

Segmentation of Lumbar Spine Image Using Watershed Algorithm

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Abstract

In the previous paper the medical images detect the edges and boundaries using various edge detection algorithms. Several disadvantages to apply edge detection in medical image such as noise sensitivity, inaccurate does not responding to some of edges and major drawbacks (i) complicated (ii) complex computations. But in proposed systemising watershed algorithm to detect the boundaries and edges in medical images. There is internal and external markers and its has global thresholding, region merging and splitting or watershed transform.

Keywords: Image, Image Segmentation, Edge detection algorithms, Watershed algorithm.

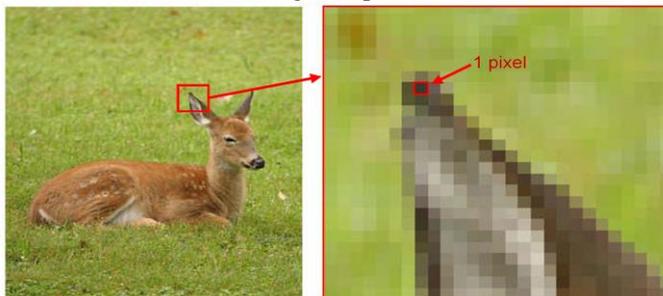
I. INTRODUCTION

Image

A digital image is represents a two-dimensional image. It is a finite set of digital values and referred as picture elements or pixels.

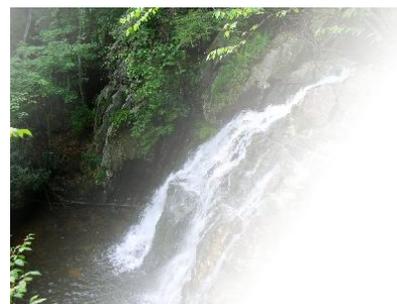
Pixels

Pixel values typically classify into gray levels, colours, heights, opacities etc.



Common image formats include

- 1 sample per point (B&W or Grayscale)
- 3 samples per point (Red, Green, and Blue)
- 4 samples per point (Red, Green, Blue, and “Alpha”, a.k.a. Opacity)



1.1 IMAGE SEGMENTATION

Image segmentation is a process of a image(digital) into multiple segments. It's represent set of pixels and also known as superpixels.

Image segmentation is used to locate boundaries and objects (curves, lines, etc.) in images.

- The image segmentation is partition an image into *meaningful* regions with respect to a particular application
- The segmentation is measured from the image that represents greylevel, colour, texture, depth or motion.

Image segmentation classify into three stages:

- a) Greyscale
- b) Texture
- c) Motion

1.2. EDGE DETECTION ALGORITHM

It to identifying points in a digital image at which the image brightness and changes sharply.



II. TYPES OF EDGE DETECTION ALGORITHM

2.1 SOBEL : The Sobel operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges.

2.2 PREWITT : The prewitt edge detector is an accurate way to approximation the magnitude and orientation of an edge.

2.3 CANNY : The Canny algorithm can be used an optimal edge detector based on a set of criteria which include finding the most edges by minimizing the error rate, marking edges as closely as possible to the actual edges to maximize localization, and marking edges only once when a single edge exists for minimal response.

2.4. Common disadvantage of edge detection algorithms

- Sensitivity to noise,
- Inaccurate responding to some of the existing edges.
- Malfunctioning at corners, curves and where the gray level intensity function varies.
- It not finding the orientation of edge because of using the Laplacian filter Colour Edge
- Detectors: Complicated, Complex Computations

2.5 Image segmentation based watershed

1. Use internal markers to watershed lines of the gradient of image to be segmented.
2. Use watershed lines as external markers
3. Each region defined by the external markers contains a single internal marker and part of the background
4. The solution is reduced to partitioning each region into two parts: object (it containing internal markers) and a single background (it containing external markers)
 - Region growing, global thresholding, region merging and region splitting, or watershed transform.

