Graph coloring Analysis For Color Images by Detection of corners and local edge maxima Algorithm

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Abstract:

New method for Detection of corners and local edge maxima is performed by selection of local maxima in both edge and corner enhanced images. The same low constant thresholds for corner and local edge maxima detection are used for different images. The Algorithm is based on an idea of spatially linking pointes along the edge that will fire in synchrony to indicate an extracted edge .

الخلاصة :

لغرض الكشف عن زوايا وحدود أقصى الحواف المحلية لتحسين صورة ما فقد تم الاعتماد على تطبيق طريقة مبتكرة وجديدة، وهذه الطريقة تعتمد على العتبات الثابتة المنخفضة للزاوية نفسها وكشف حدود الحافة القصوى المحلية للصور، وللوصول إلى النتائج المطلوبة تم الاعتماد على خوارزمية قائمة على فكرة ارتباط المؤشرات على طول الحافة بشكل تزامني بهدف تحديد مسار الحافة المعنية.

1-Introduction:

Color image can be model as three band monochrome image data , where each band of data corresponds to different color typical color image are represented to red, green ,and blue or RGB images[2] .Using the 8 bit monochrome standard as model .The corresponding color image would have 24 bits/pixel 8bit for each of three color band[4].

There are two classes of techniques for color indexing Image : indexing by (1) global color distribute ,on and (2) local or region color .An important distinction between these techniques is that indexing by local distribution enables only whole images to be compared, while regional indexing enables matching between localized regions within images .Both techniques are very useful for retrieval for images in videos but are suited for different types of queries[1]. Color indexing by global distribution is most useful when user provides a sample image for query, but color indexing by localized or regional color provides for partial or sub-image matching between images. In color images, Objects can exhibit variations in color saturation with little or no correspondence in luminance variation: several methods have been proposed is with analysis Graph for color image. A graph in its basic form is defined as a set of vertices and edges where the latter are topples of vertices. M-Color ability optimization for Graph asks for the smallest integer (**m**) for which the graph (**G**) can be colored. This integer is referred to as the chromatic number of the graph. A graph is said to be planner if it can be drawn in a plane in such away that no two edges cross each other. Graphs, where edge contours and corners represent edge contours and corners, respectively, have bee proven to be useful for object recognition[3].

2- Edge Enhancement:

The amplitude for each of the grey valve , red –green , and blue –yellow channels yields the edge operator

$$c_{\sigma}^{a11} = \sqrt{c_{\sigma}^{2} + (\tfrac{1}{2} c_{\sigma}^{r,g})^{2} + (\tfrac{1}{2} c_{\sigma}^{b,y})^{2}} \quad \text{.................................(1)}$$

Where: c=color r=red ,g=green, b=blue, y=yellow

At a single scale. The corner operator is similar to (1), with the exception that for C one should substitute ε.
We found the averaging the responses over arrange of frequencies yield much more robust corner detection operator:-

$$\sum_{avg}^{a11}(x,y)=\frac{1}{s}\sum_{j=0}^{s-1}\sum_{j=0}^{a11}(x,y) \quad ....(2)$$

We are interested in determine all the different ways in which a given graph may be colored using at most (**m**) colors .

Adjacency matrix GRAPH (1:n,1:n) , where GRAPH (I,J) =true if (I,J) is an edge of G and otherwise GRAPH (I,J) = false . Using the recursive back tracking formulation to resulting the M-Coloring.

```
Procedure M-Coloring(K)
    global integer m,n,x (1:n) Boolean GRAPH (1:n,1:n)
     integer k //k is the index of the next vertex to color x(k)//
     loop   // generate all legal assignments for x(k) //
              call nextvalue(k)
              if x(k)  =0 then exit endif // no new color //
              if k= n then print (x)
              else call M-coloring (k+1)
           endif
     repeat all
   end M-coloring
```

