

Tutorial: Segmentation by region growing

This tutorial proposes to program the region growing algorithm.

1 Introduction

The region growing segmentation method starts from a seed. The initial region first contains this seed and then grows according to

- a growth mechanism (in this tutorial, the N_8 will be considered)
- an homogeneity rule (predicate function)

The algorithm is simple and barely only needs a predicate function:

Data: I : image

Data: seed: starting point

Data: queue: queue of points to considere

Result: visited: boolean matrix, same size as I

begin

```
    queue.enqueue( seed );  
    while queue is not empty do  
        p = queue.dequeue();  
        foreach neighbor of p do  
            if not visited(p) and neighbor verifies predicate then  
                queue.enqueue( neighbor );  
                visited( neighbor ) = true;  
            end  
        end  
    end  
    return visited  
end
```

The difficulty of the code lays in the presence of a queue structure. For the purpose of simplicity, it is advised to use the java class `java.util.LinkedList`, which is allowed within matlab:



```
% create the queue structure by a Java object  
2 queue = java.util.LinkedList;  
  
4 % test it  
p = [1;2];
```



```
6 queue.add(p);

8 r = queue.remove()
```

For picking up the coordinates of a pixel with the mouse in MATLAB[®], you can use the `ginput` function:



```
I = double(imread('cameraman.tif'));
2 [Sx, Sy] = size(I);
  imshow(I,[]);
4
  % seed
6 [x, y]=ginput(1);
  seed = round([y;x]); % beware of inversion of coordinates
```

To get the coordinate of the mouse click, use the matplotlib connect utilities. Define a function `def onpick`.



```
# start by displaying a figure ,
2 # ask for mouse input (click)
  fig = plt.figure ();
4 ax = fig.add_subplot (211);
  ax.set_title ('Click on a point')
6 # load image
  img = misc.ascent ();
8 ax.imshow (img, picker = True, cmap = plt.gray ());

10 # connect click on image to onpick function
  fig.canvas.mpl_connect ('button_press_event', onpick);
12 plt.show ();

14 def onpick(event):
    """ connector """
```

2 Region growing implementation



The seed pixel is denoted s .

- Code the predicate function: for an image f and a pixel p , p is in the same segment as s implies $|f(s) - f(p)| \leq T$.

- Code a function that performs region growing, from a starting pixel (seed).
- Try others predicate functions like:

- pixel p intensity is close to the region mean value, i.e.:

$$|I(p) - m_s| \leq T$$

- Threshold value T_i varies depending on the region R_i and the intensity of the pixel $I(p)$. It can be chosen this way:

$$T_i = (1 - \frac{\sigma_i}{m_i}) \cdot T$$