Review of Image Segmentation Techniques

H.P. Narkhede

Abstract*— Segmentation is nothing but making the part of image or any object. Pattern recognition and image analysis are the initial steps of image segmentation. In the computer vision domain and image analysis we can done important research topic in the segmentation of video with dynamic background. Image segmentation is most of judging or analyzing function in image processing and analysis. Image segmentation refers to partition of an image into different regions that are homogenous or similar and inhomogenous in some characteristics. Image segmentation results have an effect on image analysis and it following higher order tasks. Image analysis includes object description and representation, feature measurement. Higher order task follows classification of object.. Hence characterization, visualization of region of interest in any image, delineation plays an important role in image segmentation. Using the different algorithms the current methodologies of image segmentation is reviewed so that user interaction is possible for images. In this paper, the review of image segmentation is explained by using different techniques.

***Index Terms*— image segmentation, image analysis**

I. INTRODUCTION

Dynamic background is done by using image segmentation of video.Segmentation of video with dynamic background has been an important research topics in intelligent surveillance and human-machine interface technologies[1]. For the segmentation we need the Images. But the images are either in form of black and white or color. Color images are due to the grey level[2]. As the grey level contrast changes the color of color image also changes.Image segmentation plays important role in segmentation of medical images. Medical images play vital role in assisting health care which provides health care access patients for treatment. For the medical images,segmentation is crucial as a follows by first step in Medical Image Analysis(MIA)[3]. In image analysis appear errors as image measurement, image display and feature extraction.So that in case of medical image segmentation proper image segmentation is difficult because of size of the head,torce,leg,brain parts,type of disease etc are different. So for the segmentation of medical images we need different algorithms and different procedure to segment and classification of image.However, depending on the experience of radiologist,he can consume time for studying medical images which depends on visual interpretation.Use of Computer-aided systems becomes very necessary to overcome these limitation.

Digital image processing having one of the method of artificial intelligence and it combined with fuzzy logic, pattern recognition and machine learning are so valuable in Image technique can be grouped under a general framework-image Engineering(IE). Image Engineering is made up of three layers mainly upper layer as image understanding, Middle layer as Image Analysis, Lower layer as image processing, as shown n figure 1.

Manuscript Received on July, 2013.

H.P.Narkhede, Department Of Electronics and Telecommunication, J. T. Mahajan College of Engineering, Faizpur, India.

Image segmentation is the first step and also one of the most difficult tasks of image analysis,which has objective of extracting information which is represented in the form of data from image via image segmentation,feature measurement and object representation as shown in figure 1. The result of segmentation of image is considerably depends on the accuracy of feature measurement[3].image segmentation is the computer-aided so that the computerization of medical image segmentation plays an important role in medical imaging applications. Image segmentation process that subdivides an image into its constituent parts and extracts those parts of interest or objects. Automatic image segmentation also done but the most critical task is that the segmentation result affect all the subsequent processes of image analysis [4].Image (and video) segmentation is a critical step of image analysis occupying the middle layer of image engineering, which means it is influenced not only from data but also from human factors. Image analysis having the feature measurement,object representation and description, and even the higher level tasks such as object classification and scene interpretation[3].

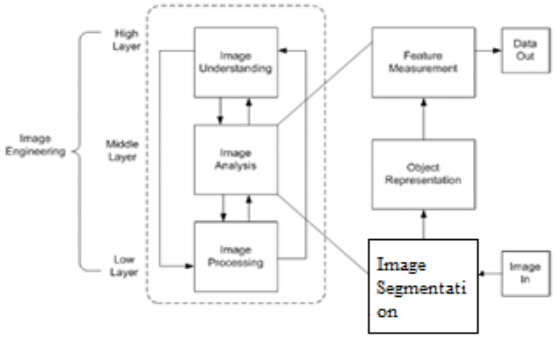

Figure 1: Image Engineering And Image Segmentation [3].

In case of medical science, medical image segmentation technique understood by figure 2.

Process if automatic medical image segmentation by intelligent method requires five steps such as Pre-processing,Segmentation of input image, Extraction and selection feature of the image,recognition and last step is post-processing out of which the combination of second and third step is nothing but the process of image analysis.

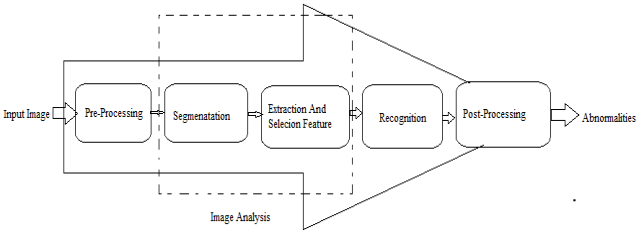

Figure 2. Automatic Medical Image Segmentation using Intelligent Method[6]

Based on image segmentation evaluation techniques [3],they are categorized into two types:

- Characterization

- Comparison

Characterization may be seen as an intratechnique process while comparison technique as an inter-technique one.

