and the veins, which carry blood from the capillaries back toward the heart. Without the vasculature to carry blood to and from tissues, they would die in the absence of nutrition and waste removal.

Blood vessels do not actively engage in the transport of blood (they have no appreciable peristalsis) but arteries and veins to a degree-can regulate their inner diameter by contraction of the muscular layer. This changes the blood flow to downstream organs, and is determined by the autonomic nervous system. Blood vessel permeability is increased in inflammation. Damage due to trauma or spontaneously, may lead to hemorrhage due to mechanical damage to the vessel endothelium. In contrast, occlusion of the blood vessel by atherosclerotic plaque, by an embellished blood clot or a foreign body leads to downstream ischemia (insufficient blood supply) and possibly necrosis.

Digital image processing allows one to enhance image features of interest while attenuating detail irrelevant to a given application and then extract useful information about the scene from the enhanced image. Images are produced by a variety of physical devices, including still and video cameras, X-ray devices electron microscopes, radar, and ultrasound purposes , including entertainment, medical ,business (e.g. documents), industrial, military, civil (e.gtraffic),security and scientific. The goal in each case is for an observer, human or machine, to extract useful information about the scene being imaged. Often the raw image is not directly suitable for this purpose and must be processed in some way. Such processing called image enhancement**;** Processing by an observer to extract information is called image analysis. Enhancement and analysis are distinguished by their output, images vs. scene information and by the challenges faced and methods employed. Image enhancement has been done by chemical, optical and electronic means, while analysis has been done mostly by humans and electronically.

## II. RELATED WORK

Computer-assisted detection and segmentation of blood vessels in angiography are crucial for endovascular treatments and embolization. In this article, I give an overview of the image segmentation methods using the features developed recently at our laboratory. Our current research directions are also highlighted.

Segmentation of blood vessels is one of the essential medical computing tools for clinical assessment of vascular diseases. It is a process of partitioning an angiogram into nonoverlapping vascular and background regions. Based on the partitioning results, surfaces of vasculatures can be extracted, modeled, manipulated, measured and visualized. These are very useful and play important roles for the endovascular treatments of vascular diseases. Vascular diseases are one of the major sources of morbidity and mortality worldwide. Therefore, developing reliable and robust image segmentation methods for angiography has been a priority in our group and other research groups. It is challenging to perform image segmentation in angiography.

The success of the approach depends on the definition of a comprehensive set of goals for the computation of edge points. These goals must be precise enough to delimit the desired behavior of the detector while making minimal assumptions about the form of the solution.

We define detection and localization criteria for a class of edges, and present mathematical forms for these criteria as functional on the operator impulse response. A third criterion is then added to ensure that the detector has only one response to- a single edge. We use the criteria in numerical optimization to derive detectors for several common image features, including step edges. On specializing the analysis to step edges, we find that there is a natural uncertainty principle between detection and localization performance, which are the two main goals. With this principle we derive a single operator shape which is optimal at any scale. The optimal detector has a simple approximate implementation in which edges are marked at maxima in gradient magnitude of a Gaussian-smoothed image. We extend this simple detector using operators of several widths to cope with different signal-to-noise ratios in the image. We present a general method, called feature synthesis, for the fine-to-coarse integration of information from operators at different scales. Finally we show that step edge detector performance improves considerably as the operator point spread function isextended along the edge. This detection scheme uses several elongated operators at each point, and the directional operator outputs are integrated with the gradient maximum detector.

Coronary heart disease has been one of the main threats to human health. Coronary angiography is taken as the gold standard; for the assessment of coronary artery disease. However, sometimes, the images are difficult to visually interpret because of the crossing and overlapping of vessels in the angiogram. Vessel extraction from X-ray angiograms has been a challenging problem for several years. There are several problems in the extraction of vessels, including: weak contrast between the coronary arteries and the background, unknown and easily deformable shape of the vessel tree, and strong overlapping shadows of the bones. In this article we investigate the coronary vessel extraction and enhancement techniques, and present capabilities of the most important algorithms concerning coronary vessel segmentation.

## III. SYSTEM ARCHITE CTURE DESIGN

Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interesting an image. A familiar example of enhancement is when we increase the contrast of an image because "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually.

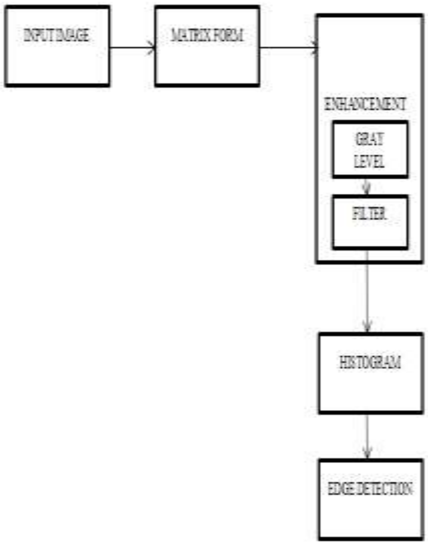


**Fig 3.1 Architecture Diagram For Edge Detection**

- First ,To remove noise by using median filter.
- Second,take histogram of the image.
- Third,Edge detection of the image.

Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose, or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. As a field of scientific investigation, medical imaging constitutes a sub-discipline of biomedical engineering, medical physics or medicine depending on the context: Research and development in the area of instrumentation, image acquisition (e.g. radiography), modeling and quantification are usually the preserve of biomedical engineering, medical physics, and computer science; Research into the application and interpretation of medical images is usually the preserve of radiology and the medical sub-discipline relevant to medical condition or area of medical science (neuroscience, cardiology, psychiatry, psychology, etc.) under investigation

### 3.1.1 Median Filter

In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal. The median filter is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire signal. For 1D signals, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically.

