

A Brief Survey on Image Segmentation Methods

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ABSTRACT

Term segmentation is about splitting the whole image into segments. In case of image analysis, image processing one of the crucial steps is segmentation of image. Segmentation of image concern about dividing entire image in sub parts that may be similar or dissimilar with respect to features. Output of image segmentation has consequence on analysis of image, further processing of image. Analysis of image comprises depiction of object and object representation, measurement of feature. Therefore characterization, area of interest's visualization in the image, description have crucial job in segmentation of image. This survey explains some methods of image segmentation.

Keywords

Segmentation, Image Segmentation, Image Analysis.

1. INTRODUCTION

In order to do the segmentation we must have an image. Images might be black images, white images or color images. Images with color are because of grey level [1]. In case of color image, color in image varies as gray level contrast varies. Segmentation of image is one of the difficult steps of image analysis, with the aim of information extraction which corresponds to image data through image segmentation, measurement of feature, representation of object. The outcome of image segmentation very much relies upon precision of feature measurement [2]. Image segmentation procedure which splits entire image in its ingredients and take out object of interest. Image segmentation automation can be made but segmentation outcome may distresses remaining image analysis phases [3]. Depending on image segmentation methods [2], it might be grouped in 2 kinds, Characterization and Comparison.

Characterization might be treated as intra-technique procedure where as comparison procedure might be treated as inter-technique. Depending on diverse methodologies, image segmentation [2] techniques are categorized as Discontinuities Detection and Similarities Detection, depending on two image properties. Discontinuities Detection:-The finding of edge needs this property this contains image segmentation algorithm. Image intensity [5] is changed and split the image. Detection of edge is nothing but segmentation by locating pixels [6], [7] on boundary region. The edge might be illustrated by boundary involving adjoining components of an image [8]. Similarities Detection; It seems division of image in areas which are same according to pre-specified criterion [4], it contains algorithms for image segmentation for example region splitting and region merging, region growing, thresholding etc. Thresholding[9] is general thing utilized to do segmentation depends on region in which the image is symbolized as pixels cluster with values less to threshold, greater or equal to the threshold. Thresholding might be utilized in circumstances where client needs to eliminate unwanted portion of an image [10]. Also Clustering [11], [12], [13] is an approach for segmentation of area in which entire

image is divided in pixels clusters or sets [6], [7] encompassing likeness in feature space.

2. CLASSIFICATION OF SEGMENTATION METHODS

Methods of Image segmentation can be mostly categorized in 2 kinds; Local segmentation and Global segmentation. Global segmentation is related with segmentation of entire image. Typically it is related with segment parts comprising comparatively huge number of pixels [6], [7]. This constructs estimated values of parameter for global segment parts mainly robust. Segmentation of an image could be and approach from 3 diverse viewpoint. Namely Region approach, Boundary approach, Edge approach. When any pixel fits in object, that pixel represents one value else represents zero value. Segmentation [4], [14] is the working in threshold between image analysis and low level image processing. Subsequent to the whole segmentation, pixel [6], [7] feel right to an object. Structural methods [4] exercise a few information about the structure of the region for segmentation. Stochastic methods are applied on isolated pixels without knowing or bearing in mind any structural knowledge of area. Statistical analysis is one of the methods on which stochastic method [4] depends. Hybrid method [4] comprises those methods which have the features of structural as well as stochastic methods.

3. EDGE DETECTION TECHNIQUES

Image's intensity facts simply give incomplete, tentative data regarding position of edges. Edge detection method [6] is discovering pixel on the region boundary. Edge detection method tries to determine image segmentation by noticing the pixels or edges between diverse regions that have quick transition in intensity are extracted [2], [15] and coupled to create closed boundaries of object. The outcome is a binary image [5]. One cause of uncertainly appears from the presence of noise established in imaging process and afterwards in transmission, process of sampling. Another cause of uncertainly appears from the fact that any measurement piece of equipment is defective and their outcomes are merely partial inspection. It says that methods of edge detection are normally ill-posed, that is they are under-constrained and therefore might not have single solutions. The simplest approach to find edges in image is to watch for locations in an image where intensity alters speedily using one of two conditions; Locations at which earliest intensity derivative bigger in magnitude than some threshold, Locations at which second intensity derivative has a zero crossing. Edge detection [13] method is one of structural method of the image segmentation method. Depends on theory there are 2 chief edge based segmentation methods; gradient based method, gray histogram[1]. In an edge approach, edges are acknowledged first, then they are joined together to create required boundaries. Edge detectors have diverse operator for edge detection like canny operator, Laplace operator, Sobel operator, LoG (Laplacian of Gaussian) operator etc. Edge detection technique needs a superior quality of an image therefore it wants to eliminate the noise or diminish the noise.

