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OVERVIEW ON APPROCHES OF IMAGE SEGMENTATION WITH IT'S ALGORITHM AND APPLICATIONS.

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Abstract- Image processing is part of signal processing. One of the typical operations perform on image processing is image segmentation. Segmentation refers to the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels).Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a Set of segments that collectively cover the entire image, or a set of contours extracted from the image. each of the pixels in a region are similar with respect to some characteristic or computed property, such as colour, intensity, or texture. Due to the importance of image segmentation a number of algorithms have been Proposed but based on the image that is inputted the algorithm should be chosen to get the best results. In this paper the author gives a study of the various algorithms that are available for colour images, text and gray scale images.

In this paper, I have presented various image segmentation approaches like pixel based segmentation, edge base segmentation, fixation based segmentation etc. and there are various applications if image segmentation out of which finger code generation using SPFB (singular point feature block) is explain in detail .paper provides the different algorithm used for image segmentation and gives wrapper based approach which is burning approach is newest era.

Keywords: Image segmentation, Pixel based, Edge based, Fixation base, Quad tree, Wrapper based, SPFB.

1. Introduction

Image segmentation refers to the breaking of scene into different components (thus to facilitate the task at higher levels such as object detection and recognition). More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Segmentation attempts to partition the pixels of an image into groups that strongly correlate with the objects in an image and is typically the first step in any automated computer vision application The purpose of image segmentation is to partition an image into regions and objects (of related content) with respect to a particular application. Image segmentation algorithms generally are based on one of two basic properties of intensity values i.e. partitioning an image into regions based on:

- Detecting Discontinuity - ex edges, points, lines
- Detecting Similarity – ex Thresh- holding
-

Automatic Segmentation techniques are based on following Methods: point, line, edge, and corner detection, Thresholding, clustering, Compression based methods, Histogram-based methods, graph based methods, region growing, splitting & merging, Watershed transformation etc. The few applications of image segmentation are like medical, fingerprint recognition, face recognition etc. There are various types of fingerprint are available such as whorl, left loop, right loop, trend arch, arch etc and the minutiae can be classified as ridge ending and ridge bifurcation.Fingerprint recognition is the most widely used biometric system for human identification. Generally, fingerprints are the pattern of human fingers which are called as minutiae i.e. ridges and valleys. The fingerprint acquisition can be classified into two major techniques

- Automatic Fingerprint Recognition using online sensors or other devices.
- Latent prints are obtained by various Medias such as ink, powder, paper etc, there are mostly used in the crime departments.

2. Approaches of Image segmentation:

2.1. Pixel-Based Segmentation: Point-based or pixel-based segmentation is conceptually the simplest approach used for segmentation.

2.2. Model-Based Segmentation: All segmentation techniques discussed so far utilize only local information. The human Vision system has the ability to recognize objects even if They are not completely represented. It is obvious that the information that can be gathered from local neighborhood operators is not sufficient to perform this task.
Instead specific knowledge about the geometrical shape of
The objects are required, which can then be compared with the Local information. This train of thought leads to Model-based segmentation. It can be applied if we know the exact shape of The objects contained in the image.

2.3. Edge-Based Segmentation: Even with perfect illumination, pixel based segmentation results in a bias of the size of segmented objects when the objects show variations in their gray values .Darker objects will become too small, brighter objects too large. The size variations result from the

fact that the gray values at the edge of an object change only gradually from the background to the object value. No bias in the size occurs if we take the mean of the object and the background gray values as the threshold.

However, this approach is only possible if all objects show the same gray value or if we apply different thresholds for each object. An edge based segmentation approach can be used to avoid a bias in the size of the segmented object without using a complex thresh-holding scheme. Edge-based segmentation is based on the fact that the position of an edge is given by an extreme of the first-order derivative.

2.4. Fixation-Based Segmentation Method:

Vision is the most advanced of our senses, so it is not surprising that images play the single most important role in human observation. The human visual system (HVS) has an attention module that uses the low-level visual cues (such as color, texture etc.) to quickly find the salient locations in the scene. The human eyes are then drawn to these salient points (also called fixations).These fixations points are going to be used as the identification markers for the objects of interest in the scene. The human (primate) visual system observes and makes sense of a dynamic scene (video) or a static scene (image) by making a series of fixations at various salient locations in the scene.

