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A Review on Face Matching Technique Using Region Merging

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ABSTRACT: Image segmentation is to categorize or else group an image into a number of parts (regions) depending on the attributes of an image. The paper presents a study of dissimilar image segmentation techniques. Well-organized and effectual image segmentation is vital task in computer visualization and object identification. Since completely automatic image segmentation is typically very tough for natural images, interactive plan with a little easy user inputs are fine solution. The paper present several segmentation techniques by means of dissimilar segmentation algorithms like Watershed, graph based, mean-shift etc with dynamic region merging approach are in use from the literature are evaluated . The main aim of this paper is to identify that which algorithm is most excellent with dynamic region merging for image segmentation.

Keywords: Image Segmentation, Region merging, Mean-shift

I. INTRODUCTION

Image Segmentation is a method of dividing an image into several regions or sets of homogenous pixels. The goal of segmentation is to make simpler and/or alter the demonstration of an image into something that is more significant and becomes easier for analysis. Image segmentation is usually used to position objects and boundaries (lines, curves, etc.) in images. Further precisely, image segmentation is the method of alloting a tag to every pixel in an image such that pixels with the same tag share certain visual characteristics. Partitioning is completed on the basis of same touch (texture) or colour. The result of image segmentation is a set of sections that collectively cover the entire image, or a set of contours pull out from the image. Neighboring regions are considerably dissimilar with respect to the same characteristics. This method has a range of purposes including face recognition, Iris recognition, fingerprint recognition, traffic control system, remote sensing and geographical information system. Image segmentation depends on two essential properties, first *intensity* and second *similarity*. *Intensity* values involve discontinuity that refers to rapid changes in intensity as edges. *Similarity* refers to separating a digital image into regions on the basis of some pre-defined criteria. Segmentation is a procedure which divides an image into a number of unique regions, where region is set of pixels.

If J is set of all image pixels, then by applying segmentation we obtain different-different distinctive regions like {I1, I2, I3,…,In } which after combined formed the image ―J□. A lot of fresh advancements have been made in this area of Image Segmentation by which we can segment more difficult images without any difficulty with the aid of computer vision. Image segmentation, though, still far away from being resolved.

II. LITERATURE REVIEW

In region merging style image segmentation is done with combining different methods at low level such as watershed algorithm, graph-based approach, mean-shift algorithm etc.

Calderero *et al.*, [1] presented a new statistical approach to region merging where regions are modeled as arbitrary discrete distributions, directly estimated from the pixel values. Under this framework, two region merging criteria are obtained from two different perspectives; leading to information theory statically measures: the Kullback-Leibler divergence and the Bhattacharya coefficient. The developed methods were size-dependent, which assures the size consistency of the partitions but reduces their size resolution. Thus, a size-independent extension of the previous methods, combined with the modified meging order, was also proposed.

Reddy *et al.,* [2] proposed a color image segmentation method based on Finite Generalized Gaussian Distribution (FGGD). The observed color image is considered as a mixture of multi-variant densities and the initial parameters are estimated using K-Means algorithm. The final parameters are estimated using EM algorithm and the segmentation is obtained by clustering according to the ML estimation of each pixel. However, computational time is more because of complex calculations.

Zhixin and Govindaraju [3-8] proposed hand written image segmentation using a binarization algorithm for camera images of old historical documents. The algorithm uses a linear approximation to determine the flatness of the background. The document image is normalized by adjusting the pixel values relative to the line plane approximation.

Jitendra *et al.,* [4] proposed cue integration in image segmentation by using an operational definition of textons, the putative elementary units of texture perception and an algorithm for partitioning the image into disjoint regions of coherent brightness and texture. The method finds boundaries of regions by integrating peaks in contour orientation energy and differences in texton densities across the contour by cue integration.

Lei *et al.* [5] addresses the automatic image segmentation problem in a region merging style. With an initially over segmented image, in which many regions (or super pixels) with homogeneous color are detected, an image segmentation is performed by iteratively merg. Jitendra *et al.,* [4] proposed cue integration in image segmentation by using an operational definition of textons, the putative elementary units of texture perception and an algorithm for partitioning the image into disjoint regions of coherent brightness and texture. The method finds boundaries of regions by integrating peaks in contour orientation energy and differences in texton densities across the contour by cue integration. Jitendra *et al.,* [4] proposed cue integration in image segmentation by using an operational definition of textons, the putative elementary units of texture perception and an algorithm for partitioning the image into disjoint regions of coherent brightness and texture. The method finds boundaries of regions by integrating peaks in contour orientation energy and differences in texton densities across the contour by cue integration the regions according to a statistical test.