4. THRESHOLD TECHNIQUE

One easiest advance of image segmentation is depends upon values of pixels. The method is to use segmentation depends on thresholding which may assist to simple region growing steps. Thresholding algorithms could be elected physically as per an advance comprehension or robotically by image information. Thresholding algorithms additionally separated to region based, edge based, or hybrid. Edge based algorithms are associated with edge data. The object composition could be illustrated by edge points. Regular edge detection algorithms like Laplacian edge detector, canny edge detector could be categorized to this sort of regions. These algorithms are utilized to search edge pixels while removing influence of noise. Thresholding is elderly, straightforward, well accepted method for segmentation of image [16]. Segmentation of image by thresholding is an easy but commanding approach for image segmentation comprising light objects on gloomy surroundings [2]. Thresholding method is depends upon image space areas that is on image characteristics [1]. Action thresholding translates multilevel image into a binary one that is, it selects an appropriate threshold T , to split pixels of an image in numerous areas then detaches objects apart from background. Thresholding operation utilized to decide intensity value known as threshold, which disconnects the desire classes. Segmentation is achieved by combining the entire pixels with intensity greater than threshold in one class, remaining pixels in another class. Depending on threshold value selection, 2 kinds of thresholding techniques are existed [13] that are local thresholding, global thresholding. Sankar k Pal, Nikhil R Pal [15] made survey on image thresholding methods. Also thresholding could be categorized in bi-level thresholding, multi-thresholding [16]. If value of T is steady, then the technique is known as global thresholding else it is known as local thresholding. Global thresholding techniques might be unsuccessful if background enlightenment is irregular. In case of local thresholding, several threshold values are utilized to compensate for irregular enlightenment [17]. Choice of threshold usually happens interactively though; it is probable to obtain automatic threshold selection algorithms. Drawback of thresholding technique is merely 2 classes are produced, and it can't be useful to multichannel images.

5. REGION SEGMENTATION TECHNIQUES

R indicates region of image and is stated as a connected homogenous subset of an image with respect to some criterion like texture or gray level. Image regions are cluster of connected pixels with analogous belongings. In this approach, every pixel is assigned to specific area or an object. As evaluated with edge detection technique, region dependent segmentation algorithms are quite effortless and more unaffected with noise [1], [18]. Edge dependent techniques divide an image based on speedy alterations in intensity near edges while region based techniques; divide an image in regions that are analogous according to a set of pre-specified criteria [5], [8]. In segmentation that depends on regions, pixels corresponding to object are assembled together and marked. Region based segmentation in addition requires the utilization of suitable thresholding methods. The vital principles are value likeness which comprises variance in gray value, differences in gray value and spatial proximity which comprises Euclidean distance, region compactness. Region based segmentation algorithms mostly contains following techniques; Region Growing, Region splitting and merging. Region growing [3] is a procedure for dig out an image region

that is joined based on some pre-specified criteria. This criterion depends on information of intensity. Region growing is approaches to segmentation of image in which adjoining pixels are inspected and inserted to a region class of no edges are found. This procedure is repeated for every boundary pixel in area. If adjacent areas are detected, a region merging algorithm is utilized in which fragile edges are melted and strong edges are left intact. Split and merge method is the contradictory of region growing. This method works on the entire image. Region splitting is a top-down style. It starts with an entire image and splits it up so that the isolated elements are more homogenous than the entire. Only splitting is inadequate for sound segmentation as it strictly limits the segments shapes. So, a merging stage later than the splitting is for all time advantageous, which is expressed as split and merge algorithm. Every region could be divided into sub regions, and the suitable regions could be merged into a region.