A New Segmentation approach is proposed in [1] that is biologically motivated and connects segmentation with visual attention (Inspired by the Human Visual System).The human visual system has two types of attention: overt attention (eye movements) and covert attention (without eye movement). In this work, overt attention is meant whenever the term attention is used. The attention causes the eye to move and fixate at a new location in the scene. Each fixation will lie on an object, identifying that object (which can be a region in the background too) for the segmentation step. Now, segmenting that fixated region is defined as finding the "optimal" enclosing contour—a connected set of boundary edge fragments—around the fixation. This new formulation of segmenting fixated regions is a well-defined problem.

This algorithm takes a fixation point as its input and outputs the region containing the given fixation point in the scene.

Advantage-The segmentation becomes a fully automatic process which finds the optimal segmentation of the fixated regions without any user input.

2.4.1 Working of fixation-Based Segmentation:

Here, bottom-up image segmentation is considered. That is, we ignore (top down) contributions from object recognition in the segmentation process and we expect to segment images without recognizing objects. For a given fixation point, segmenting the region/object containing that point is a two step process:

a. Cue Processing: Visual cues such as color, texture, motion and stereo generate a probabilistic boundary edge map wherein the probability of a pixel to be at the boundary of any object in the scene is stored as its intensity.

b. Segmentation: For a given fixation point, the optimal closed contour (connected set of boundary edge pixels) around that point in the probabilistic edge map. This process is carried out in the polar space to make the segmentation process scale invariant.

In order to segment multiple objects, the segmentation process will be repeated for the fixation points from inside each of the objects of interest. However, the edge map contains both types of edges, namely, boundary (or depth) and internal (or texture/intensity) edges so it is important to be able to differentiate between the boundary edges from the non-boundary (e.g. texture and internal) edges.

"Polar space method" traces the closed contour through the probabilistic boundary edge map in the Cartesian (Coordinate system) space to polar coordinate system and gives optimal enclosing contour around the fixation show that we obtain segmentation accuracy.

For this segmentation framework, the fixation just needs to be inside the objects in the scene. As long as this is true, the correct segmentation will be obtained. This segmentation method clearly depends on the fixation point, and thus it is important to select the fixations automatically.

Figure 1: Fixation point on horse indicated by green cross[11].

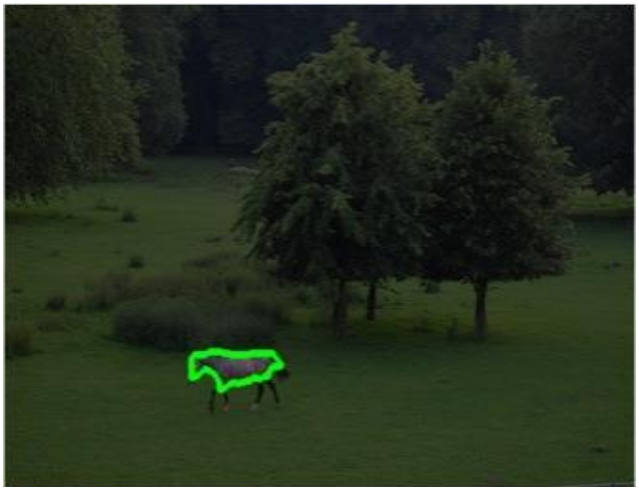


Figure 2: Method Segments the corresponding regions enclosing the fixations points [11].

Figure 3: Fixation point on tree indicated by green cross [11].

Figure 4: Method Segments the corresponding regions enclosing the fixations points on tree [11].