Peng *et al.,* [6] taken initially over segmented image, in which many regions (or super pixels) with homogeneous color are detected, an image segmentation is performed by iteratively merging the regions according to a statistical test. There are two essential issues in a region-merging algorithm: order of merging and the stopping criterion. These two issues are solved in DRM [6] by using novel predicate which is defined by the sequential probability ratio test and the minimal cost criterion. This method uses Watershed algorithm to produce over segmented image having many regions, neighboring regions are progressively merged if there is an evidence for merging according to predicate [6] show that the merging order follows the principle of dynamic programming. To improve efficiency this method is combined with Automatic Image Segmentation using Wavelets. Image segmentation plays an important role in biometrics as it is the first step in image processing and pattern recognition. Model based algorithms are used for efficient segmentation of images where intensity is the prime feature. The problem of random initialization is overcome by using Histogram based estimation. The Wavelet transform solves the problem of resolution which can indicate the signal without information loss and reduces the complexity. The segmentation is faster since approximation band coefficients of DWT are considered. Model-Based image segmentation plays a dominant role in image analysis and image retrieval. To analyze the features of the image, model based segmentation algorithm will be more efficient compared to non-parametric methods. The pixel intensity based image segmentation is obtained using Histogram-Based method, Edge-Based method, Region-Based method and Model-Based method. Model- Based segmentation algorithms are more efficient compared to other methods as they are dependent on suitable probability distribution attributed to the pixel intensities in the entire image. To achieve close approximation to the realistic situations, the pixel intensities in each region follow Generalized Gaussian Distribution (GGD).

Stawiaski *et al.,* [7] introduce the use of graph cuts to merge the regions to the watershed transform optimally. Watershed is a simple, intuitive and efficient way of segmenting an image. Unfortunately it presents a few limitations such as over –segmentation and poor detection of low boundaries. Segmentation process merges regions of the watershed over-segmentation by minimizing a specific criterion using graph-cuts optimization. Two methods were introduced, the first is based on regions histogram and dissimilarity measures between adjacent regions. The second method deals with efficient approximation of minimal surfaces and geodesics. Lecumberry *et al.,* [8] introduces a joint classification-segmentation framework with a twofold goal.

First, to automatically select the SM (Shape models) that best represents the object, and second, to acuurately segment the image taking into account both the image information and the features and variations learned from the on-line selected model. A new energy functional is introduced that simultaneously accomplishes both goals. The presentation of the framework is complemented with examples for the difficult task of simultaneously classifying and segmenting closely related shapes, such as stages of human activities.

Sharon *et al.,* [9] introduced fast multi-scale algorithm which uses a process of recursive weighted aggregation to detect the distinctive segments at different scales. It determines an approximate solution to normalized cuts in time domain i.e., linear in the size of image with few operations per pixel. The disadvantage is that the segmented image fails to give smoother boundaries.

Ning *et al.,* [10] presents a new region merging based interactive image segmentation method in which the users only need to roughly indicate the location and region of the object and background by using strokes, which are called markers. A novel maximal-similarity based region merging mechanism was proposed to guide the merging process with the help of markers. This method automatically merges the regions that are initially segmented, and then effectively extracts the object contour by labeling all the non-marker regions as either background or object.

A hybrid multidimensional image segmentation algorithm was proposed, [11] which combines edge and region-based techniques through the morphological algorithm of watersheds. An edge-preserving statistical noise reduction technique is used as a preprocessing stage in order to compute an accurate estimate of the image gradient. Then, an initial partitioning of the image into primitive regions is produced by applying the watershed transform on the image gradient magnitude. This initial segmentation is the input to a computationally efficient hierarchical (bottom-up) region merging process that produces the final segmentation.

Mavrinac [12] proposed a color image segmentation using a competitive learning clustering scheme. Two fundamental improvements are made to increase the speed performance. i) Initialization of the system with two units rather than one ii) Reducing the number of iterations with no adverse effect and random selection among winning vectors in case of a tie. A very high number of clusters lead to over segmentation which is reduced using threshold and rival penalization.

Jianbo and Malik [13] proposed normalized cuts and image segmentation. Normalized cuts measure both the total dissimilarity between the different groups as well as total similarity with in the groups, which is used for segmentation. The method is optimized using generalized eigen value problem.

Donnell *et al.,* [14] introduced a phase-based user steered segmentation algorithm using Livewire paradigm that works on the image features. Livewire finds optimal path between users selected image locations thus reducing manual effort of defining the complete boundary. The phase image gives continuous contours for the livewire to follow. The method is useful in medical image segmentation to define tissue type or anatomical structure.

