DIGITAL IMAGE SEGMENTATION USING IMPROVED SLIC

By

JIT DUTTA
TAMAL MONDAL
DIBITA ROY
DEBLINA MAZUMDER
ANINDYA DAS

UNDER THE GUIDANCE OF

PARAMA BAGCHI

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RCC INSTITUTE OF INFORMATION TECHNOLOGY
[Affiliated to West Bengal University of Technology]
CANAL SOUTH ROAD, BELIAGHATA, KOLKATA-700015

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

RCC INSTITUTE OF INFORMATION TECHNOLOGY

TO WHOM IT MAY CONCERN

I hereby recommend that the Project DIGITAL IMAGE SEGMENTAION USING IMPROVED SLIC prepared under my supervision by

Reg. No	Class Roll No.
11700115101	CSE/2015/L04
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of B.Tech (8th Semester), may be accepted in partial fulfillment for the degree of Bachelor of Technology in Computer Science & Engineering under West Bengal University of Technology (WBUT).

…….

Project Supervisor
Department of Computer Science and Engineering RCC Institute of Information Technology

Countersigned:

…….

Head Department of Computer Sc. &Engg

RCC Institute of Information Technology Kolkata – 700015.

CERTIFICATE OF APPROVAL

The foregoing Project is hereby accepted as a credible study of an engineering subject carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite to the degree for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it is submitted.

FINAL EXAMINATION FOR
EVALUATION OF PROJECT

1. ——————————————

2. ——————————————

(Signature of Examiners)

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Signature

Table of Contents

Page No.

INTRODUCTION

Super pixel algorithms are known as such mechanism that try to combine pixels [1] according to similarity into suitable positions and recently such type of object-based algorithms has been viewed and it is more interesting and quite challenging to extract objects from color images by analyzing color feature, texture feature and regional characteristics [2] and surely be to encourage more than traditional pixel [3] based methods. Color image segmentation has already been studied for decades, and although still much is still left to be achieved by providing the unique and required development work. Even if there is increased amount of availability of information contained in images and their unpredictable complexity, widespread inherent speckles and hence time worthy as a result draws back in precision and not very much practical when used.

A simple and equivocally applicable segmentation method have to be capable such that it may precisely mark expected regions either automatic or semi-automatic fashion with minimal user input despite at least images with broad diversity and ambiguity are quite uncertain. Long time period Research such as decades for example is gradually trying to combine mathematical models with image segmentation to handle such addressing issue and being agreed as a perfect technique.

In recent years, the super pixel based algorithm for the digital images is a hot research direction in the area of color Image Segmentation. It was used to the area of vision patterns and furthermore gain popularity in object recognition ,pattern recognition. [4]

The goal or key achievements of the approach segmentation is nothing but to separate or may divide the pixels as of labeling colorfulness of an input set of images over an individual not the entire image.

A.chanta Was the developer of Simple Linear Iterative clustering (SLIC) [5] mechanism. When compared to normalized cut, graph-based approach ,the SLIC block boundary error rate is lower and processing speed is shorter. An et al. proposed an image Contour surface and the segmentation accuracy can be improved after applying SLIC for making the pre-segmentation and clustering the super pixel block. However,serious segmentation errors will occur when the sampling super pixel is fewer. Although precision and efficiency of the Graph cut algorithm are improved, there exist large segmentation errors when the pre-segmentation, super pixel block number is less.

To handle the above problem, a color image segmentation algorithm using the SLIC algorithm and generally to cluster [6] the image, and the RGB mean of each pixel block that was clustered is then applied to reconstruct the simplified Graph Cut model. Experiments using real natural color images show the desired outcome of our proposed method.

Review of Literature

In this section In connection with the topic stated , this branch deals with a brief report detailing the different views related to Image Segmentation project. The first and most important a preliminary survey work on various types of images segmentation techniques related to SLIC technique and collected as many as possible journals about this image segmentation as a pre-requisite for further clarification on such fundamental issues. Image segmentation means to is to conduct a segmentation into the various items or things of some given images that can be dealt by. We go through some journals and consult our project guide and found various kinds of segmentation technique some how suits our purpose or academics and do a successful job on segmentation. The various technique of image segmentation related are

Thresholding:

