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Efficient Method to Segment Objects from Images Based on Enhanced Connected Component Labeling algorithm

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Abstract
This paper include the problem of segmenting an image into regions represent (objects), segment this object by define boundary between two regions using a connected component labeling. Then develop an efficient segmentation algorithm based on this method, to apply the algorithm to image segmentation using different kinds of images, this algorithm consist four steps at the first step convert the image gray level the are applied on the image, these images then in the second step convert to binary image, edge detection using Canny edge detection in third Are applie the final step is images. Best segmentation rates are (90%) obtained when using the developed algorithm compared with (77%) which are obtained using (ccl) before enhancement.

Keywords: Segment, ccl, Blob detection, Enhancement.

طريقة كفوءة لتقسيم الكائنات من الصور اعتماداً على تحسين خوارزمية المكونات المتصلة

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الخلاصة
تضمن هذا البحث مشكلة تقسيم صورة إلى مناطق تمثل (الكائنات)، قسم هذا الكائن عن طريق تعريف الحدود بين منطقتين باستخدام وضع العلامات على المكونات المتصلة. ثم تطوير خوارزمية تجزئة فعالة استنادا إلى هذه الطريقة، ونحن نطبق خوارزمية لتجزئة الصورة باستخدام أنواع مختلفة من الصور، وهذه الخوارزمية تتكون من اربع خطوات في الخطوة الأولى تتحول الصورة إلى مستوى الرمادي يتم تطبيقها على الصورة، في الخطوة الثانية تحويل إلى صورة الابيض والاسود ، وكشف الحافة باستخدام كشف حافة كاني في الخطوة الثالثة، في خطوة النهائية يتم تجزئة الصور. أفضل معدلات تجزئة هي (95٪) تم الحصول عليها عند استخدام الخوارزمية المطورة مقارنة مع (74٪) التي يتم الحصول عليها باستخدام (وضع العلامات على المكونات المتصلة) قبل التحسين.

1. Introduction

Image segmentation, a way of extracting and representing information from an image is to group pixels together into regions of similarity. We would group pixels together according to the rate of change of their intensity over a region or the rate of change of depth in the image, corresponding to pixels lying on the same surface such as a plane, cylinder, sphere etc [1].

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In computer vision, segmentation refers to the process of partitioning a digital image into multiple regions (sets of pixels). The goal of segmentation is a common technique used by to narrow down a large target audience into more narrowly defined target groups.

Representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The result of image segmentation is a set of regions that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic(s) [2].

This paper proposed a An enhanced algorithm to segment the images, the algorithm consists of the following phases: binary image conversion and segment object from image.

2. Related work

- **Li-Feng He, et al**. **(2013)** proposes a two-scan algorithm for labeling connected components and holes simultaneously in a binary image by using the same data structure. With our algorithm, besides labeling, can also easily calculate the number and the area of connected components and holes, as well as the Euler number. The method is very simple in principle, and experimental results demonstrate that method is much more efficient than conventional methods for various kinds of images in cases where both labeling and Euler number computing are necessary [3].
- **Dena N. (2013)** The proposed system is applicable to different sizes and types of image formats such as BMP, JPEG, and PNG file format.Using local thresholding value for each tumor region of tumor makes correct segmentation of tumor object from its background and with minimal information loss.Moments calculations give the suggested system more robustness due to its resistance to many image situation variations such as rotation, scaling and translation.The system proved its effectiveness to classify tumor types and normal case MRI brain image by applying Neural Network especially the Back propagation Neural Network which also proved to be effective in pattern recognition. The recognition rate of the training phase with BPNN is 98.8 %. and the recognition rate of its testing phase is 94.6 % [4].
- **Madihah M. et al**. (2013) [5] , proposed a method to count a total number of RBC in peripheral blood smear image by using circular Hough transform (CHT) method. The process involves preprocessing and segmentation a single cell image of RBC after cropping it to get the minimum and maximum radius of cell. Then, CHT method is applied to detect and count the number of RBC based on the range radius of cells. The results show that from ten samples of peripheral blood smear image, the accuracy using CHT method is 91.87%.

3. Canny Edge Detection [6]

This mechanism of detecting the edge is proposed by John Canny in the year of 1986, it has been greatly beneficial for the edge detection operations. Actually, J. Canny detailed a mechanism to generate the edge, the main point that it states is noting the fact that the three most influential implementation factors for the successful edge detector, must be as follows:

i) Providing a high quality detecting that has high possibility to report an edge, where there isn't an edge in case of low possibility of reporting.

ii) Providing quite a precise indexing, which means that the pixels that are denoted to be edge pixels must have high approximation to the real index of that edge.

iii) Responding just for one time to a single edge (in a 1-D signal).