Felzenswalb and Huttenlocher [15] described image segmentation based on pair wise region comparison. The algorithm makes simple greedy decisions and produces segmentations that obey the global properties of being not too coarse and not too fine according to a particular region comparison function. The method is time linear in the number of graph edges and is fast in practice

III. PROPOSED METHODOLOGY

In this, we have first used mean- shift algorithm for segmentation of an image. Image Segmentation performs an crucial role in biometrics as it is very the first step in image processing and pattern recognition. By using dynamic region merging method we merge the alike regions on the basis of their color.

We have used an iterative and interactive way for the division of an image. Client initiates the progression method and the model starts merging the sections, after first iteration some sections whose most of the parts are probable combine with each other and outcome is less regions and lesser pixels. Probability is calculated after every iteration. The process goes on till the time the client is content or there are no section left in an image. Once the client is satisfied the process can be stopped. The final segmentation outcome is acquired by the client intervention. The client can also intermingle with the final segmented image to extort the entity of interest from an image. Finally, mask is matched with database face images on the basis of color and texture.

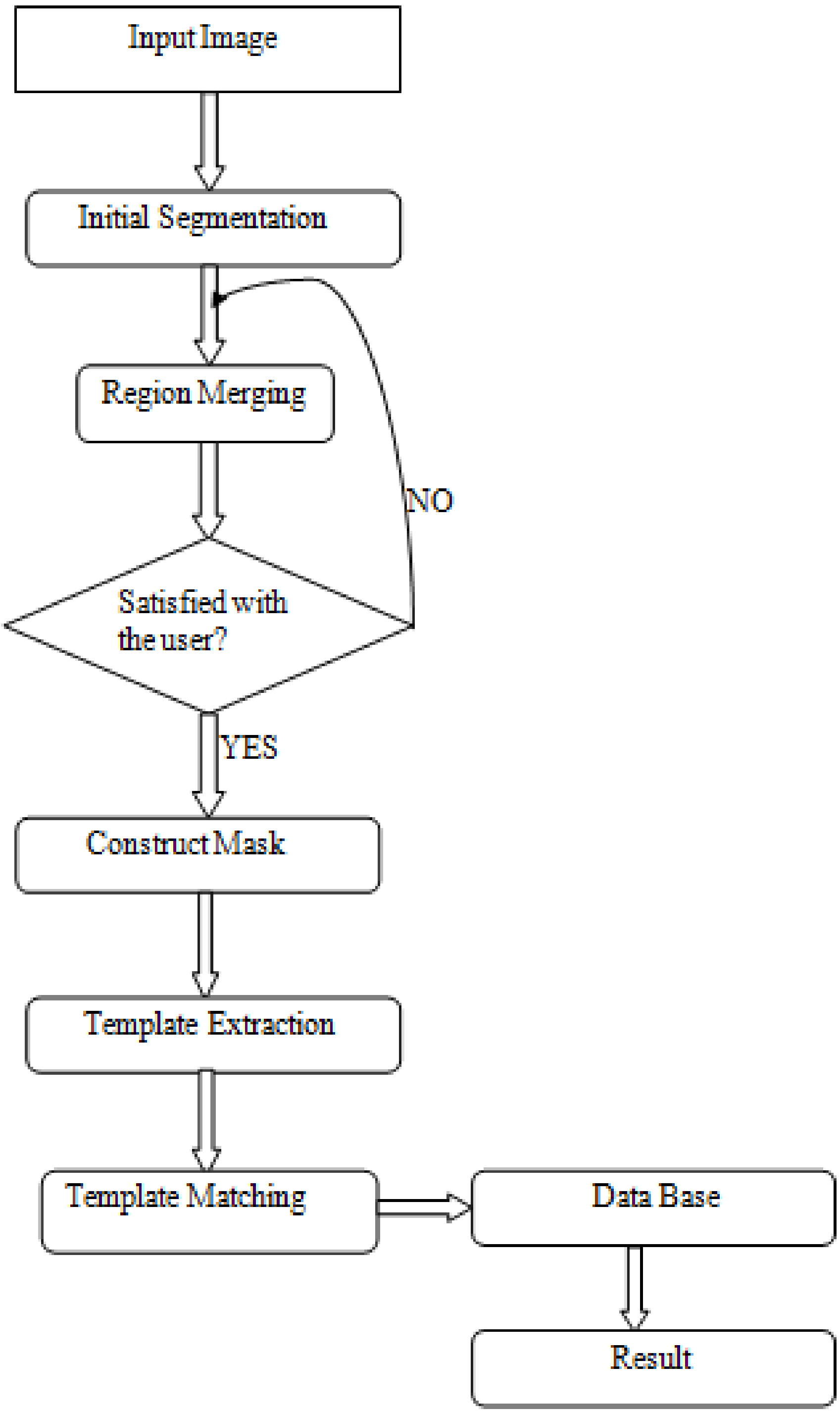
Input Image
Initial Segmentation
Region Merging
NO
Satisfied with the user?
YES
Construct Mask
Template Extraction
Template Matching
Data Base
Result

Fig. 1.