Based on different technologies, image segmentation [3] approaches are currently divided into following categories, based on two properties of image.

A. Detecting Discontinuities

The edge detection requires the detecting discontinuities property which includes image segmentation algorithm. Intensity[6] of the image is changed and partition an image. Edge detection is the segmentation by finding the pixels[7]-[8] on the a region boundary. Edge can be described by the boundary between the adjacent parts of an image[9].

B. Detecting Similarities

It means to partition an image into regions that are similar according to a set of predefined criterion [5]; this includes image segmentation algorithms like thresholding, region growing, region splitting and merging. Thresholding[10] is a very common approach used for Region based segmentation where an image represented as groups of pixels with values greater or equal to the threshold and values less to threshold value.Thresholding can be used in the situation such as to concentrate on the essential,user wants to remove unnecessary detail or part from an image[11].Clustering[12][14]-[15] is also an approach for region segmentation where an image is partitioned into the sets or clusters of pixels[7]-[8] having similarity in feature space. There are three types of images as gray scale[3], hyperspectral and medical images.

II. RELATED WORK

Ivana Despotovi [16] present a new FCM-based method for spatially coherent and noise-robust image segmentation. The contribution is twofold: 1) the spatial information of local image features is integrated into both the similarity measure and the membership function to compensate for the effect of noise; and 2) an anisotropic neighborhood, based on phase congruency features, is introduced to allow more accurate segmentation without image smoothing. The segmentation results, for both synthetic and real images, demonstrate that our method efficiently preserves the homogeneity of the regions and is more robust to noise than related FCM-based methods.

Jilan Feng [17] propose a variational multiphase segmentation framework for synthetic aperture radar (SAR) images based on the statistical model and active contour methods. The proposed method is inspired by the multiregion level set partition approaches but with two improvements. First, an energy functional which combines the region information and edge information is defined. The regional term is based on the $G0$ statistical model. The flexibility of $G0$ distribution makes the proposed approach to segment SAR images of various types. Second, fuzzy membership functions to represent the regions. The total variation of the membership functions is used to ensure the regularity. This not just guarantees the energy functional to be convex with respect to the membership functions but also enables us to adopt a fast iteration scheme to solve the minimization problem. The proposed method can segment SAR images of N regions with $N - 1$ membership functions. The flexibility of the proposed method is demonstrated by experiments on SAR images of different resolutions and scenes. The computational efficiency is also verified by comparing with the level-set-method-based SAR image segmentation approach.

Truong Quang Vinh [18] present an embedded design for dental intraoral system which supports dental image capturing and image tooth segmentation. This device assists dentists in diagnosis by using dental images, which is captured from dental camera. Moreover, we propose advanced features for the dental intraoral system including touch screen with Vietnamese graphic user interface (GUI), dental image processing, patient records, and dentist's diagnosis note. Especially, the segmentation of teeth is important for examining and extracting teeth features from dental images. A teeth segmentation method based on active contour without edge algorithm has been proposed in this paper. Consequently, our system is portable, economic and ready to be applied at dental clinics. The system can help dentists examine at patient's home and voyages, not only in clinics.

Johannes Ulén [19] introduce a multiregion model for simultaneous segmentation of medical images. In contrast to many othermodels, geometric constraints such as inclusion and exclusion between the regions are enforced, which makes it possible to correctly segment different regions even if the intensity distributions are identical. than current state of the art. As the method is based on global optimization techniques, the resulting segmentations are independent of initialization.

Changyang Li [20] propose a novel joint probabilistic model that correlates a new probabilistic shape model with the corresponding global intensity distribution to segment multiple abdominal organs simultaneously. The probabilistic shape model estimates the probability of an individual voxel belonging to the estimated shape of the object. The probability density of the estimated shape is derived from a combination of the shape variations of target class and the observed shape information. To better capture the shape variations, we used probabilistic principle component analysis optimized by expectation maximization to capture the shape variations and reduce computational complexity. The maximum *a posteriori* estimation was optimized by the iterated conditional mode-expectation maximization.

Human intestinal parasites constitute a problem in most tropical countries, causing death or physical and mental disorders. Their diagnosis usually relies on the visual analysis of microscopy images, with error rates that may range from moderate to high. The problem has been addressed by Celso T. N.Suzuki [21] via computational image analysis, but only for a few species and images free of fecal impurities. In routine, fecal impurities are a real challenge for automatic image analysis. We have circumvented this problem by a method that can segment and classify, frombright fieldmicroscopy images with fecal impurities, the 15 most common species of protozoan cysts, helminth eggs, and larvae in Brazil. Our approach exploits ellipse matching and image foresting transform for image segmentation, multiple object descriptors and their optimum combination by genetic programming for object representation, and the optimum-path forest classifier for object recognition. The results indicate that method is a promising approach toward the fully automation of the enteroparasitosis diagnosis.

