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SEGMENTATION IN MEDICAL IMAGING

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ABSTRACT

Image segmentation is the most critical functions in image analysis and processing. Fundamentally segmentation results affect all the subsequent processes of image analysis such as object representation and description, feature measurement, and even the following higher level tasks such as object classification. Hence, image segmentation is the most essential and crucial process for facilitating the delineation, characterization, and visualization of regions of interest in any medical image. Manual segmentation of medical image by the radiologist is not only a tedious and time consuming process, but also not very accurate especially with the increasing medical imaging modalities and unmanageable quantity of medical images that need to be examined. It becomes therefore necessary to review current methodologies of image segmentation using automated algorithms that are accurate and require as little user interaction as possible especially for medical images. In the segmentation process, the anatomical structure or the region of interest needs to be delineated and extracted out so that it can be viewed individually. In this paper we project the important place of segmentation of images in extracting information for decision making.

1. INTRODUCTION

Image segmentation plays a crucial role in image analysis and processing, exerting a significant influence on subsequent tasks such as object representation, feature measurement, and higher-level processes like object classification. In the realm of medical image analysis, accurately delineating and visualizing regions of interest is paramount. Manual segmentation by radiologists, while traditionally employed, is not only time-consuming but also prone to inaccuracies, especially given the increasing number of medical imaging modalities and the overwhelming volume of images requiring scrutiny. Therefore, there is an urgent need to explore and assess current automated algorithms for image segmentation, with a focus on achieving accuracy while minimizing user interaction, particularly in the context of medical images. The segmentation process involves delineating and extracting the anatomical structure or region of interest, enabling its isolated examination. This paper underscores the significance of image segmentation in extracting information for informed decision-making.

Introduction to Medical Images

Medical images play a vital role in aiding healthcare providers in diagnosing and treating patients. However, the traditional reliance on visual assessment by radiologists is time-consuming and subjective, dependent on the radiologist's experience. To overcome these limitations, the integration of computer-aided systems, particularly those involving artificial intelligence (AI) methods such as digital image processing, machine learning, fuzzy logic, and pattern recognition, becomes imperative. This integration occurs within the broader context of Image Engineering (IE), which encompasses three layers: image processing (lower layer), image analysis (middle layer), and image understanding (high layer). Image segmentation is highlighted as the initial and crucial step in image analysis, with its primary objective being to extract information through processes such as image segmentation, object representation, and feature measurement. The outcomes of segmentation significantly influence the accuracy of feature measurement. Challenges in Medical Image Segmentation:

The computerization of medical image segmentation is of paramount importance in various medical imaging applications, including diagnosis, pathology localization, anatomical structure study, treatment planning, and computer-integrated surgery. However, the inherent variability and complexity of anatomical structures in the human body pose challenges, rendering medical image segmentation a persistently intricate problem. Categories of Image Segmentation Approaches: Based on different technologies, current image segmentation approaches are categorized into two fundamental properties of images:

1. Detecting Discontinuities: - Involves partitioning an image based on abrupt changes in intensity, with examples of algorithms falling under this category including edge detection techniques.

2. Detecting Similarities: Involves partitioning an image into regions that are similar according to predefined criteria. Algorithms under this category include Thresholding, region growing, and region splitting and merging. Thresholding is a common approach for region-based segmentation, where an image is represented as groups of pixels with values greater than or equal to a specified threshold. Clustering is another approach for region segmentation.

