A REVIEW ON VARIOUS APPROACHES OF IMAGE SEGMENTATION

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Abstract-*Image segmentation process is the field of digital image processing that has been utilized in medical sector. Image segmentation is a process of segmenting the image for proper extraction of hidden features. Medical image segmentation is a technique using to mean manually, fully or semi-automatically defeating the boundaries of tissue regions or an object. Various approaches have been proposed for the process of image segmentation. Image segmentation approaches utilize for the identification of region of interest. The main issues in image segmentation are the detection of the region of interest to classify that particular ROI into different sub images.*

***Keywords*:**FCM, PFCM, Image Segmentation, ROI, Medical Image.

1. INTRODUCTION

1.1Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. A good segmentation is typically one in which pixels in the same category have similar grayscale of multivariate values and form a connected region, neighboring pixels which are in different categories have dissimilar values.

Figure 1.1: Image Segmentation

For example, in the muscle image each cross-sectional Bore could be viewed as a distinct object and a successful segmentation would form a separate group of pixels corresponding to each field. Similarly in the SAR image, each field could be regarded as a separate category.

1.2Types of Image Segmentation

1.2.1 Colored Image: Shade Image Segmentation calculation The human eyes have customizability for the shine, which we can just recognized handfuls of ash scale anytime of complex picture, yet can recognize a huge number of shades. Much of the time, just use ash Level data cannot extricate the focus from foundation; we should by method for shade data. Likewise, with the quickly change of PC handling capacities, the shade picture transforming is being more concerned by individuals.

1.2.2 Gray-scale Image Segmentation: The segmentation of image raster data into connected regions of common gray-scale has long been seen as a basic operation in image analysis. In texture analysis, just this type of segmentation is possible after individual pixels in an image have been labeled with a numeric classifier.

In planning pictures for utilized as a part of geographic data frameworks (GIs) this division is generally trailed by the creation of a vector representation for each locale.

1.2.3 Text Segmentation: It is remarkable that content extraction, including content identification, limitation, division and distinguishment is essential for feature auto-understanding. Content division, that is to discrete content pixels from complex foundation in the sub-pictures from features. Content division in feature pictures is significantly more troublesome than that in filtering pictures. Examining pictures for the most part has clean and white foundation, while feature pictures frequently have exceptionally complex foundation without former information about the content shade.

1.3Methods of Image Segmentation

1.3.1 Thresholding-based: In Thresholding, pixels are allocated to categories according to the range of values in which first shows boundaries which were

obtained by Thresholding the muscle image. Pixels with values less than 128 have been placed in one category, and the rest have been placed in the other category. The boundaries between adjacent pixels in different categories have been superimposed in white on the original image. It can be seen that the threshold has successfully segmented the image into the two predominant.

1.3.2 Edge-based: Segmentation, an edge alter is applied to the image, pixels are classified as edge or non-edge depending on the alter output, and pixels which are not separated by an edge are allocated to the same category. Second shows the boundaries of connected regions after applying Prewitt's alter and eliminating all non-border segments containing fewer than 500 pixels. (More details will be given in finally.

1.3.3Region based: Segmentation algorithms operate iteratively by grouping together pixels which are neighbours and have similar values and splitting groups of pixels which are dissimilar in value. The boundaries produced by one such algorithm, based on the concept of watersheds.

2. RELATED WORK

Banerjee, et al [1] "Bi level kaprus entropy based image segmentation using particle swarm optimization" In the field of Image Processing, Image segmentation is a low level but important task in entire image understanding system which divides an image into its multiple disjoint regions based on homogeneity. In most of the machine vesion and high level image understanding application this is one of the important steps. Till date different techniques of image segmentation are available and hence There exists a huge survey literature in different approaches of Image Segmentation. Selection of image segmentation technique is highly problem specific. There is no versatile algorithm which is applicable for all kinds of images. Optimization based image segmentation is not explored much which can be applied to reduce complexity of the problem. The aim of the paper is to search for an optimized threshold value for Image Segmentation using Particle Swarm Optimization (PSO) algorithm where fitness function is designed based on entropy of the image**.**

En-Ui Lin et al [2] "Medical image segmentation using multi-scale and super-resolution method" In this paper we will use discrete wavelet transformation (DWT) and its enhanced version double density dual discrete tree wavelet transformations (D3-DWT) as they provide better spatial and spectral localization of image representation and have special importance to image processing applications, especially medicalimaging. The multi-scale edge information from the sub-bands is then filtered through an iterative process to produce a map displaying extracted features and edges, which is then used to segment homogenous regions. We have applied our algorithm to challenging applications such as gray matter and white matter segmentations in Magnetic Resonance Imaging (MRI) images.