To generation a next color for image we write this procedure

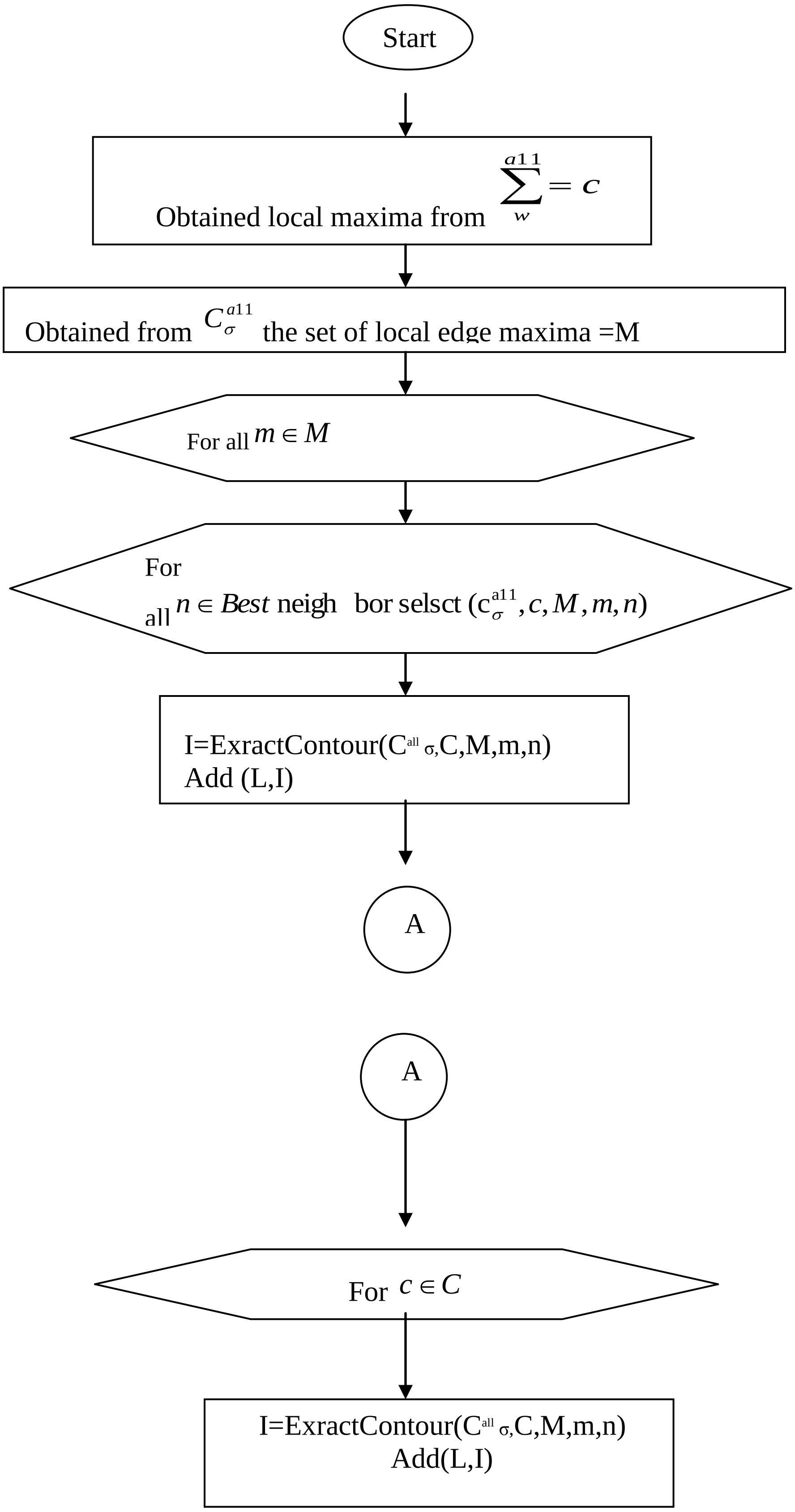
```
procedure nextvalue(k)
 global integer m,n ,x(1:n) Boolean GRAPH(1:n,1:n)
 integer j,k
 Loop
x(k) ← (x(k)+1) mod (m+1) "next highest color"
    If x(k) =0 then return end if  // all colors have been exhausted //
    For  j←1 to n do // chech if this color is distinct from adjacent color //
       If GRAPH (h,j) and x(k) =x(j) then
                 exit endif
     repeat
        if j=n+1 then return endif // new color found //
       If GRAPH (h,j) found and x(k) < > x(j) then
        repeat  // other wise try to find another color //
  End next value
```

