Assignment 1: Connected Component Labeling & Junction Detection

Sabancı University
Computer Science & Engineering
CS419 - Digital Image and Video Analysis
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1   Context

A road network is usually depicted as a binary image where pixels belonging to roads/highways/bridges, etc., are in the foreground. An example is shown in Fig. 1.
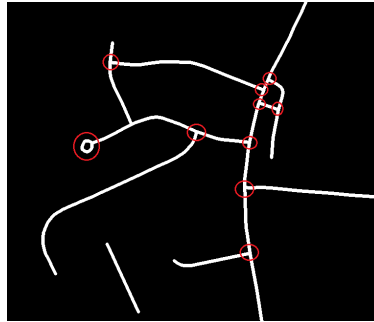

Figure 1: Road network example (10078660_15.tif) from the MR dataset with multiple intersections an one roundabout encircled in red.

Automatic road network extraction is a common task in remote sensing image analysis with applications in urban development, transportation optimization, and also in the military.

2   Data and Objective

The Massachusetts Roads Dataset (available at www.kaggle.com/datasets/balraj98/massachusetts-roads-dataset) has several such binary images (under tiff/train_labels) in tiff format.

This assignment has two objectives. The first is to detect the location (in 2D coordinates) of intersections (60 points), and the second is to detect roundabouts (in 2D coordinates) (40 points). Given an input image, you are expected to develop a pipeline of operations (binary mathematical morphology is recommended), that will produce as output the 2D coordinates of the sought objects; e.g. "there is an intersection at (574, 456)" (the numbers are fictional).

3   Details and evaluation

Your code will be evaluated with random files from the same dataset. So try to develop a general purpose solution (not specific to any given file). Performance is important, but at this early

stage we are also equally interested in your design, ideas, and whether they are justified properly. Moreover, please import your images into your code using the imread function of the cv2 library (e.g. cv2.imread('10078660_15.tif', cv2.IMREAD_GRAYSCALE).

4   What to submit

Please submit your answers as a zip file containing the documented python source code (preferably a Jupyter Notebook file) of your implementation and a single pdf file type-set with LateX (IEEE conference template) containing your design details and justifications (e.g. "I used this operator with that setting because I hypothesized xyz"). In addition, submitted file names should include your full name and student ID. Please do not submit scans or photographs of handwritten documents, or pdfs prepared in word/libreffice, or pdfs more than 3 pages, they will not be accepted for evaluation.

Post your questions to sucourse, and don't forget that plagiarism will not be tolerated (any two abnormally similar submissions will receive a grade of -100).

Good luck.