The following steps describe Canny's edge detection steps:

Step1: Reducing Noise through the smoothing**.**

Step 2: Finding gradients**.**

Step 3: Non maximum suppressions.

Step 4: Hysteresis thresholding **.**

4. Connected Component Labeling (ccl)

After image segmentation, once all groups have been determined, each pixel is labeled according to the component to which it is assigned. One of the fundamental operations in pattern recognition and computer vision is the labeling of connected components in a binary image [7]. Connected component labeling is an operation where groups of connected pixels (connected component) are classified as disjoint objects with unique identifiers (labels) [8] It is a very important tool used in pre-processing

stages .It is used in image processing such as target recognition, face identification, and medical image analysis; many algorithms have been proposed [7]. There are different CCL algorithms, that are grouped as follows: Two pass algorithm which processes the image in two consecutive passes; Multiple scan algorithm, where scanning depends on the image complexity; Parallel algorithms processes a number of pixels at a time; Single pass algorithm processes the image in one scan. CCL determines how fast an image can be processed and also determines the memory requirement of the processing CCLalso known as region detection or Blob extraction. A blob (binary large object) is an area of touching pixels with the same logical state. Blob detection is generally performed on the resulting binary image from a thresholding step. A two-pass algorithm for labeling connected components comprises three distinct phases [9].

1. The image is scanned row-wise until it comes to a pixel (p) whose pixel value is 1. Based on this information, provisional labeling of (p) occurs as follows:
- If all neighbors have pixel values of 0, assign a new provisional label to p, else
- If only one neighbor has a pixel value of 1, assign its provisional label to p, else
- If more than one of the neighbors have pixel values of 1, assign the smaller of the provisional labels to p.

2. Store the equivalence between neighboring labels.
3. During the second scan all the provisional labels are overwritten with their equivalence label resulting.

4. The Enhancement Algorithm of CCL

In this enhancement algorithm, the optimal results of segmentation are achieved using enhancement CCL this algorithm illustrate follow .

The structure of the proposed algorithm is composed of four phases as shown in Figure-1, each phase has specific tasks which illustrated in the following sections.

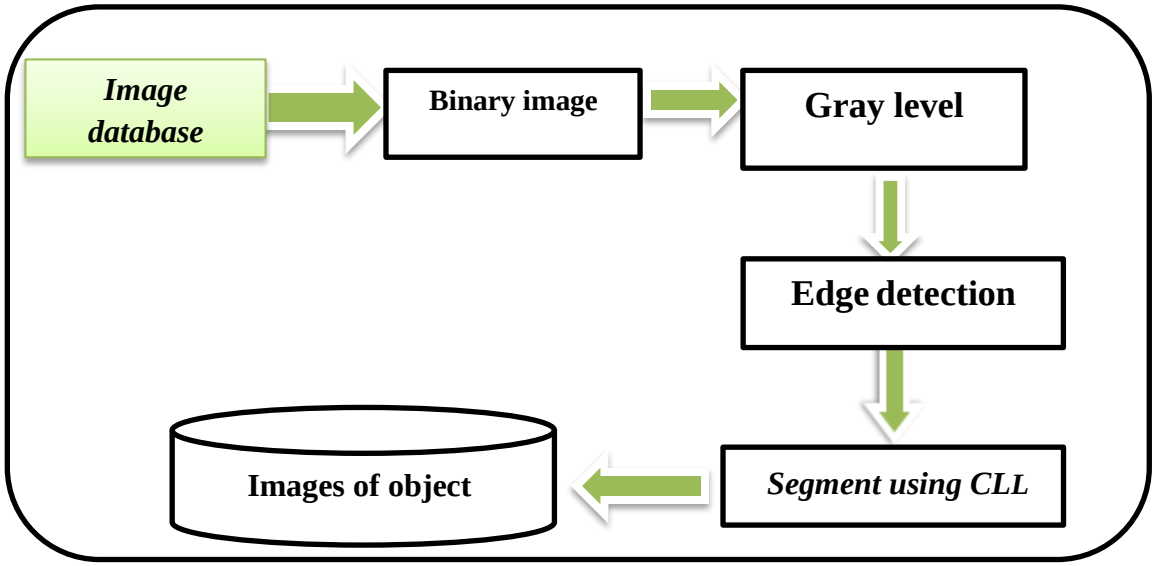


Figure 1- Structure of algorithm.