III. WATERSHED TRANSFORM USED FOR SPINE IMAGES

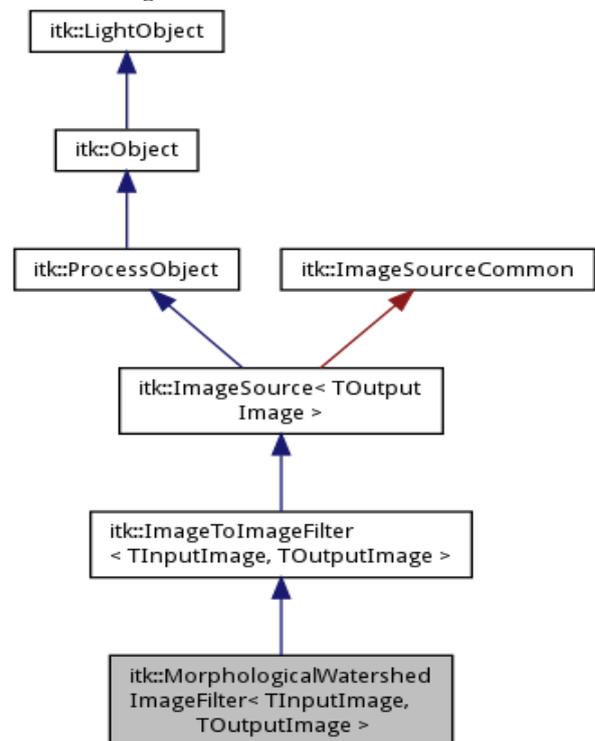
3.1 Watershed introduction

Watershed transform proposed by Digabel and Lantu_ejoul and improved by Beucher and Lantu_ejoul is the method used for image segmentation. In this section we introduce definitions of the watershed transform, it explain about the generalization of the skeleton by inuence zones (SKIZ) to grey value images.

The key functions of the Human spine as a composite structure is to protect the spinal cord. Manual material handling operations are carried out in industrial plants. Each task poses unique trouble on

the employee. However, workplaces can help employees to perform these tasks safely and easily by implementing and maintenance proper policies and procedures. The lumbar region which is most one of the important parts in the spine has played a vital role in the researches. The anatomy of lumbar region, the lumbar spine, the back pain and their relationship are put together in literature. The finite element analysis in the field of orthopaedics for the lumbar region has also been explained with its uses. The evaluation and management of occupational low back disorders and back pains were studied. The movement of human by motor control and biomechanics are explained in various aspects. Such similar investigations are made on the spine disk and reported. Till date, the motion segment of the spine consists of two parts of which one is a vertebrae and the other one a disc. To explicate proper information from the images, a fundamental tool used is the Edge detection technology. This provides the outlines of an image and boundaries. This also proves as a tool to remove the noises in the images to enhance the appearance. To detect the correct boundary in a noisy image is still difficult. Based on the evaluation the watershed algorithm is used to detect the boundaries of spine disc image from the noisy CT scanned image produce a better result. The vertebral body of each lumbar vertebra is large, wider from side to side than from front to back, and a little thicker in front than in back. It is flattened or slightly concave above and below, concave behind, and deeply constricted in front and at the sides.

3.2 How the watershed algorithm working in medical images



3.3 P-ALGORITHM

This algorithm consists of re-introducing, at each hierarchical step and contours which have been suppressed according to similarity of contrast and topological criteria. This algorithm is non parametric

and always ends with a pretty good segmentation of the image.

