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Image Segmentation using FCM Algorithm

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Abstract

During past few years, brain tumor segmentation in CT has become an emergent research area in the field of medical imaging system. Brain tumor detection helps in finding the exact size and location of tumor. An efficient algorithm is proposed in this project for tumor detection based on segmentation and morphological operators. Firstly quality of scanned image is enhanced and then morphological operators are applied to detect the tumor in the scanned image. The problem with biopsy is that the patient has to be hospitalized and also the results (around 15%) give false negative. Scan images are read by radiologist but it's a subjective analysis which requires more experience. In the proposed work we segment the renal region and then classify the tumors as benign or malignant by using ANFIS, which is a non-invasive automated process. This approach reduces the waiting time of the patient.
Keywords: Tumor, CT, ANFIS

I. Introduction

In medical imaging, 3D segmentation of images plays a vital role in stages which occur before implementing object recognition. 3D image segmentation helps in automated diagnosis of brain diseases and helps in qualitative and quantitative analysis of images such as measuring accurate size and volume of detected portion. Accurate measurements in brain diagnosis are quite difficult because of diverse shapes, sizes and appearances of tumors. Tumors can grow abruptly causing defects in neighboring tissues also, which gives an overall abnormal structure for healthy tissues as well. In this paper, we will develop a technique of 3D segmentation of a brain tumor by using segmentation in conjunction with morphological operations.

Ultrasound (US) is extensively used in the evaluation of children and adults with many different diseases and anatomic anomalies. However, it is especially difficult to segment objects of interest due to the relatively poor quality of US images compared with acquisitions from magnetic resonance imaging (MRI). A great deal of segmentation work using US images focuses on active contours taking the speckle noise into consideration. Although texture or shape priors can be incorporated into active contours to guide the motion of contours to define the kidney boundary, these methods are not sufficient for delineating RPA because they do not take into account the variability in both the shape and the size of the CS which may be quite large in patients with brain diseases.

II. Image finding

One very important area of application is image processing, in which algorithms are used to detect and isolate various desired portions or shapes (features) of a digitized image or video stream. It is particularly important in the area of optical character recognition.

III. Low-level

- Edge detection
- Corner detection
- Blob detection
- Ridge detection
- Scale-invariant feature transform

A. Edge Detection

Edge detection is the name for a set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. The same problem of finding discontinuities in 1D signals is known as step detection and the problem of finding signal discontinuities over time is known as change detection. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction.

B. Corner Detection

Corner detection is an approach used within computer vision systems to extract certain kinds of features and infer the contents of an image. Corner detection is frequently used in motion detection, image registration, video tracking, image mosaicing, panorama stitching, 3D modeling and object recognition. Corner detection overlaps with the topic of interest point detection.

C. Blob Detection

In the field of computer vision, blob detection refers to mathematical methods that are aimed at detecting regions in a digital image that differ in properties, such as brightness or color, compared to areas surrounding those regions. Informally, a blob is a region of a digital image in which some properties are constant or vary within a prescribed range of values; all the points in a blob can be considered in some sense to be similar to each other.

There are several motivations for studying and developing blob detectors. One main reason is to provide complementary information about regions, which is not obtained from edge detectors or corner detectors. In early work in the area, blob detection was used to obtain regions of interest for further processing. These regions could signal the presence of objects or parts of objects in the image domain with application to object recognition and/or object tracking.

In other domains, such as histogram analysis, blob descriptors can also be used for peak detection with application to segmentation.

D. Scale-Invariant Feature Transform

Scale-invariant feature transform (or SIFT) is an algorithm in computer vision to detect and describe local features in images. The algorithm was published by David Lowe in 1999. Applications include object recognition, robotic mapping and navigation, image stitching, 3D modeling, gesture recognition, video tracking, individual identification of wildlife and match moving.

