

# Novel technique for edge detection of vessel in angiogram images

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**Abstract:** In medical image processing, blood vessels need to be extracted clearly and properly from a noisy background, drift image intensity and low contrast pose. The Blood vessels of the human body can be visualized using many medical imaging methods such as X-ray, Computed Tomography (CT), and Magnetic Resonance (MR). Angiography is a procedure widely used for the observation of the blood vessels in medical research, where the angiogram area covered by vessels and/or the vessel length is required.

Vessel enhancement and segmentation is an effective technique used in angiogram. Segmentation is a process of partitioning a given image into several non-overlapping regions. Edge detection is an important task and in this process and complex algorithms have been modeled for the detection of the edges of the blood vessels. This paper discusses a review implementation of digital image-processing algorithm for detecting the edges of the vessels in angiogram images.

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## 1. Introduction

Angiography is a procedure widely used for the observation of the blood vessels in medical research, where the angiogram area covered by vessels and/or the vessel length is required. The Blood vessels of the human body can be visualized using many medical imaging methods such as X-ray, Computed Tomography (CT), and Magnetic Resonance (MR). In medical image processing, blood vessels need to be extracted clearly and properly from a noisy background, drift image intensity, and low contrast pose.

Segmentation plays a vital role in the detection of blood vessels in an angiogram image. It is a process of partitioning an angiogram into several non-overlapping regions. Thus it is used to extract the vascular and background regions. Based on the

partitioning results, surfaces of vasculatures can be extracted, modeled, manipulated, measured and visualized. Hence it is used to detect the various vascular diseases. Therefore, developing reliable and robust image segmentation methods for angiography has been the priority and by the other research groups. Generally segmentation subdivides the image into its constituent parts or objects. Autonomous segmentation is one of the most difficult tasks in image processing. 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 used for detecting discontinuities in gray level. First and second order digital derivatives are implemented to detect the edges in an image. Edge is defined as the boundary between two regions with relatively distinct gray-level properties. An edge is a set of connected pixels that lie on the boundary between two regions.

## 2. Literature Review

Digital image-processing algorithm for detecting the edges of the vessels in the angiogram images has been proposed by different authors and summarize below.

Anshita Aggarwal and AmitGarg [1] proposed method based on image de-noising and edge enhancement of noisy multidimensional imaging data sets new denoising scheme based on adaptive multiscale product thresholding is proposed, to merge the merits of thresholding and wavelet inter scale dependencies. A significant wavelet coefficient is identified if corresponding multi scale product value is greater than adaptive threshold.

Senthilkumar N and Thimmiaraja J [2] proposed study and compare different Techniques like Global Histogram Equalization (GHE), Local histogram equalization (LHE), Brightness preserving Dynamic Histogram equalization (BPDHE) and Adaptive Histogram Equalization (AHE) using different objective quality measures for MRI brain image enhancement. The classical contrast enhancement is Histogram Equalization (HE), which has good performance for ordinary images, such as human portraits or natural images. Transformation or mapping of each pixel of input image into corresponding pixel of processed output image is called Histogram Equalization.

S Satish Kumar and R. Amutha [3] explains that the edges of the vessels in the angiogram image are detected using the algorithm based on classical image processing techniques. The proposed algorithm is not complicated but accurate and involves very simple steps. The proposed algorithm detects the edges of the blood vessel from the given angiogram image using the classical image processing techniques. The results provide that the proposed algorithm is effective and efficient in detecting the edges.

Mei Wang, ChunlinLi, WenhaoCai and Xiaowei Wu [4] explain a new edge detection method is presented based on the information measure, and the new method is applied to the coronary angiogram. Firstly, the blood vessel path points are found by using the square template, and the quasi-center curve of the vessel segment is obtained by using the minimum gray scale criteria and the smoothing technique. Then the orientation information measure concept of an image is introduced, and the  $l$  values of the information measures of the  $l$  points in the same row

or the same column are calculated according to the quasi center curve. The corresponding information measure will be used and constructed in this paper to describe quantitatively these three characteristics of the step edge points.

Johann Dr'eo, Jean-Claude Nunes and Patrick Siar explains [5] makes a systematic comparison of different optimization techniques, namely the *minimization* method derived from the *optical flow* formulation, the *Nelder-Mead* local search and the *HCIAC* ant colony met heuristic, each optimizing a similarity criterion for the gradient images. The optimization techniques used are especially adapted for high resolution problems where more classical techniques cannot be favorably used due to the excessive time requirement.

