Assignment questions on Week 2

Answer all Questions.

1. What is the LBP_{ri} value of the following matrix:

$$\begin{bmatrix} 10 & 40 & 70 \\ 20 & (50) & 80 \\ 30 & 60 & 90 \end{bmatrix}$$

   (a) 15

   (b) 30

   (c) 29

   (d) 10

2. Which one is the $Co - occuranceMatrix$ of the following matrix given below. Here $distance(d) = 1Pixel$ and $direction = NE$.

$$\begin{bmatrix} 1 & 3 & 2 & 3 \\ 0 & 1 & 0 & 1 \\ 3 & 2 & 2 & 0 \\ 0 & 1 & 2 & 3 \end{bmatrix}$$

   (a) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 2 & 0 \\ 2 & 0 & 0 & 0 \end{bmatrix}$

   (b) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 2 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

   (c) $\begin{bmatrix} 0 & 0 & 2 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 2 & 0 & 0 \\ 2 & 0 & 0 & 0 \end{bmatrix}$

   (d) $\begin{bmatrix} 0 & 0 & 2 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 2 & 0 & 1 & 0 \end{bmatrix}$

3. What is the values of *Entropy* of the following matrix. Here $distance(d) = 1Pixel$ and $direction = NE$

$$\begin{bmatrix} 1 & 3 & 2 & 3 \\ 0 & 1 & 0 & 1 \\ 3 & 2 & 2 & 0 \\ 0 & 1 & 2 & 3 \end{bmatrix}$$

(a) -0.554

(b) -0.754

(c) -0.654

(d) -0.854

4. What is the values of $Energy$ of the following matrix. Here $distance(d) = 1Pixel$ and $direction = NE$.

$$\begin{bmatrix} 1 & 3 & 2 & 3 \\ 0 & 1 & 0 & 1 \\ 3 & 2 & 2 & 0 \\ 0 & 1 & 2 & 3 \end{bmatrix}$$

(a) 0.14

(b) 0.15

(c) 0.17

(d) 0.19

5. Given the pixels A, B, C, D and seeds S in an image, identify the pixel nearest to the seed. A - (1,2,3), B - (10,1,4), C - (4,5,1), D - (8,9,10), S - (7,10,3). Use Euclidean distance measure.

(a) A

(b) B

(c) C

(d) D

6. Compute the updated centroids C_1, C_2 after 1 iteration of clustering for the set of pixels S ={(1,1,2),(3,6,1),(2,3,1),(5,4,7)}. Let the initial centroids be $C_1 = (1, 1, 2), C_2 = (2, 3, 1)$

a) $C_1 = (1, 1, 2)$ and $C_2 = (3.34, 4.34, 3)$

(b) $C_1 = (3, 3.36, 3.34)$ and $C_2 = (2, 3, 1)$

(c) $C_1 = (2, 3.5, 1.5)$ and $C_2 = (3.5, 3.5, 4)$

(d) $C_1 = (1.5, 2, 1.5)$ and $C_2 = (4, 5, 4)$

7. Find the class label ω_i for the pixels A - (157,10,53), B - (25,100,100), C - (3,234,120), D - (124,25,75). The pixel intensity for the manually selected seeds for the 2 classes are, ω_1 = (100,20,60) and ω_2 = (30,255,175)

(a) A -ω_1, B -ω_1, C -ω_2, D -ω_2

(b) A -ω_1, B -ω_1, C -ω_2, D -ω_1

(c) A -ω_2, B -ω_2, C -ω_1, D -ω_1

(d) A -ω_2, B -ω_1, C -ω_2, D -ω_2

8. In the result of segmentation of an image I with two regions A and B, identify which of the following relations are true.

   1 - $I_A \cup I_B = I$
   2 - $I_A \cap I_B = I$
   3 - $I_A \cup I_B = \phi$
   4 - $I_A \cap I_B = \phi$

   (a) Only 1

   (b) Only 3

   (c) 1,4

   (d) 1,3

9. The following matrix I is a snippet of an RGB image. What are the value of weights of all the edges connected to the bracketed node of the M matrix, assuming 8-connected relationship between the pixels, and the weight if the edges defined as $W_{i,j} = e^{-\beta\left\|c_i - c_j\right\|}$ where c_i is the (r,g,b) colour triplet vector representing the i^{th} pixel and $||.||$ is the Euclidean distance measure. Also consider that $\beta = \{\beta_V = 100, \beta_H = 25, and\, \beta_D = 50\}$ and the notation matrix for weight calculation is N.