AmolBhagat et al [3] "Web Based Medical Image Retrieval System Using Fuzzy Connectedness Image Segmentation and Geometric Moments" This paper proposed fuzzy connectedness image segmentation for medical image retrieval in Oracle using digital imaging and communications in medicine (DICOM) format. Paper includes the comparison of image retrieval techniques with the proposed fuzzy connectedness image segmentation combined with geometric moment. Paper also gives the implementation details of proposed algorithm in Oracle. For the analysis purpose author implemented feature extraction methods for color, texture and shape based feature extraction Connectedness with Geometric Moments. From the carried proposed medical image retrieval algorithm FCISGM gives more precise result as compared to Average RGB,

Castillo, A. et al [4] "Virtual Laboratory for Digital Image Processing" This paper introduces a virtual research center for the PC transforming of computerized imaging. This product application is intended to upgrade/remake high-determination pictures with a specific end goal to dissect the actualized calculations and also their optical gimmicks. The application is considered as a virtual research center for mechatronic, biomedical and electronic designing understudies. The introduced contextual investigations exhibit the exactness of the preparing chain utilized as a part of this virtual lab, and how the understudies could better comprehend points identified with remote sensing, PC vision, biomedical building, among others.

Coraor, et al [5] "Processing in memory architectures for advanced picture handling" Continuing upgrades in semiconductor creation thickness are empowering new classes of framework on-a-chip architectures that join far reaching transforming rationale and high-thickness memory. A hefty portion of the capacities of these new architectures can be specially customized to the requests of ongoing computerized imageprocessing. This paper assesses a few hopeful outlines, utilizing the criteria of picture handling execution, adaptability, manufacturability, and creation cost.

Cheng Ling et al [6] "Advanced picture preparing of cotton yarn seriplane" The seriplane pictures of cotton yarn were examined by computerized picture transforming innovation in this work. The seriplane advanced pictures of cotton yarn were gotten by strategies of smoothing treatment, thresholding division, and picture weakening. The normal width of

yarns in the seriplaneimagesof cotton yarn was computed precisely. Subsequently, an applicable system was built to digitally examine the seriplane pictures of cotton yarn. By the technique, a quantitative assessment record was proposed for the standard photo of cotton yarn. Along these lines, it is conceivable to assess the standard photo of cotton yarn unbiasedly, which gives the premise of programmed assessment of seriplane pictures of cotton yarn.

Deepak R. Chittajallu et al [7], "An Explicit Shape-Constrained MRF-Based Contour Evolution Method for 2-D Medical Image Segmentation" Author present an explicit shape-constrained MAP-MRF-based contour evolution method for the segmentation of organs in 2-D medical images. Specifically, Author represents the segmentation contour explicitly as a chain of control points. We then cast the segmentation problem as a contour evolution problem, wherein the evolution of the contour is performed by iteratively solving a MAP-MRF labeling problem. The evolution of the contour is governed by three types of prior information, namely: (i) appearance prior, (ii) boundary-edginess prior, and (iii) shape prior, each of which is incorporated as clique potentials into the MAP-MRF problem

3.APPROACHES USED

FCM ALGORITHM: Fuzzy c-means (FCM) is a method of clustering which allows one piece of data to belong to two or more clusters. This method (developed by Dunn in 1973 and improved by Bezdek in 1981) is frequently used in pattern recognition. It is based on minimization of the following objective function:

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^{m} \left\| x_i - c_j \right\|^2$$

where m is any real number greater than 1, u_{ij} is the degree of membership of x_i in the cluster j, x_i is the I th of d-dimensional measured data, c_j is the d-dimension center of the cluster, and ||*|| is any norm expressing the similarity between any measured data and the center .Fuzzy partitioning is carried out through an iterative optimization of the objective function shown above, with the update of membership u_{ij} and the cluster centers c_j by:

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^{m} \left\| x_i - c_j \right\|^2$$

Where is a termination criterion between 0 and 1, whereas k is the iteration steps? This procedure converges to a local minimum or a saddle point of J_m.