A. Initial Segmentation

Initial Segmentation is done by using mean-shift algorithm. The mean shift algorithm is a clustering method which is neither parametric nor require any prior knowledge about the number of clusters and not even confine the contour of the clusters. The mean shift clustering algorithm is a useful application for the mode finding procedure.

If J is set of all image pixels, then by applying segmentation we get distinctive regions like { I1, I2, I3,…, In } which when combined formed 'J' . Basic formulation is as follows:

(a) = J where $I_i \cap I_j$ = , i=1,n

(b) Ii is a connected region, i=1, 2….n.

(c) P(Ii) = TRUE for i=1, 2.. n.

(d) P(Ii ▯ Ij) = FALSE for $i \neq j$.

Where P(Ii) is a logical that is defined over the points in set Ii.

Condition (a) shows that segmentation must be complete; every pixel in an image must be enclosed by segmented regions. Segmented sectioned must be disjoint. Condition (b) requires that points in a section must be connected in some predefined sense like 4-neighbourhood or 8-neighbourhood connectivity. Condition (c) handles the properties that must be fulfilled by the pixels in a segmented section e.g. P (Ii) = TRUE if all pixels in Ii have the same gray level. Last condition (d) indicates that adjacent regions Ii and Ij are different in the sense of predicate P.

B. Region Merging

Region merging algorithm is initiated from a bundle of segmented sections. Segmentation is done in order to get a small region that can provide more constant statistical informative data than a single pixel, and using regions for merging can get a better computational efficiency. We have a number of small regions presented in the edge map. A region can be illustrated in many aspects like color, edge [16], texture [17], shape and extent of the region. Among these, the color histogram is an efficient descriptor to characterize the object color feature statistics and it is highly used in pattern recognition [18] and object tracking [19] etc. Color histogram is extra vigorous than the other feature descriptors. This happens because the initially segmented small regions of the preferred object often fluctuate a lot in size and shape, but the colors of unlike regions from the same object will have high similarity. Therefore, we use the color histogram to represent each region or section. The RGB color space is used to calculate the color histogram. We consistently quantize each color channel into16 levels and then the histogram of each section is computed in the feature space of $16 \times 16 \times 16 = 4096$ bins. Here we wish to use the Bhattacharyya coefficient to evaluate the similarity among regions.

C. Constructing Mask

Here we build the mask of an image after the regions or sections are merged and the image with preferred segments is produced for taking out object of interest from it. We change the image into grayscale image to discover the mask. Then we allot value 255 and 0 to the pixels at the boundaries and remaining pixels in the image respectively. This creates the mask of an image.

D. Object Extraction

Here we make use of the mask and Boundary Fill algorithm for drawing out entity of interest from the segmented image. The object mining from an image is interactive too. The user snaps on the preferred region in an image. Depending on the user click and on a mask of an image the section's pixel's value set according to the color cost in an image and remaining part of an image pixel's values are put to 0.

Boundary Fill Algorithm: This algorithm for an object extraction with the aid of an image mask .It is fundamentally a filling algorithm. It is a recursive algorithm that initiates with a first pixel called a seed pixel, inside a section and constant painting in the direction of the boundary. Here the algorithm verifies whether the pixel is a boundary pixel or it has already filled. Once it is noticed that it's not the boundary pixel it fills the pixel and recursive call is made to itself using every neighboring pixel as a new seed .And if its boundary pixel, the algorithm just returns to its caller. The boundary fill method accepts as input the coordinates of an interior point(x, y), a fill color and a border line color. The process checks neighboring points to verify whether they are the boundary color initiating from (x, y). If not, they are again painted with the fill color and their neighbors are checked. This process lasts covering all the pixels up to the boundary color for the particular area has been tested. There are two techniques for proceeding to n pixels from the very seed pixel are 4-connected and 8-connected. We than consider the user click as a seed point (x, y).

IV. CONCLUSION

To sum up, we proposed a new face matching method based on interactive image segmentation structure. The projected technique can methodically take into custody the relationships among dissimilar image sections to achieve effective image segmentation. An image is initially over segmented or can say divided with the help of mean-shift to produce an edge map. Now the region-merging is performed based on the colour histogram of an image using Bhattacharya coefficient. Following region merging, object i.e. preferred portion of an image is taken out from an image. Then we will match the desired portion with the database face images on the basis of colour and texture of desired portion of an image.

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