Homework 6, due Wednesday February 19th, 11:59pm

February 13, 2020

1. Download the files `retina.png`. The file contains a part of a retina image showing the eye blood vessels. Construct an undirected graph containing the image pixels as nodes and horizontal and vertical edges between adjacent pixels. The edge weights between adjacent nodes p and q are:

$$w(p,q) = \max(I(p) - 50, 1) + \max(I(q) - 50, 1)$$

where $I(p)$ and $I(q)$ are the image intensities at the pixel locations p and q.

In this project we will compare Dijkstra's algorithm with the A^* search with the Euclidean distance heuristic $h(p) = \|p - \text{goal}\|$.

a) Use Dijkstra's algorithm to find the minimum cost path from the start point $(5, 193)$ to the goal point $(104, 14)$, where $(0, 0)$ is the upper left corner of the image, and the x axis is horizontal. Display the path as a curve overimposed on the image. Also report the computation time for Dijkstra's algorithm in seconds. (3 points)

b) Show that the Euclidean distance heuristic $h(p) = \|p - \text{goal}\|$ is admissible. (1 point)

c) Verify that the Euclidean distance heuristic $h(p) = \|p - \text{goal}\|$ is also monotone (consistent) with the graph. (2 points)

d) Repeat point a) using the A^* search with the Euclidean distance heuristic $h(p) = \|p - \text{goal}\|$. (3 points).

e) For the results from d), display the open and closed nodes overimposed on the image. (1 point).