Maoguo Gong [22] present an improved fuzzy C-means (FCM) algorithm for image segmentation by introducing a tradeoff weighted fuzzy factor and a kernel metric. The

tradeoff weighted fuzzy factor depends on the space distance of all neighboring pixels and their gray-level difference simultaneously. By using this factor, the new algorithm can accurately estimate the damping extent of neighboring pixels. In order to further enhance its robustness to noise and outliers, we introducea kernel distance measure to its objective function. The new algorithm adaptively determines the kernel parameter by using a fast bandwidth selection rule based on the distance variance of all data points in the collection. Furthermore, the tradeoff weighted fuzzy factor and the kernel distance measure are both parameter free. Experimental results on synthetic and real images show that the new algorithm is effective and efficient, and is relatively independent of this type of noise.

Peng Zhang, Ming Li [23] propose a hierarchical TMF (HTMF) model for unsupervised synthetic aperture radar (SAR) image segmentation. In virtue of the Bayesian inference on the quadtree, the HTMF model captures the global and local image characteristics more precisely in the bottom–up and top–down probability computations. In this way, the underlying spatial structure information is effectively propagated. To model the SAR data related to radar backscattering sources, generalized Gamma distribution is utilized. The effectiveness of the proposed HTMF model is demonstrated by application to simulated data and real SAR image segmentation.

Haili Zhang [24] presents a variational model for simultaneous multiphase segmentation and intensity bias estimation for images corrupted by strong noise and intensity inhomogeneity.Since the pixel intensities are not reliable samples for region statistics due to the presence of noise and intensity bias,the authors use local information based on the joint density within image patches to perform image partition. Hence, the pixel intensity has a multiplicative distribution structure. Then, the aximuma-posteriori (MAP) principle with those pixel density functions generates the model. To tackle the computational problem of the resultant nonsmooth nonconvex minimization, we relax theconstraint on the characteristic functions of partition regions, and apply primal-dual alternating gradient projections to construct a very efficient numerical algorithm. They show that all the variables have closed-form solutions in each iteration, and the computation complexity is very low. In particular, the algorithm involves only regular convolutions and pointwise projections onto the unit ball and canonical simplex. Numerical tests on a variety of images demonstrate that the proposed algorithm is robust, stable, and attains significant improvements on accuracy and efficiency over the state-of-the-arts.

Mei Yeen Choong [13], proposed segmentation on synthetic images and natural images are covered to study the performance and effect of different image complexity towards segmentation process. This study gives some research findings for effective image segmentation using graph partitioning method with computation cost reduced. Because of its cost expensive and it becomes unfavourable in performing image segmentation on high resolution image especially in online image retrieval systems. Thus, a graph-based image segmentation method done in multistage approach is introduced here.

III. CLASSIFICATION OF SEGMENTATION TECHNIQUES

Image segmentation can be broadly classified into two types:

1. Local segmentation
2. Global segmentation

Global segmentation is concerned with segmenting a whole image. Global segmentation deals mostly with segments consisting of relatively large number of pixels[7]-[8].This makes estimated parameter values for global segments most robust.

Image segmentation can be approach from three different philosophical perspectives. They are as region approach, boundary approach and edge approach as illustrated in figure 3.

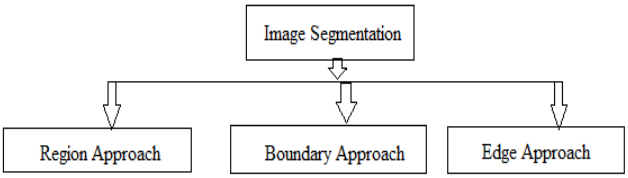

Figure 3. Image segmentation Approach[25]

If the pixel belongs to object,it has value one, otherwise it is zero. Segmentation[5][26] is the operating at the threshold between low-level image processing and image analysis. After the complete procedure of segmentation,the pixel[7]-[8] belongs to the object.

- Structural Techniques
- Shochastic Techniques
- Hybrid Techniques

Structural Techniques[5] use some information about the structure of the region for segmentation.

Stochastic techniques are applied on discrete pixels without knowing or considering any structural information of the region.Statistical analysis is one of the techniques on which the stochastic technique[5] is based.

Hybrid technique[5] include those techniques which possess the characteristics of both structural and stochastic techniques.

VI. SEGMENTATION BASED ON EDGE DETECTION

The intensity data of an image only provides partial and uncertainly information about the location of edges. Edge detection technique[7] is finding pixel on the region boundary.This method attempts to resolve image segmentation by detecting the edges or pixels between different regions that have rapid transition in intensity are extracted [3][27] and linked to form closed object boundaries. The result is a binary image [6]. One source of uncertainly comes from the existence of noise introduced in the imaging process and later in the transmission and sampling process. The other source of uncertaionly comes from fact that any measurement device is imperfect and their results are only partial observation. This means that edge detection methods are generally ill-posed,i.e. they are under-constrained and so may not have unique solutions. The easiest way to detect edges in an image is to look for places in the image where the intensity changes rapidly, using one of this criteria:

Places where the first derivative of the intensity is larger in magnitude than some threshold.

