Fundamental Biomedical Image Processing

Assignment 1

Post Date: Sept. 22, 2025; Due Date: Oct. 6, 2025

NOTE:

- Your assignments / project can be in Matlab, Python, C++. (Source code)
- Deadline. The solutions to the assignments / project should be submitted by 12pm on the date they are due. The late assignments will not be accepted.

Theoretical questions

1. A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:
   (a) How many minutes would it take to transmit a 1024 X 1024 image with 256 intensity levels using a 56K baud modem? (10%)
   (b) What would the time be at 3000K baud, a representative medium speed of a phone DSL (Digital Subscriber Line) connection? (5%)

2. Consider the image segment shown in below figure. Compute length of the shortest-4, shortest-8 & shortest-m paths between pixels p & q where, V = {1,2} and explain why? (10%)

3	2	3	2 q
2	2	1	3
1	3	3	2
p 2	2	3	4

Programming exercises (Send the source code)

1. Locating the pixels in a BMP image. (15%)
   Write a computer program to plot an equilateral triangle of sides 200 with gray level 255 and the top vertex at the coordinate (150, 150) on Fig. 1.

2. Reducing the number of gray levels in an image. (20%)
   Write a computer program capable of reducing the number of gray levels in a image (Fig. 1) from 256 to 2, in integer powers of 2. The desired number of gray levels needs to be a variable input to your program.

3. Rotating a BMP image. (20%)
   Write a computer program to obtain an image (Fig. 2.) rotated 15, 30, 45, 60, &

90 degrees clockwise about the center by using nearest neighbor interpolation to assign intensity values to the spatial transformed pixels.

4. Recovering text from an image containing a strong illumination gradient. (20%) Write a computer program capable of recovering text from an image (Fig. 3) with a strong illumination gradient.