Comparison between the Segmentation of the Three Bands of the RGB Images Applied on City Map

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Abstract—Image segmentation is to divide the image into disjoint homogenous regions or classes, where all the pixels in the same class must have some common characteristics. A new algorithm is proposed to segment regions in an image, which is based on determining seed regions in an image. The algorithm applied on images from different sources of different complexity. The segmentation applied on each band of the RGB images. The results showed the best value to expand the pixel neighbor is from 1 to 4, to keep the image from degradation. The proposed approach was applied on different types of images, the results showed that the enhancement step is necessary to reduce the number of the seed regions, number of colored regions and elapsed time.

Keywords—Image Segmentation, image processing, edge detection, image filtration.

I. INTRODUCTION

Segmentation is a process in which an image is divided into different regions in order to isolate the areas of interest on it. Segmentation leads us, from unprocessed images, to obtain a very high level of knowledge [1].

Color image segmentation is a process of extracting from the image domain one or more connected regions satisfying uniformity (homogeneity) criterion which is based on features derived from spectral component. These components are defined in a chosen space color space model. The segmentation process could be augmented by some additional knowledge about objects in the scene such as geometric and optical properties [2].

Segmentation is one of the important fields in image analysis, such as surveying by satellite, number-plate identification and aerial navigation.

In image segmentation the problem of developing automatic segmentation procedures has always been and still is of great interest. The existing automatic segmentation methods are generally associated with some particular applications where 'a priori' information about the result of the segmentation is known [3].

Seeded region growing algorithm (SRG) is a new approach which is based on conventional postulate of region growing algorithms where the criteria of similarity of pixels is applied, but the mechanism of growing regions is closer to the watershed algorithm. Instead of controlling region growing by tuning homogeneity parameters, SRG is controlled by choosing a usually small number of pixels, known as seeds. These seed pixels are chosen by users according to their own opinion what should be regions to extract on the image [4].

Image segmentation is subdividing an image into its constituent parts or regions. To perform this objective, we should deal with image based on two gray value properties: discontinuities and similarity. In the first category, the approach is to partition an image based on abrupt changes in intensity, such as edges in an image. The principal approaches in the second category are based on partitioning an image into regions that are similar according to a set of predefined criteria [5].

II. REGION GROWING

Region growing is a procedure that group’s pixels or sub-regions into larger regions based on predefined criteria for growth. The basic approach is to start with a set of "seed" points and from these grow regions by appending to each seed those neighboring pixels that have predefined properties similar to the seed [6,7,8].

The basic region growing can be performed by applying the following steps:

- Split the RGB image into its original bands.
- Enhance each band to remove the noise from each band.
- Determine seed point value in an image.
- Create a black image of the same size of original image.
- Subtract each seed point value from all pixels of original image, and then if the result of subtraction less than or equal the threshold value (T), then mark this pixel white color on the black image.
- Repeat the same process on step 5 on all seed points.

III. RGB IMAGE SEGMENTATION

The region growing steps applied on the city map shown in Figure (1).

Figure 1. The original city map image.
The original image is split into its original three bands. Figure (2) show the red band with its histogram.

![Red band of the image](image1)

![Histogram of red band](image2)

**Figure 2.** Red band of the city map image and its histogram

Figure (3) shows the (14) regions of the red band of the city map image after segmentation.

![Region R1](image3)
![Region R2](image4)
![Region R3](image5)
![Region R4](image6)
![Region R5](image7)
![Region R6](image8)
![Region R7](image9)
![Region R8](image10)
![Region R9](image11)
![Region R10](image12)
![Region R11](image13)
![Region R12](image14)
![Region R13](image15)

**R1 to R14: Regions of segmented image of the red band of city map image.**

**Figure 3.** Regions of segmented image for red band of city map image.

Figure (4) shows the green band of city map image and its histogram.

![Green band of the image](image16)

![Histogram of the green band](image17)

**Figure 4.** Green band of city map image and its histogram

Figure (5) shows the (12) regions of the green band of the city map image after segmentation.