- Places where the second derivative of the intensity has a zero crossing.

Edge detection[15] technique is one of the structural technique of the image segmentation technique. Based on theory there are two main edge based segmentation methods- gray histogram and gradient based method [2].In the edge approach, the edges are identified first, and then they are linked together to form required boundaries.

Edge detectors have different operator for detection of edge such as sobel operator, laplace operator, canny operator,LoG (Laplacian Of Gaussian) operator and so on. Edge detection method require a higher image quality so its need to reduce or remove the noise.

V. THRESHOLD METHOD

One of the simplest approach of segmentation is based on the pixel values. The technique is to utilize the thresholding based segementation which could help to simple region growing steps.

Thresholding algorithms can be selected manually as per a priori knowledge or automatically by image information. Thresholding algorithms further divided to edge-based, region-based and hybrid. Edge-based algorithms are related with the edge information. The Structures of an object can be depicted by edge points. Common edge detection algorithms such as canny edge detector and Laplacian edge detector can be classified to this type of regions. These algorithms are used to find the edge pixels while eliminating the noise influence.

Thresholding is an old,simple and popular technique for image segmentation**[**29]. Image segmentation by thresholding is a simple but powerful approach for segmenting images having light objects on dark background[3]. Thresholding technique is based on imagespace regions i.e. on characteristics of image [2]. Thresholding operation convert a multilevel image into a binary image i.e., it choose a proper threshold T, to divide image pixels into several regions and separate objects from background. Thresholding procedure used to determine as intensity value called as threshold,and threshold separates the desires classes.The segmentation is gained by grouping all pixels with intensity greater than the threshold into one class, and all other pixels into another class.

As per the selection of thresholding value, two types of thresholding methods are in existence [15], global and local thresholding. Nikhil R Pal and Sankar k Pal**[**27] done review work on image thresholding technique. Thresholding can be classified into bi-level thresholding and multi-thresholding[29]. When T is constant, the approach is called global thresholding otherwise it is called local thresholding. Global thresholding methods can fail when the background illumination is uneven. In local thresholding, multiple thresholds are used to compensate for uneven illumination [30]. Threshold selection is typically done interactively however, it is possible to derive automatic threshold selection algorithms. Limitation of thresholding method is that, only two classes are generated, and it cannot be applied to multichannel images and it is sensitive to noise and intensity inhomogeneities.

VI. REGION BASED SEGMENTATION METHODS

A region denoted by R of an image is defined as a connected homogenous subset of the image with respect to some criterion such as gray level or texture.

Regions in an image are a group of connected pixels with similar properties. In the region approach,each pixel is assigned to a particular object or region.

Compared to edge detection method, segmentation algorithms based on region are relatively simple and more immune to noise [2][31]. Edge based methods partition an image based on rapid changes in intensity near edges whereas region based methods, partition an image into regions that are similar according to a set of predefined criteria [6][9].

In the region-based segmentation, pixels corresponding to an object are grouped together and marked. Region-based segmentation also requires the use of appropriate thresholding techniques. The important principles are value similarity (which includes gray value differences and gray value variance) and spatial proximity (which consists of Euclidean distance and compactness of a region).Segmentation algorithms based on region mainly include following methods:

A. Region Growing

Region growing [4] is a technique for extracting a region of the image that is connected based on some predefined criteria. This criteria based on intensity information.

Region growing is an approach to image segmentation in which neighboring pixels are examined and added to a region class of no edges are detected. This process is iterated for each boundary pixel in the region. If adjacent regions are found, a region-merging algorithm is used in which weak edges are dissolved and strong edges are left intact.

A new region growing algorithm is proposed in this paper based on the vector angle color similarity measure. The region growing algorithm as-

1. Select seed pixels within the image
2. From each seed pixel grow a region:
   - 2.1 Set the region prototype to be seed pixel;
   - 2.2 Calculate the similarity between the region prototype and the candidate pixel;
   - 2.3 Calculate the similarity between the candidate and its nearest neighbor in the region;
   - 2.4 Include the candidate pixel if both similarity measures are higher than experiment all set thresholds;
   - 2.5 Update the region prototype by calculating the new principal component;
   - 2.6 Go to the next pixel to be examined.

This algorithm presents several advantages over other color image segmentation algorithms.

Region growing approach is simple. The border of regions found by region growing are perfectly thin and connected. The algorithm is also very stable with respect to noise.

Limitation is that, it requires a seed point, which generally means manual interaction. Thus, each region to be segmented, a seed point is needed.

