PROJECT REPORT

(COMPUTER GRAPHICS)

IMPLEMENTATION OF OTSU'S METHOD FOR IMAGE SEGMENTATION

Submitted to

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1. INTRODUCTION

Segmentation partitions an image into distinct regions containing each pixels with similar attributes. To be meaningful and useful for image analysis and interpretation, the regions should strongly relate to depicted objects or features of interest. Meaningful segmentation is the first step from low-level image processing transforming a greyscale or colour image into one or more other images to high-level image description in terms of features, objects, and scenes. The success of image analysis depends on reliability of segmentation, but an accurate partitioning of an image is generally a very challenging problem. In our project, we have chosen four different methods, each belonging to a different type of segmentation.

2. OBJECTIVE

The task is to: Study and implement each of these methods with in MATLAB and if possible, make an interactive GUI of its application / the method itself. In Otsu's method we exhaustively search for the threshold that minimizes the intra-class variance (the variance within the class), defined as a weighted sum of variances of the two classes:

$$\sigma_w^2(t) = \omega_1(t)\sigma_1^2(t) + \omega_2(t)\sigma_2^2(t)$$

Weights ω_i are the probabilities of the two classes separated by a threshold t and σ_i^2 are variances of these classes.

3. SCOPE

Image segmentation is one of the basic techniques of image processing and computer vision. It is a key step for image analysis, comprehension and description. Among all the segmentation techniques, thresholding segmentation method is the most popular algorithm and is widely used in the image segmentation field. The basic idea of automatic thresholding is to automatically select an optimal or several optimal grey-level threshold values for separating objects of interest in an image from the background based on their grey-level distribution. Otsu method is one of thresholding methods and frequently used in various fields.

Pattern recognition:

Pattern recognition involves study from image processing and from various other fields that includes machine learning (a branch of artificial intelligence). In pattern recognition, image segmentation is used for identifying the objects in an images and then machine learning is used to train the system for the change in pattern. Pattern recognition is used in computer aided diagnosis, recognition of handwriting, recognition of images etc.

Video processing:

A video is nothing but just the very fast movement of pictures. The quality of the video depends on the number of frames/pictures per minute and the quality of each frame being used. Video processing involves noise reduction, detail enhancement, motion detection, frame rate conversion, aspect ratio conversion, colour space conversion etc.

Medical Applications:

The need for accurate segmentation tools in medical applications is driven by the increased capacity of the imaging devices. Common modalities such as CT and MRI generate images which simply cannot be examined manually, due to high resolutions and a large number of image slices. Furthermore, it is very difficult to visualize complex structures in three-dimensional image volumes without cutting away large portions of, perhaps important, data. Tools, such as segmentation, can aid the medical staff in browsing through such large images by highlighting objects of particular importance. In addition, segmentation in particular can output models of organs, tumours, and other structures for further analysis, quantification or simulation.

Object Detection:

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos. Well-researched domains of object detection include face detection and pedestrian detection. Object detection has applications in many areas of computer vision, including image retrieval and video surveillance.

4. TECHNIQUES USED

The technologies used are: MATLAB