Instead of selecting seed points, client can split an image into a set of random unconnected regions after that merge the regions [1], [2] in an effort to suit the circumstances of reasonable segmentation of image. Region splitting and merging is typically employed with theory depends on quad tree data. Region splitting and merging is a method for segmentation of image which obtains spatial information into thought. In region splitting technique, let R stand for the whole image. Select a predicate P . Partition the image consecutively into minor and minor quadrant regions. The splitting method has a suitable depiction in the form of structure known as a quad tree. In quad tree, tree's root represents whole image and every node represents section. In region merging technique, merge any adjoining regions that are analogous enough. Reiterate above steps until no further splitting or merging happens. This method wants the inputted data to be arranged into a pyramidal grid arrangement of regions, with every region organized in groups of 4 in case of 2D, 8 in case of 3D. Physical dealings will not be required in this method. But the drawback is, it needs the inputted data to be organized into a pyramidal grid arrangement which might be tricky [19].

6. CLUSTERING TECHNIQUES

In image processing clustering is a crucial task. Clustering [11], [12] is an unsupervised learning job, at which there are requirements to see a finite set of categories called as clusters to recognize pixels [13]. No training stages are used in Clustering; instead train themselves by means of existing information. Clustering is mostly utilized when classes are acknowledged in prior. A correspondence criterion is described between pixels [2], afterwards analogous pixels are assembled collectively to create clusters. Pixels grouped into clusters is depends upon the law of exploiting the intra class likeness and curtailing the inter class likeness. Clustering method tries to use the affiliation among patterns of the set by organism the patterns in clusters or groups so that pattern inside a cluster are extra analogous to each other as compare to patterns of diverse cluster. Clustering outcome quality relies on similarity measure utilized by method and its execution. Superior clustering technique [20] will create top quality clusters with high intra-class likeness and low inter-class likeness. The excellence of a clustering technique is also deliberated by its capability to discover. Clustering is nothing but categorization of objects in groups according to certain belongings of these objects. In clustering methods, an effort is carried out to dig out a vector from local image regions. A usual process for clustering is to assign every pixel to the

nearby cluster mean. Clustering algorithms are categorized like; k- means clustering, fuzzy clustering, hard clustering etc. An admired well famous hard clustering algorithm [21] is the k-means. In the hard clustering, a membership value 0 or 1 is given to every pattern data. Working is very straightforward, provides early hard c-partition, it calculates c center and assigns every object to its nearby center in order to reduce the within-cluster variation. After every iteration it carries out experiment comparing the current and the precedent partition, if the outcome of the diversity is lesser than a prefixed threshold, it stops otherwise it go on. Algorithm k-means [22], [23] is nothing but statistical clustering algorithm. Clustering data is technique that produces object groups. Algorithm k-mean is depends on index of likeness or unlikeness between couples of component data. Algorithm k-mean is unsupervised, iterative, numerical, non-numerical and technique. This form of algorithm is admired for straightforwardness, accomplishment and it is universally utilized for pixels grouping in an image. The clustering technique with the spatial, shape information is mounting. Fuzzy clustering technique could be believed to be finer as compare to their hard equivalents because they can show the affiliation between the input pattern information, clusters more unsurprisingly. Fuzzy c-means [22] is a well-liked soft-clustering technique, whose usefulness is mostly limited to spherical clusters. In number of situations, it is very flexible as compare to the equivalent hard-clustering algorithm. Clustering technique can be separated into 2 types; hierarchical, partitional. In every category, there exist numerous kinds of algorithms for searching the cluster. Hierarchical clustering method are depends upon the utilization of a proximity matrix demonstrating the likenesses between each couple of data points that be clustered the final outcome is clusters tree showing the nested patterns group and similarities levels at which groupings vary. The resulting clusters are usually produce as the internal tree node, where as the root node is kept for the whole database and nodes at leaf

for individual data samples. Clustering depends on partition utilizes iterative optimization produce that aims at lessening objective function f , which determine the kindness of clustering. This sort of clustering are consist of 2 learning steps; partitioning of every pattern to its closed cluster and cluster centroids calculation.

7. ARTIFICIAL NEURAL NETWORK TECHNIQUES

The Neural Network is nothing but artificial demonstration of human brain this attempts to imitate its learning procedure. Artificial Neural Network [24], [25] frequently known as a neural network or merely neural net. Up to date, neural nets are broadly utilized to answer the crisis of image segmentation in medical stream. It is dependent on life imitation, particularly learning process of human brains, comprises a huge number of parallel nodes. Every node could carry out some fundamental computing. Learning process could be accomplished through moving the node connections and weights of connection [26]. Its major significant benefit is not dependent on the function called as probability density distribution function. It could also verifies segmentation consequences whenever the data divergence from the usual condition. Neural net could also diminish the expert intervention requirements while doing process of image segmentation. This crisis is common in lots of age segmentation techniques. Initially, the problem of image segmentation is changed into energy minimization or classification issues, Afterwards issues are answered depending on neural network in this technique. The neural net was trained with set of training sample with aim to decide the connection between the nodes and weights between the nodes. After that with trained neural network new images were segmented. Neural net segmentation technique comprises 2 vital steps: feature extraction and neural network dependent image segmentation.