B. Region Splitting and Merging

Split and merge technique is the opposite of the region growing. This technique works on the whole image. Region splitting is a top-down approach. It begins with a

whole image and divides it up such that the segregated part are more homogenous than the whole. Splitting alone is insufficient for reasonable segmentation as it severely limits the shapes of segments. Hence, a merging phase after the splitting is always desirable, which is termed as the split-and-merge algorithm. Any region can be split into subregions, and the appropriate regions can be merged into a region. Rather than choosing seed points, user can divide an image into a set of arbitrary unconnected regions and then merge the regions [2]-[3] in an attempt to satisfy the conditions of reasonable image segmentation. Region splitting and merging is usually implemented with theory based on quad tree data.

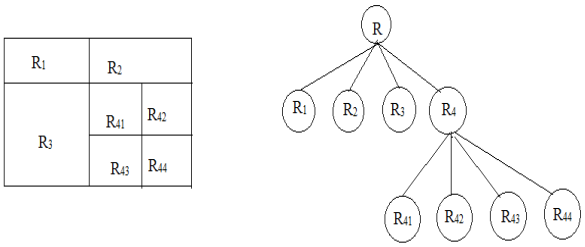

Figure 4. Quad tree[25]

Region splitting and merging is an image-segmentation technique that takes spatial information into consideration. The region-splitting and merging method is as follows:

Region splitting Method:

1. Let R represent the entire image. Select a predicate P.
2. Split or subdivide the image successively into smaller and smaller quadrant regions.

The splitting technique has a convenient representation in the form of structure called a quad tree shown in figure 4. In a quad tree,the root of the tree corresponds to the entire image and each node corresponds to subdivision.

Region Merging Method:

Merge any adjacent regions that are similar enough. The procedure for split and merge is given.

1. Start with the whole image.
2. If the variance is too large,break it into quadrants.
3. Merge any adjacent regions that are similar enough.
4. Repeat step (2) and (3) iteratively until no more splitting or merging occurs.

This technique requires the input data to be organized into a pyramidal grid structure of regions, with each region organized in groups of four in case of 2D , and of eight in case of 3D.

No manually interaction will be required in this technique. But the limitation is that, it requires the input to be organized into a pyramidal grid structure which could be difficult[34].

VII. SEGMENTATION BASED ON CLUSTERING

Clustering or either data grouping is a key initial procedure in image processing. Clustering[12][14] is an unsupervised learning task, where one needs to identify a finite set of categories known as clusters to classify pixels [15]. Clustering use no training stages rather train themselves using available data. Clustering is mainly used when classes are known in advance. A similarity criteria is defined between pixels [3], and then similar pixels are grouped together to form clusters. The grouping of pixels into clusters is based on the principle of maximizing the intra class similarity and maximizing the inter class similarity. Clustering technique attempts to access the relationship among patterns of the set by organism the patterns into groups or clusters such that pattern within a cluster are more similar to each other than patterns belongs to different cluster. The quality of a clustering result depends on both the similarity measure used by the method and its implementation. A good clustering method[36] will produce high quality clusters with high intra-class similarity – similar to one another within the same cluster low inter-class similarity. Dissimilarity to the objects in other clusters. The quality of a clustering results depends on both the similarity measure used by the method and its implementation. The quality of a clustering method is also measured by its ability to discover. Clustering refers to the classification of objects into groups according to certaion properties of these objects. In the clustering techniques,an attempt is made to extract a vector from local areas in the image. A standard procedure for clustering is to assign each pixel to the nearest cluster mean. Clustering algorithms are classified as hard clustering, k- means clustering, fuzzy clustering, etc.

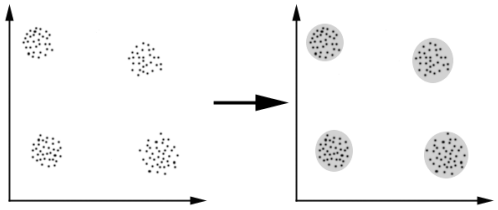

Figure 5. Clustering[15]

Clustering algorithms are classified as hard clustering, k-means clustering, fuzzy clustering, etc.

A popular and well known hard clustering algorithm[37] is the k-means one(noted HCM). In hard clustering, a membership value of zero or one is assigned to each pattern data. Its functioning is very simple,gives an initial hard c-partition,it computes the c center and assigns each object to its nearest center in order to minimize the within-cluster variance.After each iteration it performs a test comparing the current and the precedent partition, if the result of the difference is lower than a prefixed threshold,it stops else it continues. k-means algorithm[38]-[39] is statistical clustering algorithm.

Data clustering is method that create groups of objects(clusters). K-mean algorithm is based upon the index of similarity or dissimilarity between pairs of data component. K-means algorithm is iterative, numerical, non-numerical and unsupervised method. This type of algorithm is popular for simplicity, implementation and it is commonly used for grouping pixels in the image.Clustering method with the spatial and shape information is growing.