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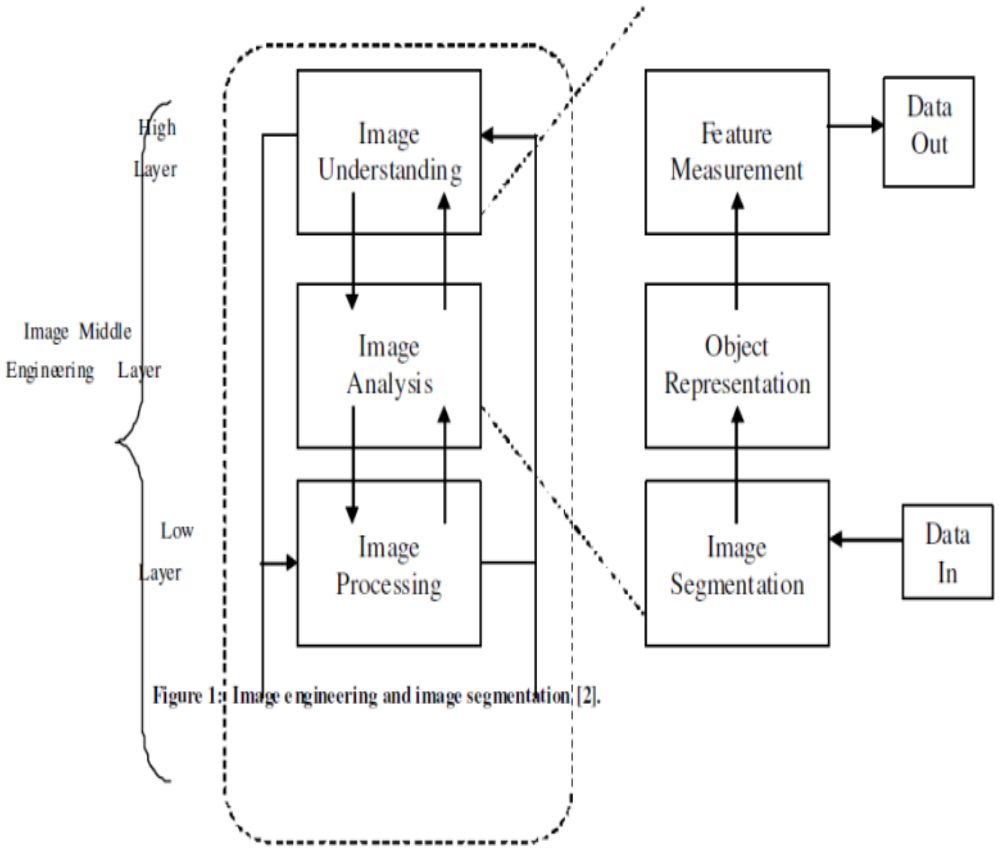

Figure 1: Image engineering and image segmentation [2].

Edge Detection-Based Segmentation: Segmentation based on edge detection aims to achieve image segmentation by detecting edges or pixels between different regions with rapid transitions in intensity. Gray histogram and gradient-based methods are discussed, and an integrated method is presented for part-based object recognition.

2. THRESHOLDING METHOD:

Thresholding algorithms, whether chosen manually based on prior knowledge or automatically using image information, are further categorized into edge-based, region-based, and hybrid methods. Edge-based algorithms are associated with edge information, depicting object structures through edge points. Common edge detection algorithms, such as the Canny edge detector and Laplacian edge detector, fall under this category.

Region-Based Segmentation Methods: In comparison to edge detection methods, segmentation algorithms based on regions are simpler and more robust to noise. Region growing and region splitting and merging are discussed as region-based segmentation approaches.

1. Region Growing: Involves grouping pixels in the entire image into subregions or larger regions based on predefined criteria. The process includes selecting seed pixels, defining similarity criteria, growing regions by appending neighboring pixels with similar properties, and stopping when no more pixels meet the inclusion criterion. 2. Region Splitting and Merging: Instead of choosing seed points, region splitting and merging divide an image into unconnected regions and then merge them to achieve reasonable image segmentation. The process utilizes quad-tree data and allows both splitting and merging, aiming to create a partition without adjacent regions with identical properties. Segmentation Based on Clustering: Clustering, an unsupervised learning task, involves identifying a finite set of categories (clusters) to classify pixels. Clustering algorithms include hard clustering, k-means clustering, fuzzy clustering, and others.

Hybrid Image Segmentation Using Watershed and Fast Region Merging: Addressing the segmentation challenge involves dividing an image into homogeneous segments, ensuring that when two neighboring segments combine, they form a heterogeneous segment. Various techniques, including histogram-based methods, edge-based techniques utilizing differential filters, region-based segmentation, and Markov random field-based segmentation, are discussed. Hybrid segmentation techniques combine edge-based and region-based methods, such as initially partitioning an image into regions and then merging using split-and-merge techniques, followed by contour detection using edge-based methods.

3. CONCLUSION

This study provides an overview of segmentation methodologies in digital image processing, reviewing various research methodologies and issues in image segmentation. Despite decades of research, no universally accepted segmentation method exists, as results are influenced by factors like image homogeneity, spatial characteristics, texture, and content. Image segmentation remains a challenging problem in image processing and computer vision, presenting an ongoing research challenge worldwide.

4. REFERENCES:

[1] S. Naz, H. Majeed, H. Irshad,"Image Segmentation using Fuzzy Clustering: A Survey", International Conference on ICET, pp.181-186, 2010.

[2] Wahba Marian, An Automated Modified Region Growing Technique for Prostate Segmentation in TransRectal Ultrasound Images, Master's Thesis, Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, Ontario, Canada, 2008.

[3] T. Gevers, V. K. Kajcovski,"Image Segmentation by direct region subdivision", Proceedings of the 12th IAPR International Conference on Pattern Recognition, Vol. 1.