IV. PATTERN RECOGNITION

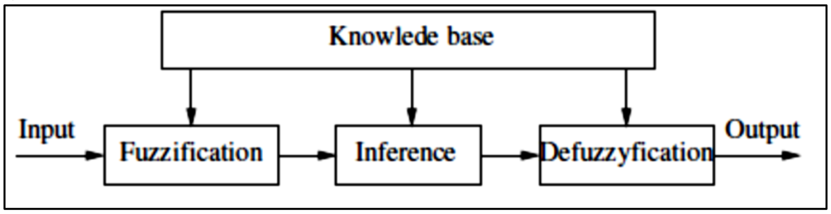
Pattern recognition is a branch of machine learning that focuses on the recognition of patterns and regularities in data, although it is in some cases considered to be nearly synonymous with machine learning. Pattern recognition systems are in many cases trained from labeled "training" data (supervised learning), but when no labeled data are available other algorithms can be used to discover previously unknown patterns (unsupervised learning).

V. FEATURE EXTRACTION IN SOFTWARE

Many data analysis software packages provide for feature extraction and dimension reduction. Common numerical programming environments such as MATLAB, SciLab, NumPy and the R language provide some of the simpler feature extraction techniques (e.g. principal component analysis) via built-in commands. More specific algorithms are often available as publicly available scripts or third-party add-ons.

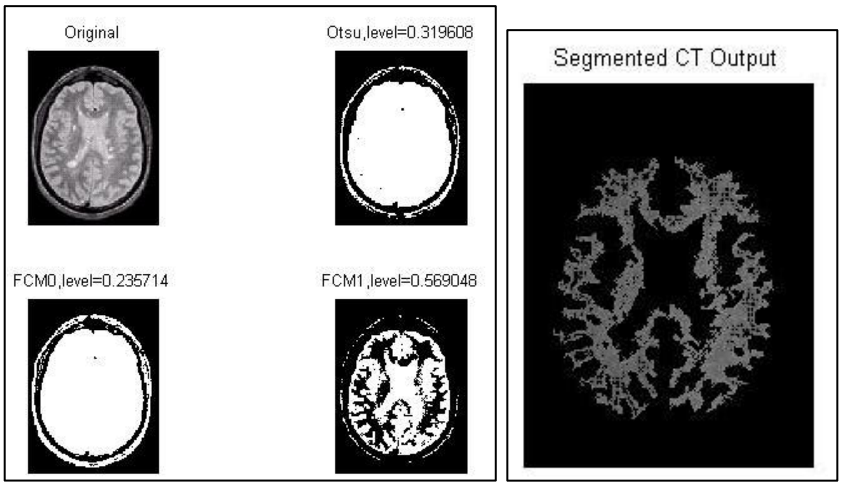
VI. ADAPTIVE NEURO FUZZY INFERENCE SYSTEM

Adaptive neuro fuzzy inference system (ANFIS) is a kind of neural network that is based on Takagi–Sugeno fuzzy inference system. Since it integrates both neural networks and fuzzy logic principles, it has potential to capture the benefits of both in a single framework. Its inference system corresponds to a set of fuzzy IF–THEN rules that have learning capability to approximate nonlinear functions. Hence, ANFIS is considered to be a universal estimator.



A. RESULT Input Image

B. Level of FCM



VII. CONCLUSION

We propose an automatic brain tumor detection and localization framework that can detect and localize brain tumor in CT. The proposed brain tumor detection and localization framework comprises five steps: image acquisition, pre-processing, edge detection, modified histogram clustering and morphological operations. After morphological operations, tumors appear as pure white color on pure black backgrounds. We used 50 neuro images to optimize our system and 100 out-of-sample neuro images to test our system. The proposed tumor detection and localization system was found to be able to accurately detect and localize brain tumor in CT. This system achieved an error rate of 8%. The preliminary results demonstrate how a simple machine learning classifier with a set of simple image-based features can result in high classification accuracy. The preliminary results also demonstrate the efficacy and efficiency of our five-step brain tumor detection and localization approach and motivate us to extend this framework to detect and localize a variety of other types of tumors in other types of medical imagery.

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