Table1. Summary Chart

Authors	Name of Segmentation Method	Description of Method	Benefits of Method	Limitations of Method
W. X. Kang et.al.[1] Zhang et.al.[2] Rastgarpour M. et.al.[5] Jesmin F. Khan et.al.[6] V. K. Dehariya et.al.[13] Nikhil R Pal et.al.[15]	Edge Detection Method	Depends on discontinuity detection, generally aims to situate points with less or more rapid gray level changes.	- Approach by which human perceives objects. - Job fine for images possessing excellent region disparity.	- Not good with images where edges are unclearly defined - Not good with images having moreover edges -It's not minor work to create a boundary or closed curve. -Tiny noise resistant as compare to other methods.
W. X. Kang et.al.[1] Zhang et.al.[2] V. K. Dehariya et.al.[13] Nikhil R Pal et.al.[15] Y. Zhang et.al.[16] T. Lindeberg et.al.[17]	Thresholding Method	Wants that the image has a various peaks, each one correspond to a region.	- Not requires former image knowledge. -Minimum complexity of computation.	-Not good for image with no any clear peaks. -Not good for image with wide, plane valleys. -Not believes spatial facts, therefore no guarantee of contiguous segmented regions.

W. X. Kang et.al.[1] Zhang et.al.[2] D.L. Pham et.al.[3] Rastgarpour M. et.al.[5] H. G. Kaganami et.al.[8] H. Zhang et.al.[18] S.Lakare et.al.[19]	Region Dependent Method	Assembles pixels in uniform regions. Counting region growing, splitting, merging or their permutation.	- Do well if region homogeneity norm is painless to define. - Extra noise resistant as compare to Edge Detection method.	-Pretty pricey regarding memory, computational time. -Region growing relies on seed region selection and sequence by which regions, pixels are inspected. -Output segments by region splitting emerge too square because of splitting format.
Zhang et.al.[2] Yang Yang et.al.[11] J. Senthilnath et.al.[12] V. K. Dehariya et.al.[13] R.Xu et.al.[20] F .Z. Kettaf et.al.[21] S. Naz et.al.[22] S.Tatiraju et.al.[23]	Fuzzy Method	Use fuzzy operators, mathematics, properties and inference rules, give a mode to handle the uncertainty inherent in a range of troubles because of ambiguity instead randomness.	-fuzzy membership function could be utilized to show the degree of few properties or linguistic phrase, fuzzy If-Than rules could be utilized to do approximate inference.	-fuzzy membership determination isn't minor job. - Calculation occupied in fuzzy approaches could be intensive.
T.F. Wang et.al.[24] Y.L.Huang et.al.[25] T.Kohonen [26]	Neural Network Method	to do clustering ,classification or neural net are used.	-Doesn't require writing tedious programs. - Could entirely exploit the parallel nature of neural net.	-Extended Training period. -Initialization might affect the outcome. -Extra training must be kept away.

8. CONCLUSIONS

In this survey paper various methods of image segmentation are studied, the summary of diverse segmentation techniques applied on digital image processing is enlightened shortly. The paper also evaluates variety of research techniques applied on image segmentation. These techniques are most significant for pattern detection and recognition by using edges, images, points etc. Techniques of image segmentation stated in this survey paper are utilized in numerous modern machines for face identification, image identification, pattern recognition etc. Image segmentation has a promising and demanding opportunity as the universal segmentation algorithm and has become the center of attention of current research. Here is no solitary technique that can be believed superior for all form of images. Not every technique evenly fine for a particular kind of image. Because of all these issues, image segmentation leftovers a demanding crisis in image processing and is still awaiting problem. At rest image segmentation provides more techniques applied to diverse fields.

Lots of novel image segmentation methods might be designed in upcoming days. Image segmentation is a wide area for researchers to do work in future.

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