The simple and acceptable mechanism is known as Thresholding.[7] This method is generally relied on a cutoff-level(limiting value) to convert equivocally gray-scaled into binary image. A technique named “balanced histogram Thresholding” comes relatively more useful under appropriate background .The principle operation of the latter that it opts limiting value (may be values depending on levels). Many well known mechanism are popular like “maximum entropy”, “Otsu's method” and “k-means clustering” etc. Now, various techniques has been sited for the Thresholding Computed Tomography(TCT) images. The main idea is ,somewhat different from what happens in “Otsu's method”[7], mostly the limiting value also termed as Thresholds obtained by considering radiographs ,less emphasize on the recreated image. Mostly, at this juncture multi-dimensional fuzzy rule has been adopted for non-linear thresholds. Among those research works, emphasis is given over on each and every single pixels relationship to perform a segmentation using mostly “multi-dimensional” rules obtained from “fuzzy logic” and standard algorithms.

Cluster methods:

The fundamental and simple cluster algorithm is known as K –means. It is basically an repetitive method, to obtain only the k-cluster of any image. The fundamental logic is to select K-number of cluster center, by following some random approach or perhaps "heuristic algorithm", like K-means++.Next, each and every pixel has to be included into the cluster as for shortening the distance among the pixel and cluster center.

Then for each and every pixel present in the cluster again cluster center is computed. Repeat steps mentioned at least up to the state of convergence i.e. no pixel's change clusters. In this proposed method, distance is generally obtained only by squared or perfect variation in between the pixel and cluster center. The contrast is relied on either by color, intensity, texture, and location, or quite certainly by some weighted combination of the former properties of any pixel. Assuming, probably the value "K" can be chosen by a heuristic or randomly. The mentioned algorithm is surely to be converged, but chances are very less that will give optimal outcome. The outcome of solely relies on how the clusters are set initially and also on the chosen value of "K".

Region based Feature Extraction:-

The feature may be agreed in principle that behaves as a situation to try to combine one or more units, where as each and every feature defines the fundamental quantities of an image, and computed as in a fashion so may specify some significant characteristics of the object.

The various features classified and currently employed are [8]

• General features: The features which are (shape,color,texture) are said to be under this category .However, based on the level of abstraction may be divided into,

1.Pixel-label based: color, location at each and every pixel are example of such

2.Local based: These are as such which deals with the overall outcomes by inspecting over the subpart of an image band or by edge recognition.

Mostly, as per specifications

Color Features:-It deals with the imaged characteristics of images in the domain of visional classification. However ,under the action of color features is seen that some of advantages are,

1.Robustness :"color histogram" undergoes no effect either by rotation of any images with respect to the axis or may have a very negligible effect.

2.Effectiveness: Now, There exist a co-relation between original set of Images and extracted familiar Images.

3. Simplicity:"Color histogram" is very easily operable by examining an image, setting up values of color, and try to build histogram using color information obtained so far.

4. Computational Simplicity: It is seen that for an image of size m x n the complexity is O(m,n).

Objective of the Project

Image segmentation states to the act of dividing an image into various parts that it encloses. The principle objective is that to obtain the informative regions of the images for example crops and many more. But still it is seen that a region may appear as a collection of pixels which have a border and shapes like rectangle or circle. But mostly ,when the regions are unable to be enclosed the whole image, we can still talk about segmentation, into foreground regions of interest and surroundings locations to be ignored.

In our project, the main issue is that to segment and object from the image and extract it individually as a specified portion not the entire image. Image segmentation is broadly used.Our proposed method will help to extract things from any set of images. Like if you have an image like an unknown object appear in a image then we can using image segmentation easily recognize objects and extract it from the image. So in sort ,this is the true objective of this image segmentation project.

There is plenty of methods available for image segmentation of segmenting object from the image. But we try to impose the most efficient process of segmentation of an object from the image. Mostly ,it focuses on efficiency and accuracy. If it is not a efficient and simple way to make segmentation of image then this will be not much be useful and will be proven to be difficult . So this is to be include as a part of our objective to find more feasible , general and accurate technique of image segmentation.

System Design

1.Version: 32 or 64-bit computer

2.Memory: Anaconda requires minimum 3GB space to download and installation purpose.

3.OperatingSystem:Windows, macOS, Linux

4.Compatability:Python 2.7,3.4,3.5 or 3.6

Here,

Anaconda 3-5.1.0-Windows-x86_64 and

opencv_python-3.2.0+contrib-cp36-cp36m-win_amd64 suits our purpose.

Apart,

64-bit windows machine,RAM: 4GB,DDR3 and Core i3 3rd Gen, 2.4 GHZ based Working Enviornment.

