Lab 5 – Introduction to Segmentation

Goal: to provide an introduction to image segmentation and matting. In this lab we'll learn about Distance Transform and geodesic and their applications. Also, we'll learn the basis of the image Segmentation and Matting algorithm [1].

1. Distance Transform and Its Application to Traveling Salesman Problem

1. Describe the following distance metrics: Euclidean, Cityblock, Chessboard, Quasi-Euclidean. Provide the relevant formulae.
2. Describe the Distance Transform.
3. Run Matlab's demo **travel**. Describe the Traveling Salesman Problem. How this problem can be solved?

2. Geodesic and Its Application to Maze Solving

1. Describe the geodesic.
2. Describe the Maze Solving algorithm [2].

3. Introduction to Segmentation and Matting

1. Describe the image Segmentation and Matting algorithm.
2. Why do we convert the image to HSV representation and then segment only the V layer?
3. Describe the Kernel Density Estimation.
4. Describe the Fast Marching method.
5. What is the Foreground /Background) Likelihood?
6. What is the Histogram Back-Projection?
7. What is the Weighted Geodesic Distance?
8. What is the Discrete Weighted Geodesic Distance?
9. What is the Boundary ("Binary Segmentation", "White Line" in [1])?
10. What is the Narrow Band?
11. What is the Trimap?
12. What is the Alpha?
13. What is the Segmented Foreground on New Background?

References

[1] X. Bai and G. Sapiro, Geodesic matting: a Framework for fast interactive image and video segmentation and matting, *Int. J. Comput. Vis.*, 82(2), pp. 113-132, 2009.

[2] Blog post of Steve Eddins about maze solving: http://blogs.mathworks.com/steve/2011/11/01/exploring-shortest-paths-part-1/ (The maze is in "Part 5", but it's recommended to go over all parts in order to understand what is done.)