The algorithm is composed of the following steps:

1. *Initialize $U=[u_{ij}]$ matrix, $U^{(0)}$*
2. *At k-step: calculate the centers vectors $C^{(k)}=[c_j]$ with $U^{(k)}$*

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^{m} \left\| x_i - c_j \right\|^2$$

3. *Update $U^{(k)}$, $U^{(k+1)}$*

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^{m} \left\| x_i - c_j \right\|^2$$

4. *If $|| U^{(k+1)} - U^{(k)}||<$*
5. *Then STOP; otherwise return to step 2*

In medical field minute details of image are also matter a lot that's why it is very difficult to process. They need to be divided in such a manner so that their minute details can be easily examined. To divide the image into parts is called segmentation. In this work image segmentation is used to find the region of interest (ROI). The segmentation will be accomplished using fuzzy C mean technique.

K-FCM ALGORITHM: In this approach the kernel based fuzzy C mean approach is used for the segmentation of the image. In this kernel based segmentation approach used for segmentation process this approach can be implemented to manipulate the input data into higher dimensions of feature vectors by using the nonlinear map. This feature space division of the image is known to be the small regions of the image that have been separated for the implementation of FCM to each single region by providing kernel values. In this approach the image is firstly de-noised by using nonlinear spatial filter to enhance the quality of the image. In this approach one advantage is that it automatically defines the number of clusters that have to develop using KFCM. This approach firstly utilizes kernel values and then computes the fuzzy membership functions for the image regions using the computation equations. It finds the centered for each sub feature space of the image and this process goes till to the best cluster centers has been found for each region of the image. This approach is more robust to noise and original clustered forms and outliers of the image. This approach includes class of robust non-Euclidean at distance measures for original data spaces. This approach simple retains computation simplicity.

PENALIZED FCM ALGORITHM: PFCM approach is an extension of FCM approach. In FCM approach spatial information about image is not taken into consideration it only depends on the different

gray level information about the image. FCM is very sensitive to noise so Penalization of FCM is purposed. General Principal of this approach is only to interoperate neighbor pixel information. In order to incorporate the spatial context into FCM objective function is penalized by regularized term. This is inspired by NEM algorithm. Objective function given by

$$J_{PFCM}=\sum_{i=1}^{k}\sum_{i=1}^{c}(U_{ik})q \quad d^2(x_k, v_i) + \gamma\sum_{i=0}^{n}\sum_{i=0}^{n}\sum_{i=0}^{n} U_{ik(1-U_{iq})^q W_{kj}} \quad (1)$$

This approach used for the image segmentation utilized regularization term for the removal of noise sensitive in the FCM. A functionɣ (<=0) controls the effect of penalty term used in the PFCM. Value of the penalty term should be minimum for the better execution of FCM algorithm in the process of image segmentation [9].

ROI (REGION OF INTEREST): A region of interest (often abbreviated ROI), is a selected subset of samples within a dataset identified for a particular purpose.[1] The concept of a ROI is commonly used in many application areas. For example, in medical imaging, the boundaries of a tumor may be defined on an image or in a volume, for the purpose of measuring its size. The endcordial border may be defined on an image, perhaps during different phases of the cardiac cycle, for example end-systole and end-diastole, for the purpose of assessing cardiac function. In geographical information systems (GIS), a ROI can be taken literally as a polygonal selection from a 2D map. In computer vision and optical character recognition, the ROI defines the borders of an object under consideration. In many applications, symbolic (textual) labels are added to a ROI, to describe its content in a compact manner. Within a ROI may lay individual points of interest (POIs).

GPU BASED IMAGE SEGMENTATION: Modern GPUs used for general-purpose computations have a highly data parallel architecture. They are composed of a number of cores, each of which has a number of functional units, such as arithmetic logic units (ALUs). One or more of these functional units are used to process each thread of execution, and these groups of functional units are called thread processors throughout this review. All thread processors in a core of a GPU perform the same instructions, as they share a control unit. This means that GPUs can perform the same instruction on each pixel of an image in parallel. The terminology used in the GPU domain is diverse, and the architecture of a GPU is complex and differs from one model and manufacturer to another. For instance, the two GPU manufacturers NVIDIA and AMD refer to the thread processors as CUDA cores and stream processors, respectively. Furthermore, the thread processors are called CUDA cores in the CUDA programming language and processing elements in OpenCL (Open Computing Language).

4.CONCLUSION

Image segmentation is a process of segmenting the image for proper extraction of hidden features. Medical image segmentation is a technique using to mean manually, fully or semi-automatically defeating the boundaries of tissue regions or an object. Image segmentation is a process of changing the representation step of an image into some extent which is easy to analyze. In this studied various approaches for image segmentation and ROI, Implementation of Image Division Algorithm, multi scale and super resolution approach for image segmentation. Evaluate parameters for performance evolution like PSNR, MSE, Random Index, GCE and Variance.

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