$$I = \begin{bmatrix} (100,0,0) & (0,1,0) & (0,100,0) \\ (0,0,100) & (1,1,1) & (100,0,0) \\ (100,0,0) & (1,0,0) & (0,100,0) \end{bmatrix} \qquad M = \begin{bmatrix} 0 & 0 & 0 \\ 0 & (0) & 0 \\ 0 & 0 & 0 \end{bmatrix} \qquad N = \begin{bmatrix} 3 & 1 & 4 \\ 5 & 6 & 7 \\ 8 & 2 & 9 \end{bmatrix}$$

   (a)$W_{6,1} = W_{6,2} = e^{-1410.42}$, $W_{6,3} = W_{6,4} = W_{6,8} = W_{6,9} = e^{-4950.50}$, $W_{6,5} = W_{6,7} = e^{-2475.25}$

   (b)$W_{6,1} = W_{6,2} = e^{-4950.50}$, $W_{6,3} = W_{6,4} = e^{-141.42}$, $W_{6,5} = W_{6,7} = e^{-2475.25}$, $W_{6,8} = W_{6,9} = e^{-4950.50}$

   (c) $W_{6,1} = W_{6,2} = e^{-141.42}$, $W_{6,3} = W_{6,4} = W_{6,8} = W_{6,9} = e^{-4950.50}$, $W_{6,5} = W_{6,7} = e^{-2475.25}$

   (d) $W_{6,1} = W_{6,2} = e^{-2475.25}$, $W_{6,3} = W_{6,4} = W_{6,8} = W_{6,9} = e^{-4950.50}$, $W_{6,5} = W_{6,7} = e^{-1410.42}$

10. What is the value of degree of the bracketed marked node of M matrix, assuming 8-connected relationship between the pixels, and the weight if the edges defined as $W_{i,j} = e^{-\beta\left\|c_i - c_j\right\|}$. Lets consider that $\beta = \{\beta_V = 100, \beta_H = 25, and\, \beta_D = 50\}$.

$$I = \begin{bmatrix} (100,0,0) & (0,1,0) & (0,100,0) \\ (0,0,100) & (1,1,1) & (100,0,0) \\ (100,0,0) & (1,0,0) & (0,100,0) \end{bmatrix} \qquad M = \begin{bmatrix} 0 & 0 & 0 \\ 0 & (0) & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

    (a) 7.64×10^{-124}

    (b) 7.64×10^{-62}

(c) 15.28×10^{-62}

(d) 15.28×10^{-124}

11. What are the values of $L_{4,4}$ and $L_{3,5}$ from Laplacian matrix L of an RGB image I and the seeds for the two classes are marked in the matrix M as 1 and 2 and the unmarked pixels are in 0. Assuming 8-connected relationship between the pixels, and the weight if the edges defined as $W_{i,j} = e^{-\beta\left\|c_i - c_j\right\|}$. Lets consider that $\beta = \{\beta_V = 100, \beta_H = 25, and\, \beta_D = 50\}$ and the notation matrix for weight calculation is N

$$I = \begin{bmatrix} (100,0,0) & (0,1,0) & (0,100,0) \\ (0,0,100) & (1,1,1) & (100,0,0) \\ (100,0,0) & (1,0,0) & (0,100,0) \end{bmatrix} \qquad M = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 2 & 0 \end{bmatrix} \qquad N = \begin{bmatrix} 3 & 1 & 4 \\ 5 & 6 & 7 \\ 8 & 2 & 9 \end{bmatrix}$$

(a) $L_{4,4} = e^{-14142.14}$, $L_{3,5} = e^{-14142.14}$

(b) $L_{4,4} = e^{-2475}$, $L_{3,5} = e^{-2475}$

(c) $L_{4,4} = e^{-4950.50}$, $L_{3,5} = e^{-14142.14}$

(d) $L_{4,4} = e^{-2475}$, $L_{3,5} = e^{-14142.14}$

12. What are the dimension of the Laplacian matrix $(L), L_U, L_M, B^T$ and X of an RGB image I and the seeds for the two classes are marked in the matrix M as 1 and 2 and the unmarked pixels are in 0, assuming 8-connected relationship between the pixels. Where

$$X = -L_U^{-1}\left\{B^T L_M\right\}$$

$$I = \begin{bmatrix} (100,0,0) & (0,1,0) & (0,100,0) \\ (0,0,100) & (1,1,1) & (100,0,0) \\ (100,0,0) & (1,0,0) & (0,100,0) \end{bmatrix} \qquad M = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 0 & 2 & 0 \end{bmatrix}$$