2.5. Image Segmentation by Probabilistic Bottom-Up Aggregation and Cue Integration:

A parameter free approach is presented here that utilizes multiple cues for image segmentation. Beginning with an image, a sequence of bottom-up aggregation steps is executed in which pixels are gradually merged to produce larger and larger regions. In each step, considered are pairs of adjacent regions and provided a probability measure to assess whether or not they should be included in the same segment. This probabilistic formulation takes into account intensity and texture distributions in a local area around each region[3]. It further incorporates priors based on the geometry of the regions. Finally, posteriors based on intensity and texture cues are combined using a mixture of experts formulation.

This probabilistic approach is integrated into a graph coarsening scheme providing a complete hierarchical segmentation of the image. The algorithm complexity is linear in the number of the image pixels and it requires almost no user-tuned parameters. In this paper a different approach is explored which relies primarily on local information available within the image to be segmented.

This method is illustrated by constructing modules to handle intensity contrast and texture differences, and use an adaptively controlled "mixture of experts"-like approach to integrate the different cues and reach unified segmentation decisions [2].

Segmentation results are evaluated by assessing its consistency with the ground truth segmentation and its amount of fragmentation.

2.6. Graph-Based Image Segmentation:

This method segments an image into regions. A predicate is defined for measuring the evidence for a boundary between two regions using a graph-based representation of the image.

An efficient segmentation algorithm is then developed based on this predicate, and shown that although this algorithm makes greedy decisions it produces segmentations that satisfy global properties. The algorithm is applied to image segmentation using two different kinds of local neighborhoods in constructing the graph, and illustrates the results with both real and synthetic images [4]. The algorithm runs in time nearly linear in the number of graph edges and is also fast in practice. An important characteristic of the method is its ability to preserve detail in low-variability image regions while ignoring detail in high-variability Regions. This method is based on selecting edges from a graph, where each pixel corresponds to a node in the graph, and certain neighboring pixels are connected by undirected edges.

Weights on each edge measure the dissimilarity between pixels. However, unlike the classical methods, this technique adaptively adjusts the segmentation criterion based on the degree of variability in neighboring regions of the image.

This results in a method that, while making greedy decisions, can be shown to obey certain non-obvious global properties.

Also it is shown that other adaptive criteria, closely related to the one developed here, result in problems that are computationally difficult (NP hard).

2.7. Quad tree decomposition.

An image can be represented by a data structure known as the quad-tree [5] [6] [8]. A quad tree is a tree whose nodes either leaves or with 4 children. To represent an image by a quad-tree representation, the image is first divided into 4 quadrants of equal size. Then, each quadrant will be further sub-divided if it has more than one color.

2.8. Recursive Thresholding.

It exploits region statistics to controls partitioning. The entire image is first split, and then each extracted region is considered for further splitting. Each successive split improves the context in which additional decisions are made.

2.9. Region Split-and-Merge segments.

It's breaking an image into quasi-homogeneous Regions using a binary space partition (BSP) or a quad tree partition. In the second phase, a bottom-up strategy is used to merge the regions whose histograms are more similar

2.10. Histogram Clustering

It's often used to select region centers that are then grown, tentative regions found by over segmenting are clustered in a spectral space to find a final set of regions. I use clustering only for splitting regions, with connected component analysis, region merging, and perhaps further splitting used to verify and improve the segmentation.

3. Algorithm:

3.1. Color Image Segmentation algorithm

The human eyes have adjustability for the brightness, which we can only identified dozens of gray-scale at any point of complex image, but can identify thousands of colors. In many cases, only utilize gray-Level information cannot extract the target from background; we must by means of color information. Accordingly, with the rapidly improvement of computer processing capabilities, the color image processing is being more and more concerned by people. The color image segmentation is also widely used in many multimedia applications, for example; in order to effectively scan large numbers of images and video data in digital libraries, they all need to be compiled directory, sorting and storage, the color and texture are two most important features of information retrieval based on its content in the images and video. Therefore, the color and texture segmentation often used for indexing and management of data; another example of multimedia applications is the dissemination of information in the network. Today, a large number of multimedia data streams sent on the internet, However, due to the bandwidth limitations; we need to compress the data, and therefore it calls for image and video segmentation.