Fuzzy clustering method can be considered to be superior to those of their hard counterparts since they can represent the relationship between the input pattern data and clusters more naturally. Fuzzy c-means[38] is a popular soft-clustering method,its effectiveness is largely limited ti spherical clusters.Fuzzy c-means is one of the most promising fuzzy clustering method. In most cases,it is more flexible than the corresponding hard-clustering algorithm.

Clustering method can be divided into two categories,

hierarchical and partitional within each category, there exist many types of algorithms for finding cluster.

Hierarchical clustering technique are based on the use of a proximity matrix indicating the similarities between every pair of data points to be clustered the end result is tree of clusters representing the nested group of patterns and similarities levels at which groupings change. The resulting clusters are always produce as the internal node of the tree, while the root node is reserved for the entire database and leaf nodes are for individual data samples.

Partition-based clustering uses an iterative optimization produce that aims at minimizing an objective function *f*, which measure the goodness of clustering. Partition-based clustering's are composed of two learning steps-the partitioning of each pattern to its closed cluster and the computation of the cluster centroids.

VIII. SEGMENTATION BASED ON ARTIFICIAL NEURAL NETWORK

A neural net is an artificial representation of human brain that tries to simulate its learning process. An artificial neural network [40]-[42] is often called a neural network or simply neural net.

In recent years, artificial neural networks have been widely used to solve the problem of medical image segmentation. Neural network based on simulation of life, especially the human brain's learning process, constitutes a large number of parallel nodes. Each node can perform some basic computing. The learning process can be achieved through the transferring the connections among nodes and connection weights[43]. Its main advantage is not dependent on the probability density distribution function. It can also prove the segmentation results when the data deviation from the normal situation. Neural network can also reduce the requirements of expert intervention during the image segmentation process. This problem is prevalent in many age segmentation methods. Firstly, the image segmentation problem is converted into energy minimization or classification issues and so no. Then the issues are solved based on neural network in this method. The neural network was trained with training sample set in order to determine the connection and weights between the nodes. Then the new images were segmented with trained neural network. Neural network segmentation method includes two important steps: feature extraction and image segmentation based on neural network.

Table 1. Comparison of image segmentation techniques

Segmentation Technique	Method Description	Advantages	Disadvantages
Edge Detection Technique	Based on the detection of discontinuity, normally tries to locate points with more or less abrupt changes in gray level.	Edge detection technique is the way in which human perceives objects and works well for images having good contrast between regions.	1)Does not work well with images in which the edges are ill-defined or there are too many edges; 2)It is not a trivial job to produce a closed curve or boundary; 3)Less immune to noise than other techniques.
Thresholding Technique	Requires that the histogram of an image has a number of peaks, each correspond to a region	It does not need a prior information of the image.And it has less computational complexity	1)Does not work well for an image without any obvious peaks or with broad and flat valleys; 2)Does not consider the spatial details, so cannot guarantee that the segmented regions are contiguous.
Region-Based Technique	Group Pixels into homogeneous regions. Including region growing, region splitting, region merging or their combination.	Work best when the region homogeneity criterion is easy to define. They are also more noise immune than edge detection approach.	1)Are by nature sequential and quite expensive both in computational time and memory; 2)Region growing has inherent dependence on the selection of seed region and the order in which pixels and regions are examined; 3)The resulting segments by region splitting appear too square due to the splitting scheme.
Fuzzy Technique	Apply fuzzy operators, properties, mathematics, and inference rules, provide a way to handle the uncertainty inherent in a variety of problems due to ambiguity rather than randomness.	Fuzzy membership function can be used to represent the degree of some properties or linguistic phrase, and fuzzy IF-THAN rules can be used to perform approximate inference	1)The determination of fuzzy membership is not a trivial job; 2)The computation involved in fuzzy approaches could be intensive.

Neural Network Technique	Using neural networks to perform classification or clustering	No need to write complicated programs. Can fully utilize the parallel nature of neural networks.	1)Training time is long; 2)Initialization may effect the result; 3)Overtraining should be avoided

IX. CONCLUSION

In this review of image segmentation study, the overview of various segmentation methodologies applied for digital image processing is explained briefly. The study also reviews the research on various research methodologies applied for image segmentation and various research issues in this field of study. These methods are most important for detection of pattern and recognition using edges,images and points. The image segmentation techniques mentioned in this review paper are used in many advanced machine for identification of faces, images and to recognition of pattern. Image segmentation used in medical science to detect cancerous cells from medical images. They also detect roads from satellite images.

Image segmentation has a promising and challenging future as the universal segmentation algorithm and has become the focus of contemporary research. There is no single method which can be considered good for all type of images, nor all methods equally good for a particular type of image. Due to all above factors, image segmentation remains a challenging problem in image processing and computer vision and is still a pending problem in the world. Still image segmentation gives more methodologies applied to different fields.