![Region R1](image18)
![Region R2](image19)
![Region R3](image20)
![Region R4](image21)
![Region R5](image22)
![Region R6](image23)
![Region R7](image24)
![Region R8](image25)
![Region R9](image26)
![Region R10](image27)
![Region R11](image28)
![Region R12](image29)

**R1 to R12: regions of segmented image of the green band of the city map image.**

**Figure 5.** Regions of segmented image for green band of city map image.

Figure (6) shows the blue band of city map image and its histogram.

![Blue band of the image](image30)

![Histogram of the blue band](image31)

**Figure 6.** Blue band of city map image and its histogram.
The figure (7) shows the (16) regions of the blue band of city map image after segmentation.

<table>
<thead>
<tr>
<th>Region No</th>
<th>Ranges of red band</th>
<th>Ranges of green band</th>
<th>Ranges of blue band</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>R_01</td>
<td>198</td>
<td>202</td>
<td>205</td>
</tr>
<tr>
<td>R_02</td>
<td>124</td>
<td>128</td>
<td>165</td>
</tr>
<tr>
<td>R_03</td>
<td>179</td>
<td>202</td>
<td>205</td>
</tr>
<tr>
<td>R_04</td>
<td>196</td>
<td>202</td>
<td>205</td>
</tr>
<tr>
<td>R_05</td>
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</tr>
<tr>
<td>R_06</td>
<td>163</td>
<td>167</td>
<td>205</td>
</tr>
<tr>
<td>R_07</td>
<td>163</td>
<td>176</td>
<td>205</td>
</tr>
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<td>R_08</td>
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<td>202</td>
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</tr>
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<td>R_09</td>
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<td>R_15</td>
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</tr>
<tr>
<td>R_16</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The proposed algorithm supposed that:
Intensity range of region A is [LA to RA].
Intensity range of region B is [LB to RB].

Where:
LA: is left side of intensity range of region A.
RA: is right side of intensity range of region A.
LB: is left side of intensity range of region B.
RB: is right side of intensity range of region B.

Then:
Region A is similar to region B if
LA = LB or RA = RB

Figure (8) shows the similar regions in the red band of the city map image grouped together and, it is colored with blue color.
(a): Regions that its right side of intensity range is 202 or left side is 198.
(b): Regions that its intensity range is between 124-128.
(c): Regions that its left side of intensity range is 163.
(d): Region that right side of intensity range is 255.

Figure 8. The red band regions segmentation colored with blue color.

Figure (9) shows the similar region in the green band of map image grouped together and, it is colored with blue color.

(a): Regions that its intensity range is between 205-209.
(b): Region that its intensity range is between 165-169.
(c): Region that right side of intensity range is 255.

Figure (9): The green band regions segmentation colored with blue color.

Figure (10) shows the similar region in blue band of the city map image grouped together and, it are colored with blue color.
IV. CONCLUSION AND DISCUSSION

Table (2) shows the relationship between the value of the expand interval and the number of colored regions in the segmented image.

TABLE II. THE RELATIONSHIP BETWEEN THE VALUES OF EXPAND INTERVAL AND THE NUMBER OF COLOR REGIONS.

<table>
<thead>
<tr>
<th>Expand interval Value</th>
<th>Color regions R</th>
<th>Color regions G</th>
<th>Color regions B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>30</td>
<td>35</td>
<td>24</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
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<td>22</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>25</td>
<td>21</td>
</tr>
</tbody>
</table>

The expanded interval (in pixel) in table (2) from 0 to 5, where 0 means the interval is not expanded and 1 means the interval is expanded from the right by 1 and from left by 1, and so on. Table (2) shows that where the expand interval increased the colored regions (segment regions) are decreased, which means that it eliminate some regions, which cause the degradation to the result of segmentation, because some of the neighbor regions are merged together and cause this degradation.

After result registration and preview image segmentation, the best quality of segmentation is set, when the value of expand interval is between 1 and 4. Figure (11) the relationship between the values of expand interval and the number of colored regions are degraded when the number of the expand interval becomes (4).

Figure (11): Relationship between the numbers expand interval and the number of regions of the three bands.

REFERENCES