In the enhanced CCL algorithm
Input : Binary image **Output :** Segmented object
Begin **Step1:** scan image of each pixel. **Step2:** convert image to binary image . - **Scaled image (** for each pixels) **Step3:** detect coordinate of point (x ,y) of shape in image. *//thresholding.* **Step4:** convert this coordinate. **Step5:** Detection of each cell particular color using function Connected Components Labeling

enhancement ();*//segment using ccl*.
Step6: Segmentation of each cell from image using blob detection.
Step7: get bounding rectangle of the points list.
- Calculate center point.
- Calculate radius.

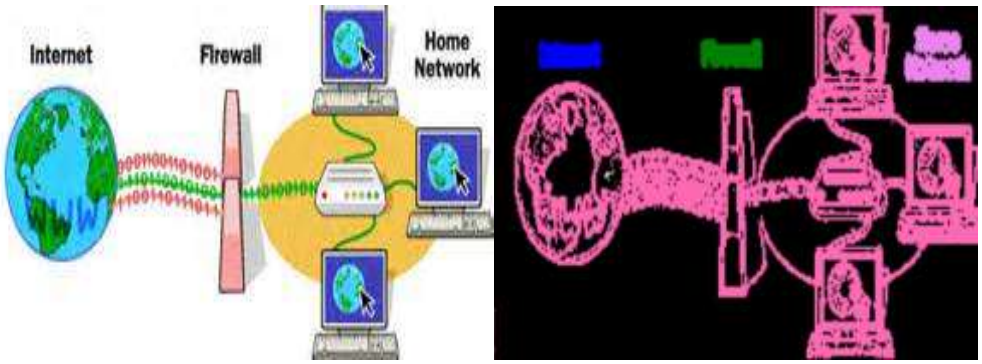
Step8: For (int I =0, n = edge points. Count; i<n; i++)
- Calculate mean distance between provided edge points and estimated circles edge.

End for I.
Step9: Blob Counter blob counter = new Blob Counter ( ); // *locate object using blob counter*
continous →
Step10: **For** (int j = 0; n = blobs .length; i<n; i++);
- Check each object and draw circle around objects, which are recognized as circles.

End for j
End

4.1 Image Segmentation

In this stage, asset of sub divisions each of an image is achieved to produced number of regions, each region represent each object separated, CCL method is used to segment image by divided the pixels into two clusters (object and background) based on threshold this operation begin scan all pixel of image when find first location black put label and search about all pixels black around this location then will separated all object in image in color and white pixel represent background this method different about traditional CLL which put all group labels Figures-(2،3) shows the segmented objects from image.



a. Entire image b .Isolated object

Figure 2-Segmentation objects from image

a. Entire image b .Isolated object

Figure 3-Segmentation

5. Experemental results

Experimental evaluation of the algorithm is performed on these experimental results are compared for between traditional algorithm and segmentation enhancement algorithm.

This algorithm consists of number of images, accuracy measure is the most widely used measurement method to evaluate the classification images, thus to compute the accuracy of the decision tree the following equation is used:

Table-1 shows the accuracy rate of traditional algorithm of CCL, and shows the accuracy rate of images by using segmentation enhancement algorithm.

The optimal results of segmentation are achieved using segmentation enhancement algorithm with rate (90%) compared with rate (77%) when using traditional algorithm of CLL.

Figure-4 shows the percentage distribution of the accuracy for the images correct segment and wrong segment, has higher accuracy than others by using segmentation enhancement algorithm .

Figure-5 shows ratio accuracy of images has higher accuracy by using segmentation enhancement algorithm compare with traditional CLL.

Table 1-Accuracy rate traditional of algorithm of CLL and enhancement algorithm

Type of segmentation	Correct segment	Wrong segment	Accuracy
traditional algorithm of CCL	**155**	**45**	**77%**
Enhancement Algorithm	**180**	**20**	**90%**