3.2. Seed Region Growing Algorithm And Watershed Algorithm

The basic idea of region growing method is a collection of pixels with similar properties to form a region. The steps are as follows:

(I) find a seed pixel as a starting point for each of needed segmentation.

(II) Merge the same or similar property of Pixel (Based on a pre-determined growing or similar formula to determine) with the seed pixel around the seed pixel domain into the domain of seed pixel.

(III) These new pixels act as a new seed pixel to continue the above process until no more pixels that satisfy the condition can be included. The seed region growing algorithm is proposed by Adams and Bishop, Metmert and Jack way [7] further described the dependency Relationship between pixels in the seed growth:

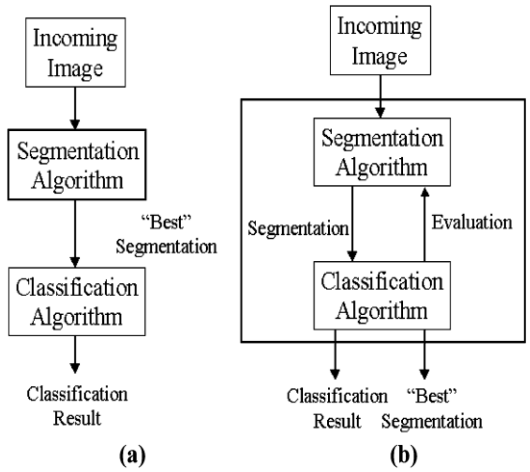
(i) The first order of dependence occurs when the number of pixels has the same difference ratio as their vicinity.

(ii) The second order of dependence occurs when a pixels has the same difference ratio as their vicinity Frank and Shouxian Cheng applied the automatic seed selection method, they selected seed which can represents needed segmentation region based on certain similarity criteria and proposed a strategy to solve the above two pixels dependence [9]. The watershed algorithm is more representative in the application of mathematical morphology theory for image segmentation. Watershed algorithm is a region based segmentation techniques image that uses image morphology [10].

4. A Wrapper Based Approach to Image Segmentation:

Our approach resolves the problem of the object of interest Being over-segmented by using the classifier to intelligently Re-assemble a subset of these sub regions into the final segmented object based on the shape of the object of interest. Our approach actually prefers the object of interest be over-segmented into a number of smaller regions to ensure that a minimal amount of background is connected to any of the object regions. The correct segmentation is now no longer based on some low-level image homogeneity of the object, i.e., color, grayscale, or texture, but rather it is based on the probability of correct classification of the proposed segmentation for a given class. Thus, in our method, the classification algorithm provides both the semantic context for the segmentation, as well as a figure of merit for the resultant segmentation, based on the classification accuracy for the pattern class under consideration. Note that since we do not have ground truth regarding the objects being segmented, the classification is assumed to be correct when a minimum distance between the classification

Figure 5: (a) filer-based segmentation and
(b) wrapper-based segmentation.



Of the candidate segmentation and one of the desired pattern classes is attained. The classification distance must be below threshold in order for the wrapper-based segmentation to declare a successful segmentation; otherwise, we adopt the "reject option" of the classifier and declare the desired pattern class is not present in the image.

5 .Application of Image Segmentation:

- Medical imaging
- Locate tumors and other pathologies
- Measure tissue volumes
- Computer-guided surgery Diagnosis
- Treatment planning
- Study of anatomical structure
- Locate objects in satellite images (roads, forests etc.)
- Face recognition
- Iris recognition
- Fingerprint recognition
- Traffic control systems
- Brake light detection
- Machine vision
- Agricultural imaging – crop disease detection
- Finger code generation

6. Finger Code Generation Using SPFB Technique:

Various methods have developed for fingerprint recognition; especially for segmentation of fingerprints is one of the

important tasks in the fingerprint recognition system. The existing methods have merits and demerits in the segmentation process. Mostly, the segmentation process is done to segment the fore ground and background, it leads to the loss of features. In some methods the segmentation take place on block based, region based, graph based and pixel based approaches. Hence, to fulfill the drawbacks in the existing system, we propose aSPFB(Singular Point Feature Block) based technique for fingerprint image segmentation in the generation of finger code with the singular features such as Reference point, Core Point and Delta point. A global feature Entropy is computed as an additional feature which supports in the matching process in the absence of core point and delta point. The block diagram of the proposed technique is presented in the following figure shows the entire segmentation process of the proposed technique and the main task this system is as follows.