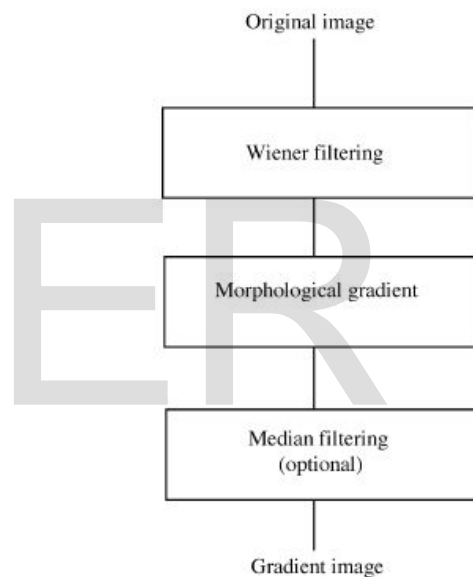


Fig: Non Linear Filtering Scheme

M Spiegel, T Redel, T Struffert, J Hornegger and A Doerfler[6] propose a novel 2D digital subtraction angiography (DSA)-driven 3D vessel segmentation and validation framework. 2D DSA projections are clinically considered as gold standard when it comes to measurements of vessel diameter or the neck size of aneurysms. An ellipsoid vessel model is applied to deliver the initial 3D segmentation. To assess the accuracy of the 3D vessel segmentation, its forward projections are iteratively overlaid with the corresponding 2D DSA projections. Local vessel discrepancies are modeled by a global 2D/3D optimization function to adjust the 3D vessel segmentation toward the 2D vessel contours. Our framework has been evaluated on phantom data as well as on ten patient datasets. Three 2D DSA

projections from varying viewing angles have been used for each dataset. The novel 2D driven 3D vessel segmentation approach shows superior results against state-of-the-art segmentations like region growing, i.e. an improvement of 7.2% points in precision and 5.8% points for the Dice coefficient. This method opens up future clinical applications requiring the greatest vessel accuracy, e.g. computational fluid dynamic modeling.

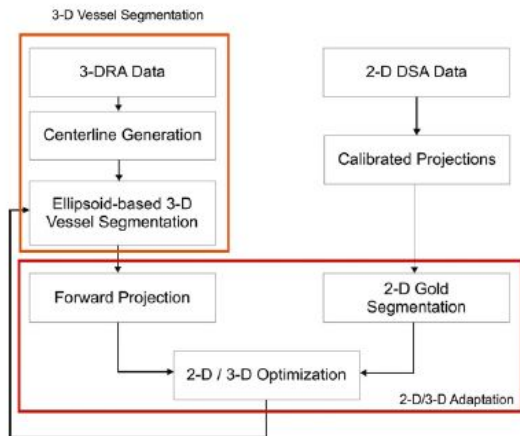
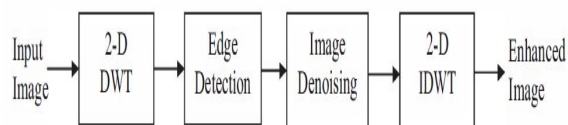


Fig: algorithm flow chart

### 3. Proposed Work

The proposed algorithm for edge detection using the classical image processing techniques is shown in the block diagram.

Input image -> Noise removal using median filter -> Histogram Equalization -> Histogram of Equalized Image -> 2D Filter -> Non maximal Suppression -> Edge Detected Image



The first step is to read the given angiogram image. And convert it into a matrix where each pixel value is in range from 0-255. Then filter out any noise in the original image before trying to locate and detect any edges. Preprocessing involves various steps like filtering, intensity adjustment etc. Median filtering is a nonlinear method used to remove noise from images. It is widely used as it is very effective at removing noise while preserving edges. Image enhancement refers to accentuation or sharpening of image features such as edges, boundaries or contrast to make a graphic display more useful for display and analysis. The classical contrast enhancement is Histogram Equalization which has good performance for ordinary images, such as human portraits or natural images. Histograms are a way of visualizing the predominant intensities of an image. As a definition, image histograms are a count of the number of pixels that are at a certain intensity. Still noise is present in an image then apply 2D filter to remove again the noise. To detect the perfect edges apply corrected edge detection method so as to get clear edges of angiogram images. Non-maximum suppression is an edge thinning technique. Given estimates of the image gradients, a search is carried out to determine if the gradient magnitude assumes a local maximum in the gradient direction. Apply non maximal suppression to find clear and accurate edges of angiogram image.

### 4. Conclusion

Segmentation plays a vital role in the detection of blood vessels in an angiogram image. It is a process of partitioning an angiogram into several non-overlapping regions. Proposed algorithm will detects the edges of the blood vessel from the given angiogram image using the classical image processing techniques. The edges segmented should be accurate and clear as compared to the previous edge detection and the steps involved to obtain the edges of the blood vessel should be simple and easy to implement.

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