How to detect the edges in face images

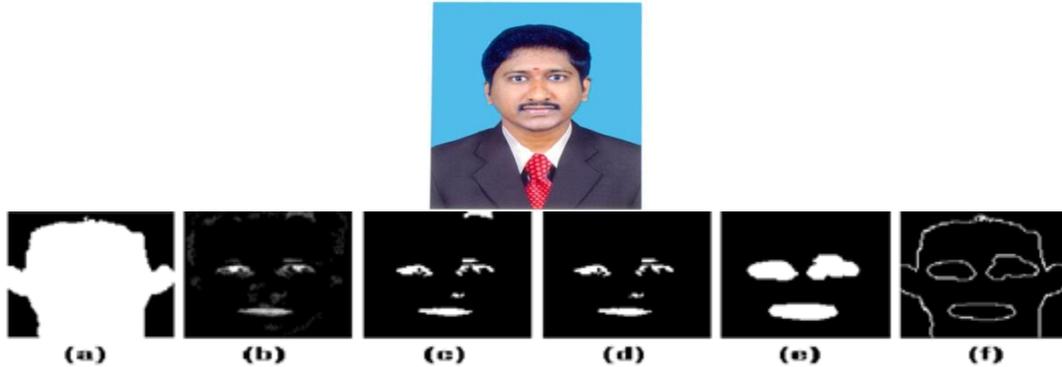
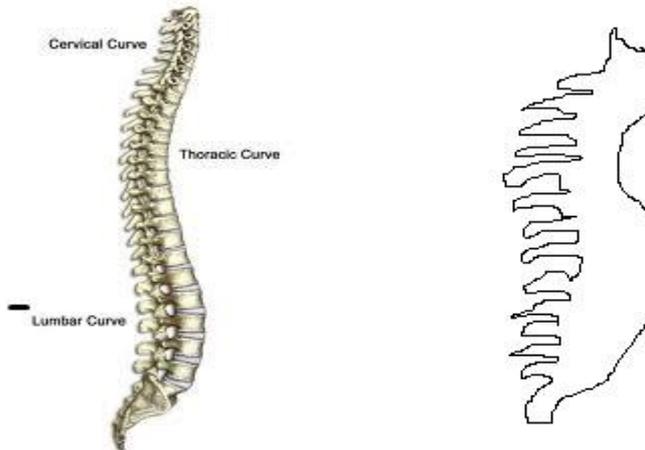


Figure: face detection of my photo images.

Spine image to detect the images:



IV. RESULTS AND DISCUSSION

To further evaluate the efficiency of the proposed method in addition to the visual inspection, the proposed boundary detection method numerically using the Hausdorff distance and the probability of error in image segmentation. Where $P(O)$ and $P(B)$ are probabilities of objects and background in images. The objects surrounded by the contours obtained using the five snake models and the proposed method are compared with that manually drawn by skilled

doctors from the Medical Hospital. From the above Table.1 shows the average result of probability of Error in Image segmentation of watershed algorithm were compared with standard Medical values and also predicts the error difference. Showing the results it shows the Error difference value is very minimal .So the watershed algorithm produced nearer to the standard value.

S. No	Image illustration	Medical Standard Value (%)	Watershed Algorithm (%)	Error Difference in Watershed Algorithm segmentation (%)
1	MRI Scan noisy spine disc image	8.51	8.56	+0.05
2	Average magnitude image	7.73	7.78	+0.05
3	Density of edge length image	7.00	7.08	+0.08
4	Filtered MRI Scan image	6.44	6.36	-0.08
5	Initial position map	5.90	5.96	+0.06
6	Fine Edge filtered image	5.07	5.14	+0.07

Table.1 shows the average result of probability of Error in Image segmentation of watershed algorithm were compared with standard Medical values

V. FURTHER RESEARCH AND DEVELOPMENT

In this paper discuss about various edge detection algorithms and its disadvantages and classify the advantage of watershed algorithm how it works. In further research and development using lumbar spine image to detect the edges and calculate the weight a human taken and measure the stress how much weight carrying. The research paper supported for mechanical oriented purposes. In the field they human carry’s over weight in the working place. So we know a normal human carry a weight it useful to give a particular weight to human. Water shed algorithm is not used for part of spine. It used to detect the other human parts also.

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