Methodology for implementation

Super pixels are viewed as a matter of interest and as well as of utmost importance for use in computer vision applications [9] and not only that furthermore advancement is desired . However, at this level of progress ,there are very less methods that can handle uniform, entente super pixels with a less compute delays. Our proposed method states a segmentation technique known to be SLIC that tries to cluster pixels to obtain uniformed super pixel. The key features of is it very easily operable and hence making it very convenient. Experimental analysis governs that it has a very negotiable amount of calculative cost[10]. We also demonstrate key achievements of the super pixel approach with practical examples to show the desired performance as stated over pixel-based methods.

What is a super pixel?

A super pixel may be defined as a bunch of pixels having familiar features[10]. And often useful for color image segmentation. There are a substantial amount of methods available to generate the super pixels but the one that we are using is state of the art very negotiable amount of calculative overhead delays.

It creates super pixels by dealing with the color familiarity and then applying clustering. Generally five-dimensional[labxy] slot, [lab] stands for color vector in CIELAB color arena, which remains unchanged for slight color measurements and x,y is the pixel position.

Our algorithm takes as input the amount of uniformly sized super-pixels “K”. If there is an image with N pixels, we have to find the “N/K” i.e. approximate size. Next, for **each and** every super pixel ,center S=N/K ^ 1/2for each and every grid interval. “K” super pixel cluster center(C_k)is represented as $[l , a , b , x , y]_{k \times 5.}$

Here, Ds used as for distance measurement not the Euclidean Form,

$$d_{lab}=\sqrt{(l_k-l_i)^2+(a_k-a_i)^2+(b_k-b_i)^2}$$

$$d_{xy}=\sqrt{(x_k-x_i)^2+(y_k-y_i)^2}$$

$$D_s=d_{lab}+\frac{m}{S}d_{xy}$$

where,Ds denotes the summation of lab distance measurement with that of (x,y) plane being normalized with the grid interval S. The term m denotes compactness of a super pixel in the term Ds. The more larger value of m, spatial proximity is more visualized and hence more compact the cluster becomes.

Algorithm:

The Simple Linear Iterative Clustering is discussed as follows

A sampling has to be performed based on K spaced cluster centers and arranging them to the respective seed positions in accordance with the lowest gradient location viewed as in the 3 x 3neighborhood.

The formulation for Image Gradient are as:

$$G(x,y)=\left\|I(x+1,y)-I(x+,y)\right\|^2+\left\|I(x,y+1)-I(x,y-1)\right\|^2$$

where I(x, y) denotes the lab vector regarding to the appropriate pixel at locations (x,y), and ||.|| is the L2 norm. This takes into account both color and intensity information. Each and every pixel is related with the nearby cluster center, which surrounds around this specificpixel. An average [l,a,b,x,y]of each and every pixel belonging to a cluster is granted for the measurement for new center co-ordinate .An iterative repetition is performed for the action of regrouping pixels and again compute“cluster center “until convergence.

Implementation Details

Mostly, how local regions with similar texture and color disburse are part of the same super pixel group is indeed of great importance, still problem is to traverse each of the *individual* super pixel segmentation of images.

Furthermore, each segment is represented by a unique integer, meaning that each pixels having a particular segmentation will posses the same value in the segments array.

Mostly, stated method looks into graph representations across regions of images and would be to extract features from each of the segmentations which could be later utilized. This would be useful for training for building an Image Retrieval system based on content that can be a basic building block for future reference.

Algorithm Flow:

1: Initialize cluster centers $C_k = [l_k, a_k, b_k, x_k, y_k]^T$ by sampling pixels at regular grid steps S.
2: Perturb cluster centers in an $n \times n$ neighborhood, to the lowest gradient position.
3: **repeat**
4: **for** each cluster center C_k **do**
5: Assign the best matching pixels from a $2S \times 2S$ square neighborhood around the cluster center according to the distance measure (Eq. 1).
6: **end for**
7: Compute new cluster centers and residual error E {$L1$ distance between previous centers and recomputed centers}
8: **until** $E \leq$ threshold
9: Enforce connectivity.