REFERNCES

1. Qingsong Zhu, Zhan Song, Yaoqin Xie, and Lei Wang, "A Novel Recursive Bayesian Learning-Based Method for the Efficient and Accurate Segmentation of Video With Dynamic Background", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 9, SEPTEMBER 2012
2. W. X. Kang, Q. Q. Yang, R. R. Liang,"The Comparative Research on Image Segmentation Algorithms", IEEE Conference on ETCS, pp. 703-707, 2009.
3. Zhang, Y. J, An Overview of Image and Video Segmentation in the last 40 years, Proceedings of the 6th International Symposium on Signal Processing and Its Applications, pp. 144-151, 2001
4. D.L. Pham, Ch. Xu and J.L. Princo, —a survey on current methods in medical image segmentation‖ Annual Review of Biomedical Engineering, vol. 2, 2000
5. Wahba Marian, An Automated Modified Region Growing Technique for Prostate Segmentation in Trans-Rectal Ultrasound Images, Master's Thesis, Department of Electrical and Computer Engineering, University of Waterloo, Waterloo, Ontario, Canada, 2008.
6. Rastgarpour M., and Shanbehzadeh J., Application of AI Techniques in Medical Image Segmentation and Novel Categorization of Available Methods and Tools, Proceedings of the International MultiConference of Engineers and Computer Scientists 2011 Vol I, IMECS 2011, March 16-18, 2011, Hong Kong.
7. Jesmin F. Khan, Sharif M. A. Bhuiyan, and Reza R. Adhami," Image Segmentation and Shape Analysis for Road-Sign Detection", IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 12, NO. 1, MARCH 2011
8. Andrew Janowczyk, Sharat Chandran, Rajendra Singh, Dimitra Sasaroli, George Coukos, Michael D. Feldman, and Anant Madabhushi," High-Throughput Biomarker Segmentation on Ovarian Cancer Tissue Microarrays via Hierarchical Normalized Cuts", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 59, NO. 5, MAY 2012
9. H. G. Kaganami, Z. Beij,"Region Based Detection versus Edge Detection", IEEE Transactions on Intelligent information hiding and multimedia signal processing, pp. 1217-1221, 2009.
10. Panagiotis Sidiropoulos, Vasileios Mezaris, Ioannis (Yiannis) Kompatsiaris and Josef Kittler," Differential Edit Distance: A Metric for Scene Segmentation Evaluation", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 6, JUNE 2012
11. Alasdair McAndraw, School of Computer Science and Mathematics Victoria University of Technology"An Introduction To digital Image Processing With MATLAB",September 2004
12. Yang Yang, Yi Yang, Heng Tao Shen, Yanchun Zhang, Xiaoyong Du, Xiaofang Zhou," Discriminative Nonnegative Spectral Clustering with Out-of-Sample Extension", Digital Object Indentifier 10.1109/TKDE.2012.118 1041-4347/12/$31.00 © 2012 IEEE
13. Mei Yeen Choong, Wei Yeang Kow, Yit Kwong Chin, Lorita Angeline, Kenneth Tze Kin Teo, "Image Segmentation via Normalised Cuts and Clustering Algorithm", 2012 IEEE International Conference on Control System, Computing and Engineering, 23 - 25 Nov. 2012, Penang, Malaysia
14. J. Senthilnath,S.N.Omkar,V.Mani,TejovanthN,P.G . Diwakar, and Archana Shenoy B," Hierarchical Clustering Algorithm for Land Cover Mapping Using Satellite Images", IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING, VOL. 5, NO. 3, JUNE 2012
15. V. K. Dehariya, S. K. Shrivastava, R. C. Jain,"Clustering of Image Data Set Using K-Means and Fuzzy K-Means Algorithms", International conference on CICN, pp. 386- 391, 2010.
16. Ivana Despotović, "Spatially Coherent Fuzzy Clustering for Accurate and Noise-Robust Image Segmentation", IEEE Signal Processing Letters, Vol. 20, No. 4, April 2013
17. Jilan Feng, Zongjie Cao, "Multiphase SAR Image Segmentation With G0-Statistical-Model-Based Active Contours", IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, 0196-2892/$31.00 © 2013 IEEE
18. Truong Quang Vinh, Bui Minh Thanh, Nguyen Ngoc Tai, "Dental Intraoral System Supporting Tooth Segmentation", 978-1-4673-2088-7/13/$31.00 ©2013 IEEE
19. Johannes Ulén, Petter Strandmark, and Fredrik Kahl, "An Efficient Optimization Framework for Multi-Region Segmentation Based on Lagrangian Duality", IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 32, NO. 2, FEBRUARY 2013
20. Changyang Li, Xiuying Wang, Junli Li, Stefan Eberl, "Joint Probabilistic Model of Shape and Intensity for Multiple Abdominal Organ segmentation From Volumetric CT Images", IEEE JOURNAL OF BIOMEDICAL AND HEALTH INFORMATICS, VOL. 17, NO. 1, JANUARY 2013
21. Celso T. N.Suzuki, Jancarlo F. Gomes, Alexandre X. Falc˜ao, Jo˜ao P. Papa∗, and Sumie Hoshino-Shimizu, "Automatic Segmentation and Classification of Human Intestinal Parasites From Microscopy Images", IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 60, NO. 3, MARCH 2013
22. Maoguo Gong, "Fuzzy C-Means Clustering With Local Information and Kernel Metric for Image Segmentation", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 22, NO. 2, FEBRUARY 2013
23. Peng Zhang, Ming Li, Yan Wu, Gaofeng Liu, Hongmeng Chen, and Lu Jia, "Unsupervised SAR Image Segmentation Using a Hierarchical TMF Model", IEEE GEOSCIENCE AND REMOTE SENSING LETTERS 1545-598X/$31.00 © 2012 IEEE
24. Haili Zhang, Xiaojing Ye, and Yunmei Chen, "An Efficient Algorithm for Multiphase Image Segmentation with Intensity Bias Correction", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. , NO. , MAY 2013
25. Digital Image Processing, Rafael C. Gonzalez & Richard E. Woods, Second Edition 2002, Prentice Hall.
26. K. K. Singh, A. Singh,"A Study of Image Segmentation Algorithms for Different Types of Images", International Journal of Computer Science Issues, Vol. 7, Issue 5, 2010
27. Nikhil R Pal and Sankar K Pal, A review on Image Segmenatation Techniques,Indian Statistaical Institute,Pattern Recognition,Vol 26,No.9,pp.1277,1993.
28. C. Zhu, J. Ni, Y. Li, G. Gu,"General Tendencies in Segmentation of Medical Ultrasound Images", International Conference on ICICSE, pp. 113-117, 2009.
29. Y. Zhang, H. Qu, Y. Wang,"Adaptive Image Segmentation Based on Fast Thresholding and Image Merging", Artificial reality and Telexistence-Workshops, pp. 308-311, 1994.

