Exercise 04 for MA-INF 2201 Computer Vision WS23/24
12.11.2023
Submission on 19.11.2023
Graph Cut and Active Contour Model

1. **Graph Cuts**

Consider the graph show in Figure 1 to answer the following questions:

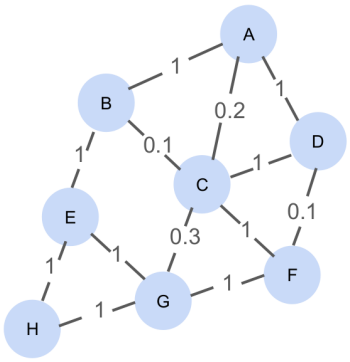

Figure 1: A simple graph. The weights are specified on the edges

1. Compute the eigenvector y corresponding to the second smallest eigenvalue of the following generalized eigenvalue problem:

$$(D - W)y = \lambda Dy \tag{1}$$

where W is the affinity matrix of the given graph and D is the diagonal matrix that contains the degrees of the vertices. *(5 Points)*

Hint: Use cv2.eigen *to solve the equivalent standard eigenvalue problem*:

$$D^{-\frac{1}{2}}(D - W)D^{-\frac{1}{2}}z = \lambda z; z = D^{\frac{1}{2}}y \tag{2}$$

2. Use the result of part (a) to find the minimum normalized cut NCut(C1, C2). The sign of the values in the eigenvector computed in (a) determine the separation of the vertices into the two clusters C1, C2. List the nodes in each cluster and compute the cost of the normalized cut. *(5 Points)*

2. **Active Contour Models**

Read the images **ball.png** and **coffee.png** and segment the object in both images using snakes. Initialize the snake by a circle around the object and optimize it using dynamic programming. The elastic term should be used as pairwise cost, penalizing deviation from the average distance between pairs of nodes. Visualize for both images how the snake converges to the boundary of the object. *(10 Points)*
Please write the names of your group members in the README.