(a) $L \Rightarrow 9 \times 9, L_U \Rightarrow 7 \times 7, L_M \Rightarrow 2 \times 2, B^T \Rightarrow 7 \times 2, X \Rightarrow 2 \times 7$

(b) $L \Rightarrow 9 \times 9, L_U \Rightarrow 2 \times 2, L_M \Rightarrow 7 \times 7, B^T \Rightarrow 2 \times 7, X \Rightarrow 2 \times 7$

(c) $L \Rightarrow 9 \times 9, L_U \Rightarrow 7 \times 7, L_M \Rightarrow 2 \times 2, B^T \Rightarrow 2 \times 7, X \Rightarrow 2 \times 7$

(d) $L \Rightarrow 9 \times 9, L_U \Rightarrow 7 \times 7, L_M \Rightarrow 2 \times 2, B^T \Rightarrow 7 \times 2, X \Rightarrow 7 \times 2$

13. What is the is the value of *Elasticity* defined as $\left\|\frac{\partial \mathbf{r}(s)}{\partial s}\right\|$ at the double bracketed pixel of the following image matrix.

$$\begin{bmatrix} (10) & 50 & 50 & 50 \\ 50 & (10) & 50 & 50 \\ 50 & 50 & ((0)) & 50 \\ 50 & 50 & (10) & 10 \end{bmatrix}$$

(a) 0

(b) 0.5

(c) 1

(d) 1.5

14. What is the is the value of $Stiffness$ defined as $\left\| \frac{\partial^2 \mathbf{r}(s)}{\partial s^2} \right\|$ at the double bracketed pixel of the following image matrix.

$$\begin{bmatrix} (10) & 50 & 50 & 50 \\ 50 & (10) & 50 & 50 \\ 50 & 50 & ((0)) & 50 \\ 50 & 50 & (10) & 10 \end{bmatrix}$$

(a) 0

(b) 0.5

(c) 1

(d) 1.5

15. What is the is the value of $InternalEnergy$ defined as $w_1 \left\| \frac{\partial \mathbf{r}(s)}{\partial s} \right\| + w_1 \left\| \frac{\partial^2 \mathbf{r}(s)}{\partial s^2} \right\|$ at the double bracketed pixel of the following image matrix. Here $w_1 = 1$ and $w_2 = 1$ are the weights of the internal energy.

$$\begin{bmatrix} (10) & 50 & 50 & 50 \\ 50 & (10) & 50 & 50 \\ 50 & 50 & ((0)) & 50 \\ 50 & 50 & (10) & 10 \end{bmatrix}$$

(a) 0

(b) 0.5

(c) 1

(d) 1.5

16. What is the is the value of $ExternalEnergy$ defined as $-\| \bigtriangledown f(\mathbf{r}(s)) \|$ at the double bracketed pixel of the following image matrix.

$$\begin{bmatrix} (10) & 50 & 50 & 50 \\ 50 & (10) & 50 & 50 \\ 50 & 50 & ((0)) & 50 \\ 50 & 50 & (10) & 10 \end{bmatrix}$$

(a) 0

(b) 28.28

(c) 1

(d) 7.07

17. Which among the following formulas corresponds to precision:
    (a) $\frac{TN}{TN+FP}$
    (b) $\frac{TP}{TP+FN}$
    (c) $\frac{TP}{TP+FP}$
    (d) None of these

18. Using the given confusion matrix, compute sensitivity and precision.

		Ground truth	
		+	-
Prediction	+	10	2
	-	3	5

    (a) 0.67, 0.84
    (b) 0.83, 0.77
    (c) 0.77, 0.63
    (d) 0.63, 0.83

19. Calculate F score when precision is 0.8 and sensitivity is 0.65 using the confusion matrix given below.

		Ground truth	
		+	-
Prediction	+	10	2
	-	3	5

(a) 0.72
(b) 0.36
(c) 0.73
(d) Insufficient information

20. Which among the following values of area under the curve (AUC) indicates better performance?
(a) 0.1
(b) 0.7
(c) 0.5
(d) 0.9

End