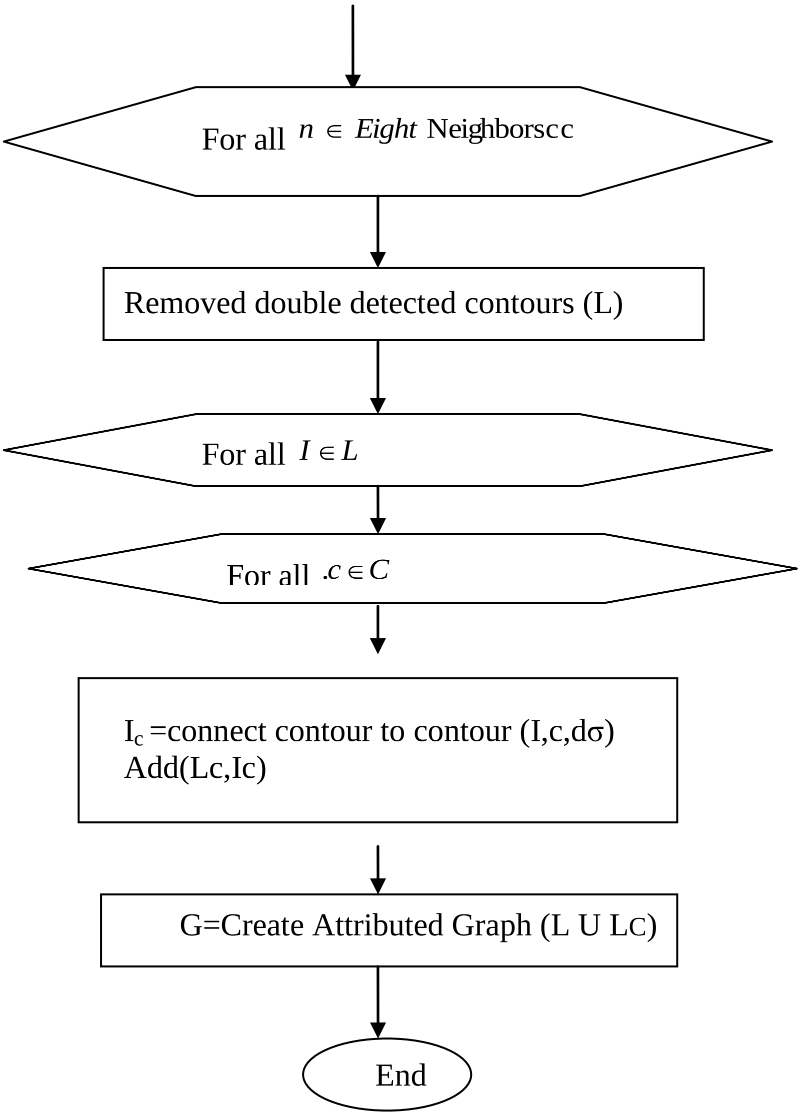
The number of internal nodes in the state space the number of internal nodes in the state space is $\sum_{i=0}^{n-1} m^i$. At each internal node , O(mn) time is spent by next value to determine the nodes corresponding to time is bounds by

$$\sum_{i=1}^{n} m^i n = n(m^{n+1}-1)/(m-1) = O(nm^n) \ ....(3)$$

3- Graph extraction analysis

The idea of contour is select corners and local edge maxima as starting points , and then to follow a contour to another corner or local maximum by selecting the strongest edge responses during the following process. The flowchart for attributed graph extraction is :-





