CSC566 – DIGITAL IMAGE PROCESSING

LAB SIX: CLASSICAL AND DEEP LEARNING SEGMENTATION METHODS

Submission: PDF Report + MATLAB Code (.m)

LEARNING OUTCOMES

By completing this lab, students will be able to:

1. Apply and compare classical segmentation techniques such as thresholding, region growing, and edge detection.
2. Interpret segmented results and justify method suitability.
3. Perform semantic segmentation using a pretrained deep learning model in MATLAB.
4. Visualise and evaluate segmentation masks overlayed on images.

PART 1 — CLASSICAL IMAGE SEGMENTATION METHODS

1. **INSTRUCTIONS (PART 1)**

   Step 1 – Select five built-in MATLAB images

   Choose any five of the following images:

   1. cameraman.tif
   2. coins.png
   3. pout.tif
   4. text.png
   5. saturn.png
   6. peppers.png
   7. rice.png

   Example code:

```
I = imread('coins.png');

Igray = rgb2gray(I);    % if needed
```

Step 2 – Apply the following segmentation methods

A. Adaptive Thresholding (MATLAB built-in)

```
T = adaptthresh(Igray, 0.5);

BW_adapt = imbinarize(Igray, T);
```

B. Nick Thresholding

```
BW_nick = nick_threshold(Igray, 15, -0.2);
```

C. Bradley Thresholding

```
BW_bradley = bradley_threshold(Igray, 31);
```

D. Region Growing

```
seed = [row col];   % student determines seed

BW_region = grayconnected(Igray, seed(1), seed(2),
12);
```

E. Two Edge Detection Methods

Choose two: Sobel, Prewitt, Canny, Roberts, LoG

Example:

```
BW_sobel = edge(Igray, 'sobel');

BW_canny = edge(Igray, 'canny');
```

Step 3 – Reporting Format

Prepare a table for each of the five images with the following columns:

- Original
- Adaptive Thresholding
- Nick Thresholding
- Bradley Thresholding
- Region Growing
- Edge Method 1
- Edge Method 2

Step 4 – Discussion

For each image, write one paragraph explaining:

- Which segmentation method gives the best output.
- Why certain methods struggle (lighting, noise, texture).
- Which method is most suitable for the image type.

PART 2 — SEMANTIC SEGMENTATION (DEEP LEARNING)

This section introduces students to modern semantic segmentation using a pretrained neural network.

1. INSTRUCTIONS (PART 2)

Step 1 – Load MATLAB's pretrained DeepLabv3+ network

```
net = deeplabv3plus;
```

Step 2 – Choose a test image

```
I = imread('streetScene.png');
```

Step 3 – Perform semantic segmentation

```
C = semanticseg(I, net);

B = labeloverlay(I, C);

imshow(B)

title('Semantic Segmentation Result')
```

Step 4 – Display detected classes (optional)

```
classes = categories(C);
```

Step 5 – Add the results to your report

Insert a simple table containing:

- The original image
- The semantic segmentation output (DeepLabv3+)

After that, write a short paragraph discussing:

- Which objects were correctly segmented.
- Any mistakes or misclassifications.
- How semantic segmentation is different from classical methods such as thresholding and region growing.

FINAL DELIVERABLES

A. PDF Report

Include the following:

1. Introduction
2. Part 1 results (all segmentation tables + discussions)
3. Part 2 results (semantic segmentation + discussion)
4. Short reflection comparing classical vs. deep learning segmentation

B. MATLAB Code Files

Submit your .m files:

segment_classical.m

segment_semantic.m

Any helper functions used

5. OPTIONAL BONUS (+5 MARKS)

   Create a side-by-side comparison figure:

figure

```
subplot(1,2,1), imshow(I), title('Original')

subplot(1,2,2), imshow(B), title('DeepLabv3+ Result')
```