30. T. Lindeberg and M.-X. Li "Segmentation and classification of edges using minimum description length approximation and complementary junction cues", Computer Vision and Image Understanding, vol. 67, no. 1, pp. 88--98, 1997.
31. H. Zhang, J. E. Fritts, S. A. Goldman,“Image Segmentation Evaluation: A Survey of unsupervised methods”, computer vision and image understanding, pp. 260-280, 2008
32. H. Zhang, J. E. Fritts, S. A. Goldman,“Image Segmentation Evaluation: A Survey of unsupervised methods”, computer vision and image understanding, pp. 260-280, 2008.
33. L.Aurdal,“Image Segmentation beyond thresholding”, Norsk Regnescentral, 2006.
34. S.Lakare and A.Kaufman,”3D Segmenatation techniques For Medical Volumes”,Center For Visual Computing,department Of Computer Science,State University Of New York,dec.2000
35. P. Karch, I. Zolotova,“An Experimental Comparison of Modern Methods of Segmentation”, IEEE 8th International Symposium on SAMI, pp. 247-252, 2010.
36. R.Xu, D.Wunsch A.Jain, M.Murty, P.Flynn,”Data Clustering: A Review”,ACm Computing Surveys,31,1999,pp-264
37. F .Z. Kettaf, D. BI, J. P.,“A Comparison Study of Image Segmentation by Clustering Technique”, Proceedings of ICSP, pp. 1280-1282, 1996.
38. S. Naz, H. Majeed, H. Irshad,“Image Segmentation using Fuzzy Clustering: A Survey”, International Conference on ICET, pp.181-186, 2010.
39. S.Tatiraju, A. Mehta,“Image Segmentation using k-means clustering, EM and Normalized Cuts”, Department of EECS, pp. 1-7.
40. T.F. Wang, D.Y. Li et al. Automatic segmentation of medical ultrasound image using self-creating and organizing neural network.Journal of electronics.1999,21(1),pp.124-127.
41. Z. B. Chen, Q. H. Zheng, T. S. Qiu, Y. Liu. A new method for medical ultrasonic image segmentation.Chinese Journal of Biomedical Engineering.2006,25(6),pp.650-655.
42. Y.L.Huang,D.R.Chen. Watershed segmentation for breast tumor in 2Dsonography. Ultrasound in Medicine & Biology. 2004,30(5),pp.625632.
43. T.Kohonen.Self-organization and associative memory. SpringerVerlag New York, Inc.New York, NY, USA,1989.
44. P. Karch, I. Zolotova,“An Experimental Comparison of Modern Methods of Segmentation”, IEEE 8th International Symposium on SAMI, pp. 247-252, 2010.

AUTHOR PROFILE

Miss. H. P. Narkhede received the B.E. Degree in Electronics and Telecommunication from Department Of Electronics and Telecommunication Engineering, North Maharastra University,India in 2010. She is currently Second Year M.E.student of Electronics and Telecommunication Engineering. She presented paper in national level conference. She delivered guest lectures on different points related to image processing. Her research interest is in image processing, application and image segmentation of human photo images.