Algorithm:Individual Superpixel Based Extraction

1:Load an Image

2:Repeat

3:By making an use of Super pixel function call the initial super pixel segmentation is performed;

4:Display the outcome

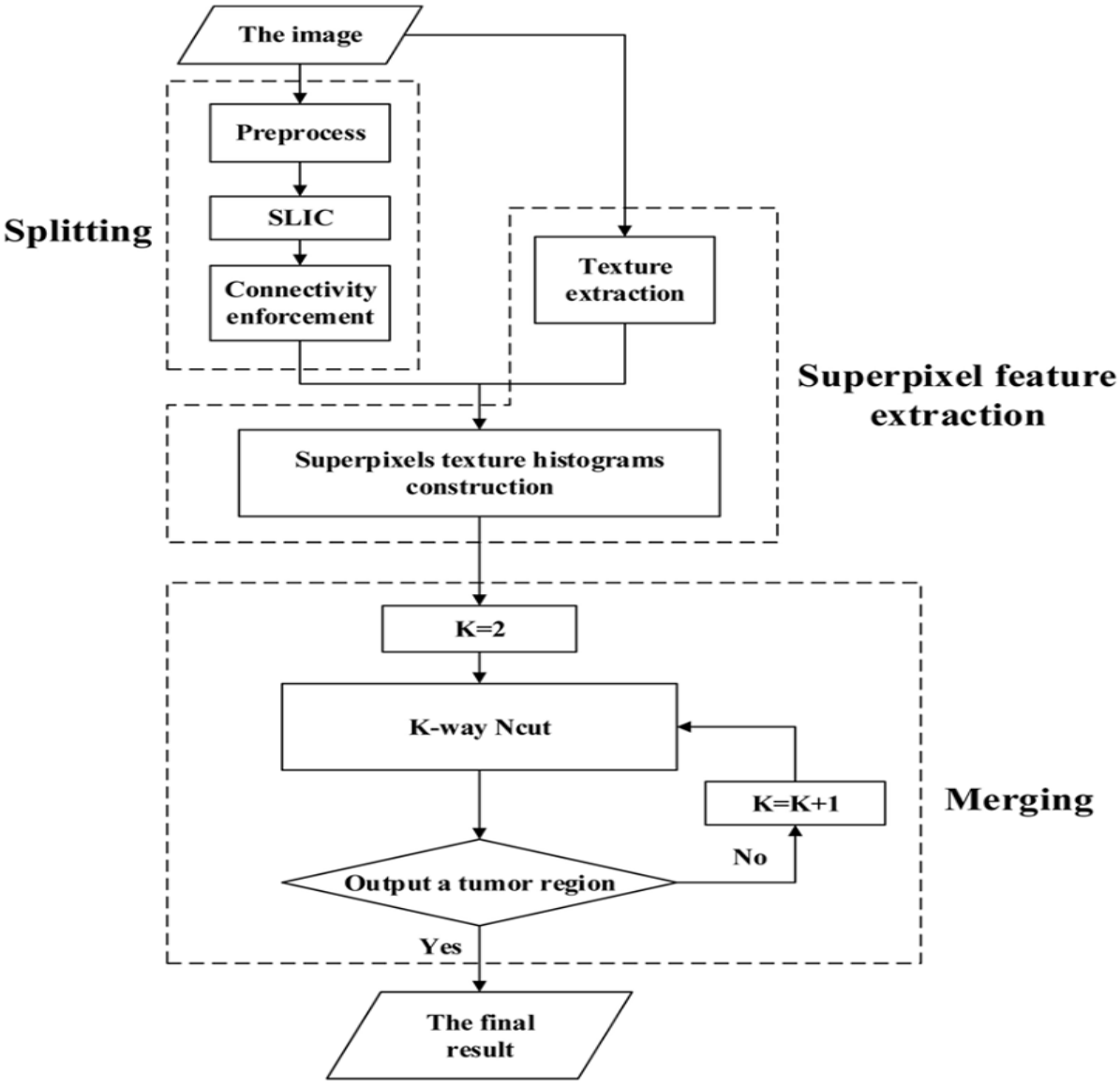
5:for each unique segment value (i, segval) do

6:construct a mask for the segment

7:end for

8:show the individual supermodel

Workflow:



The Key benefits of using super pixel segmentation algorithms is as such,

computational efficiency,

perceptual meaningfulness,

over segmentation

Results/ Sample Output

Conclusion:

Super pixel based technique comes to very useful while detection of unique and salient objects based on the feature based rule for the fast and nimbly working of the declared digital image segmentation and extraction of individual super pixel. Keeping in view the issue of speed up Slic super pixel segmentation is carried out and then for separation among the various components(traversing of individual super pixel) combined on various datasets. The final outcome drive towards the accomplishment of the desired solution.

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