Figure(1): The flowchart for attributed graph extraction

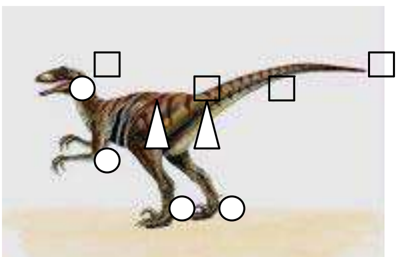
The flow chart contains 3 stages :-

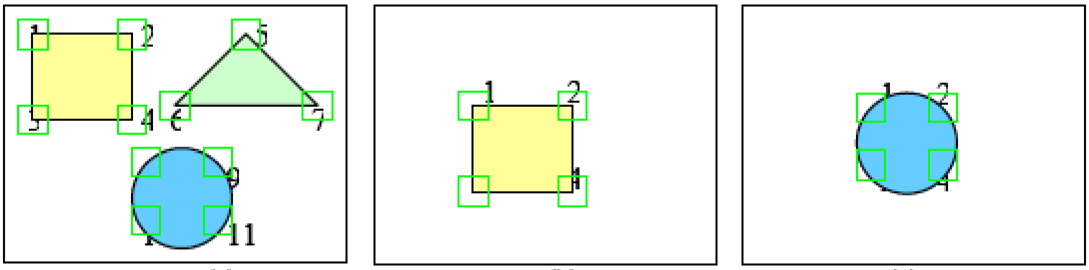
1-Detecting corners and local edge maxima by threshold(select value and set every thing above that value equal to (1) and ever thing below the threshold value equal to (0)) initial stage of a tab dimensional layer of linking cells (L) .

2-Extracting contours starting at local maxima and edge contour .

3-Connecting corners with edge contours and each other , also activating and linking neighboring neurons along an edge contour .

In our method little brighter grey squares are corner edge connection and bright squares denote a junction due to extraction or the end of a contour .Figure below shows the contour graph containing four nodes . Each path to a leaf represents a coloring using at most 3 color – not that only twelve solution exist with exactly 3 colors .





(a) (b) (c)

Figure(2): contour graph containing four nodes To measure the similarity between query image (a) and each of the images, (b) ,(c) 168=C $^{8}2$ *6
Tσ =10,Tc=10,T=1 and len=15

4-Iteration over color sets form image:-

We use the two additional thresholds in the system model . The color set $\hat{C}$ is back –projected on t0 the image only if thresholds are met that predict whether Selection of local edge maxima is a less critical process than marking corners , therefore a constant the shelf at a single scale that is equal or even lower than that for making corners gives . the back projection will produce new and desirable regions .

1.The threshold to corresponds to the images support for each color set $\hat{C}$ used the back projection only if for m such that c[m]=1 there are at least two pixels in the image of color m [if color m is selected in the color set then color m must be present in the global with a support of to samples .
2-Threshold T_1corresponds to the un- allocated colors from the global colors in image . A color set $\hat{C}$ used for the back projection only if for m such that c[m] =1 there are at least T_1 pixels in the global residue histogram of color m . [if a color set includes color m then to samples of color m must be still be un- allocated to previously extracted regions .
The color set iteration steps for single color is :-

1- single color – color sets .
2- given the image histogram H[m] find all $\overline{m} = M$ where H[m] ≥ To .
3- For each $\overline{m}$ construct unit length $\hat{C}$ onto image I(m,n) and extract regions. For each region n record the local region histogram L_n [m] .
4- Compute residue histogram H_r [m] =H[m] $-\sum_{n} L_n[m]$.
5- Repeat above .

Conclusion:

1-Position (x,y) from Image is marked as a corner if the $\sum_{avg}^{a11}(x,y)$ response is larger than its neighbors.
2- To connects corners to contours if the closest distance between corner and contour is less than d_{σ}.
3-Results obtained with our method for $\sigma = 2.34$ corners are represent as grey squares and detected contours are maked in black .
4-The computational time associated to the color based stage is about one minute for a 512×512 image , whereas the region level motion detection stage requires a few seconds for graph containing about one hundred spatial regions .

5-The use of color based criterion improves the accuracy of the localization of motion boundaries .

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