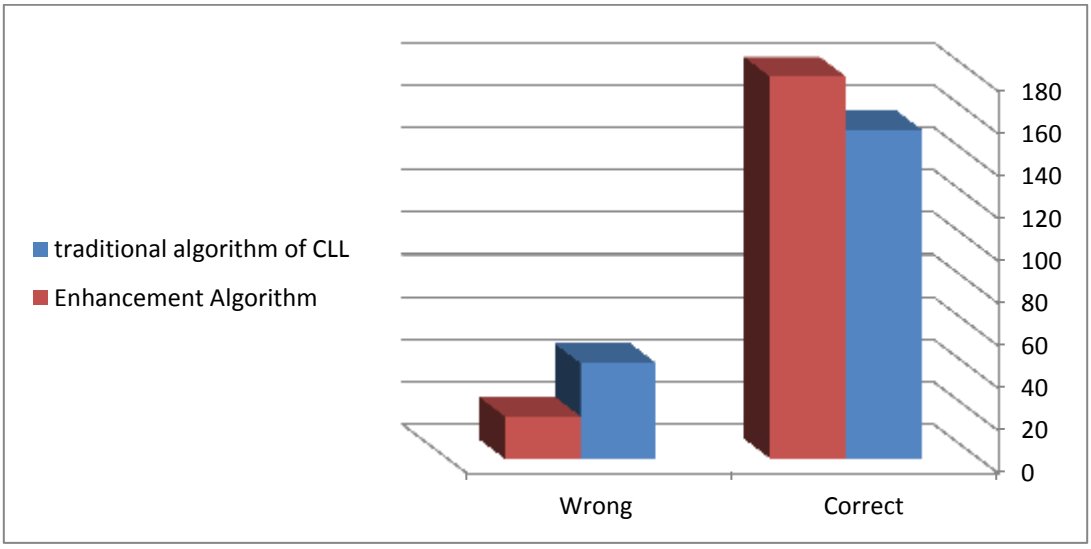


Figure 4-Result of accuracy of wrong and correct segment

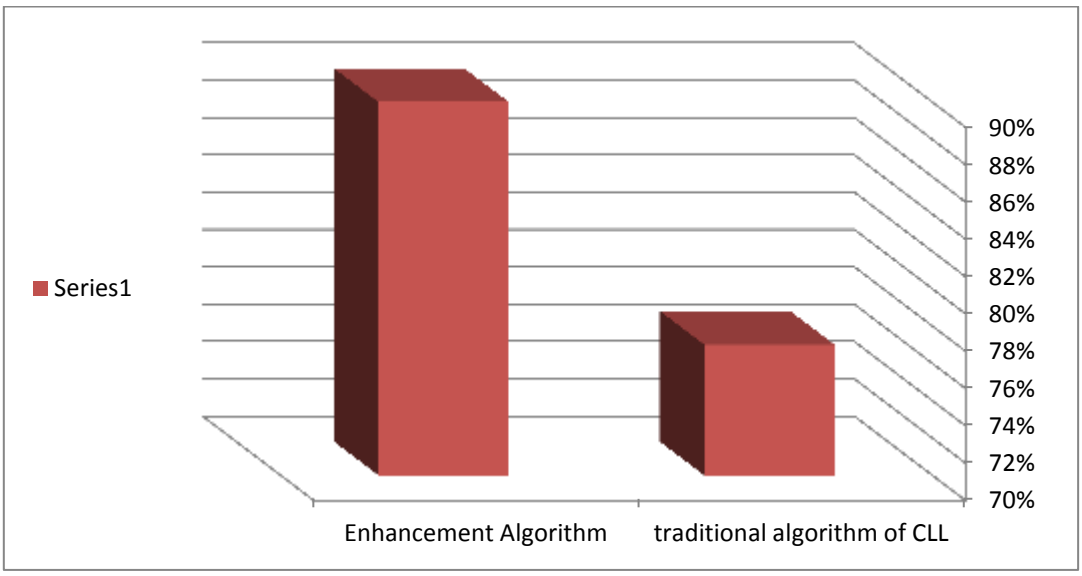


Figure 5- Accuracy Rate traditional algorithm of CCL and enhancement algorithm.

6. Conclusions

From the above literature survey it is proven that traditional method are very tedious, have less accuracy a Thus it may be possible to have many error.

Therefore a rapid segmentation method has been proposed. In this discussion the image analysis has been done on the digital image for improving the result of measuring objects.

Using this algorithm that includes four stages: binary image, gray level, edge detection using canny edge detection and segmentation using CCL; image input convert into gray level then convert into binary image after convert image perform to edge detection to detect boundary of object final using CCL segmentation to separate object form background by make each object color different on another object and make background black color. Accuracy results indicate that segmentation power of CCL enhancement better than traditional algorithm since it produced (90%) accuracy rate compared with (77%) accuracy rate when CCL is used.

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