· Estimation of Orientation field
· Singular point Detection
· Finger code generation
· Feature Extraction

The detailed of entire segmentation Process is presented in the following sections.

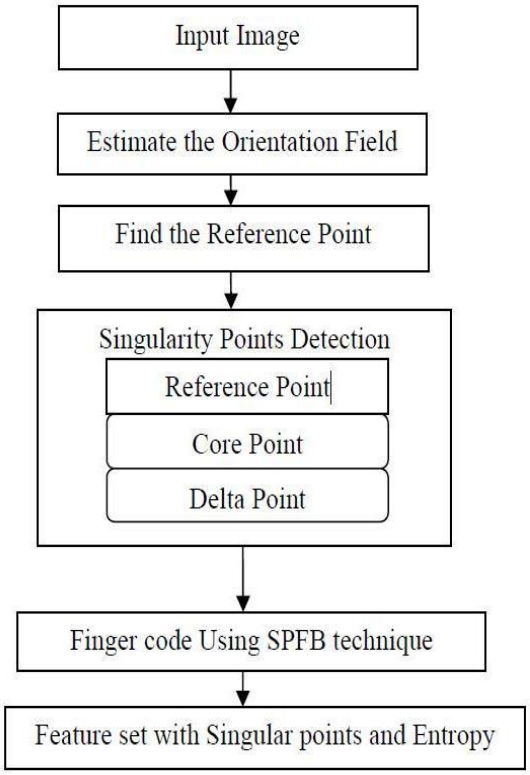


Figure 6: Block diagram.

6.1. Algorithm of finger code generation using SPFB.

The segmentation process of the fingerprint images is take place in two phases and defined as algorithm I and algorithm II. In algorithm I results in the singular point detection and in the generation of finger code. In algorithm II the fingerprint matching is take place and the FAR and FRR has estimated and are as follows.

6.1.1 Algorithm - I

Input: Fingerprint Image
Output: Feature set

Generation of finger code with Singular points:

Step1: *Select an input image I of size M x N*
Step 2*: Divide the input image I into non-overlapping Blocks with size w×w.*
Step 3: *Compute the gradients ∂x(i, j) and ∂y(i, j) at Each pixel (i, j) which is the center of the block.*
Step 4: *Estimate the local orientation*
Step 5: *Compute the reference point using the Equation of it.*
Step 6*: Compute the core point and Delta point using It's equation as discussed in the earlier Section.*
Step 7: *Construct the finger code with the equation*
Step 8: *Establish feature set.*
Step 9: *Repeat* ***step 1*** *to* ***step 9*** *for all images in the Database*
Step 10: Stop

6.1.2. Algorithm –II

Input: Target Image
Output: Fingerprint Matching

Fingerprint Matching:

Step 1: *Select the target image L of size M x N and Divide into m x n block.*
Step 2: *Repeat* ***step 3*** *to* ***step 9*** *as in the algorithm I*
Step 3: *Compute the Euclidean distance between the Target image and the image set for matching Using the equation.*
Step 4*: Compute the FRR and FAR using their Respective equation.*
Step 5: *Stop*

7. Conclusion:

In this paper, we classify and discuss main image segmentation types. Image segmentation has a promising future as the universal segmentation algorithm and has become the focus of Contemporary research. In spite of several decades of research Up to now to the knowledge of authors, there is no universally Accepted method for image segmentation, as the result of image

Segmentation is affected by lots of factors, such as: homogeneity Of images, spatial characteristics of the image continuity, texture, image content. Thus 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 imageProcessing and computer vision and is still a pending problem in the world of signal processing.

This paper also presents a new Singular Point Feature Block (SPFB) based approach in the generation of Finger code and the extraction of singular point Feature has been proposed

with its methodology and algorithm and various approaches with wrapper based approach.

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