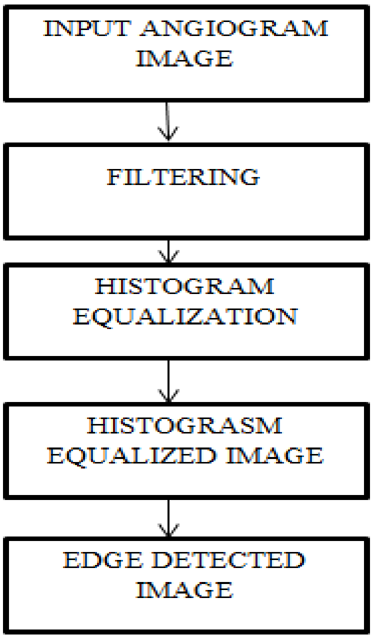


**Fig: 4.2 Data Flow Diagram**

Angiogram image is given as input for pre-processing. This pre-processing include noise removal and gray scale conversion. Noise is removed by using median filter. Histogram equalization is used for edge detection. Normalized histogram is find for edge detection. 2D FIR filter is used to find the edges of the angiogram image.

Segmentation is a process of partitioning a given image into several non-overlapping regions. It is a process of partitioning an angiogram into several non-overlapping regions. Thus it is used to extract the vascular and background regions. Threshold methodis used for the segmentation of our study

## IV.MODULE DESCRIPTION

The following modules are present in the project

- Noise reduction
- Image enhancement
- Histogram equalization
- Edge detection

### 4.1 Noise Reduction

The converted image will be of low resolution. So we need to normalize the image in order to avoid parameter variation. In this study we have used Median Filter to reduce the noise of the image.

Median computation

>>B=medfilt2(A); → 1

The above command will computer the median for each and every pixel and normalized matrix will be stored in the variable B

### 4.2 Histogram Equalization

Whenever an image is converted from one format to another some of the degradation occurs at the output. Hence, the output image has to undergo a process called image enhancement which consists of a collection of techniques that seek to improve the visual appearance of an image. Fuzzy Inference System is used to enhance the image for our study.

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### 4.3 Edge Detection

Edge Detection is done to segment the blood vessels from the angiogram images. Edge detection algorithms are followed by linking and boundary detection procedures. Edge Detection is an important task and in literature, Morphological filterhave been used for the Edge Detection of the blood vessel

## V. TECHNIQUES USED

Some of the techniques which are used in this project are segmentation and edge detection.Image segmentation is the process of assigning a label to every pixel in an image.Region boundaries and edges are closely related, since there is often a sharp adjustment in intensity at the region boundaries

### 5.1 Segmentation

In computer vision, segmentation refers to the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels).The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc) in image. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristics or computed property, such as color, intensity or texture. Adjacent regions are significantly different with respect to the same characteristics.

#### 5.1.1 Application

Some of the practical applications of image segmentation are:

- Medical imaging
- Locate tumors and other pathologies
- Measure tissue volumes
- Computer-guided surgery

- Diagnosis
- Treatment planning
- Study of anatomical structure
- Locate objects in satellite images (roads, forests, etc)
- Face recognition
- Fingerprint recognition
- Traffic control systems
- Brake light detection

Several general-purpose algorithms and techniques have been developed for image segmentation. Since there is no general solution to the image segmentation problem, these techniques often have to be combined with domain knowledge in order to effectively solve an image segmentation problem for a problem domain

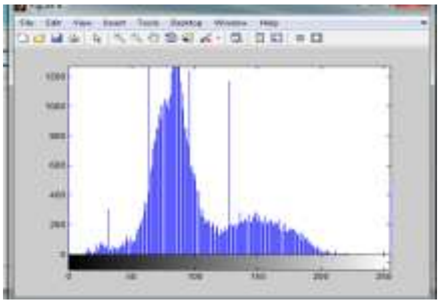
### 5.2 Edge Detection

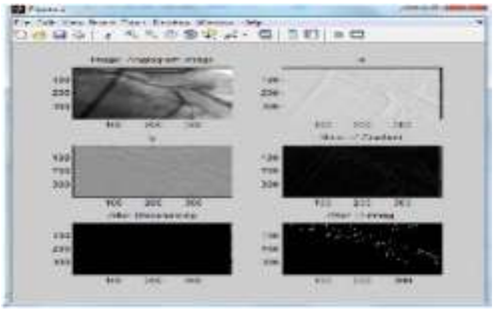
Edge detection is a well-developed field on its own within image processing. Region boundaries and edges are closely related, since there is often a sharp adjustment in intensity at the region boundaries. Edge detection techniques have therefore been used as the base of another segmentation technique.

The edges identified by edge detection are often disconnected. To segment an object from an image however, one needs closed region boundaries

## VI. RESULT

This is the histogram of the angiogram image. The histogram is getting after noise removal.





**This image shows the edge detected output after getting histogram.**

## VII. CONCLUSION

Thus the edges of the angiogram image are detected by using median and 2D FIR filter. The edges segmented are accurate and clear as compared to the canny edge detection and the steps involved to obtain the edges of the blood vessel are simple and easy to implement. The results provide that the algorithm is effective and efficient in detecting the edges.

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