Medical Image Analysis

Week 3: Assignment Key and Solution

Answer key:

Q. No.	Ans. Key
1	c
2	a
3	b
4	a
5	d
6	a
7	c
8	d
9	b
10	d

Q. No.	Ans. Key
11	d
12	c
13	b
14	b
15	a
16	c
17	d
18	b
19	a
20	b

Solutions to selected questions:

Q1. Refer Lec. 3.1_3.2 Slide No. 13.

Node 1: p(C1) = 15/25, p(C2) = 10/25

Entropy (Node 1) = -(p(C1)log10(p(C1))+p(C2)log10(p(C2))) = 0.29

Node 2: p(C1) = 8/12, p(C2) = 4/12

Entropy (Node 2) = -(p(C1)log10(p(C1))+p(C2)log10(p(C2))) = 0.28

Node 3: p(C1) = 7/13, p(C2) = 6/13

Entropy (Node 3) = -(p(C1)log10(p(C1))+p(C2)log10(p(C2))) = 0.30

Q2. Refer Lec. 3.1_3.2 Slide No. 13.

Information gain = Entropy(Node 1) – (((12/25)*Entropy(Node 2))+((13/25)*Entropy(Node 3))) = 0

Q3. In the last layer only node no. 6 is the pure node and the other can be split further for getting pure node.

Q4. Refer Lec. 3.1_3.2 Slide No. 13. (Follow down steps from **Q1**)

Q5. Calculate the entropy for both the trees as discussed in Lec.3.1_3.2 Slide No. 13. (Follow down steps from **Q1**)

Q6. Calculate the information gain for both the nodes as discussed Lec.3.1_3.2 Slide No.13). (Follow down steps from **Q2**)

Q7. Calculate the posterior probability by no of sample for one particular class present in one node. Such as, $\mathrm{p}(\omega_1, \mathrm{n}_5^1) = \frac{0}{6} = 0$ and $\mathrm{p}(\omega_2, \mathrm{n}_5^1) = \frac{6}{6} = 1$.

Q8. Calculate the values of posterior probability of class1 and class2 for the total forest as discussed in Lec. 3.1_3.2 Slide No.20.

P(class1) = (1/5)×(0.375+0.625+0.5+0.555+0.667) = 0.54

Q9. Refer Lec. 3.3 Slide no. 3

Q10. $y = \frac{1}{1+e^{-x}}$

$$\frac{\partial y}{\partial x} = \frac{-1}{(1+e^{-x})^2}(-e^{-x}) = \frac{1+e^{-x}-1}{(1+e^{-x})^2} = \frac{1}{(1+e^{-x})} + \frac{1}{(1+e^{-x})^2} = \frac{1}{(1+e^{-x})}\left[1 - \frac{1}{(1+e^{-x})}\right]$$
$$= y(1-y)$$

Q11. Output of node 1 = 0.2+(0.1*1)+(0.15*2)+(0.3*3) = 1.5, after non-linearity = 0.82

Output of node 2 = 0.05+(0.05*1)+(0.01*2)+(0.03*3) = 0.21, after non-linearity = 0.55

$$J(W) = \sum_n \|p_n - \hat{p}_n\| = 0.5 * \sqrt{(1-0.82)^2 + (0-0.55)^2} = 0.58$$

Q12. Refer Lec. 3.3 Slide no. 7, demonstration on neural network

Q13. Refer Lec. 3.4_3.5 Slide no. 17

Q15. For, module = nn.SpatialConvolution(nInputPlane, nOutputPlane, kW, kH, [dW], [dH], [padW], [padH])

owidth = floor((width + 2*padW - kW) / dW + 1) = floor((32+2*0-5)/1+1) = 28

oheight = floor((height + 2*padH - kH) / dH + 1) = 28

nChannels = nOutputPlane = 6

Q16. Refer deep neural network demonstration

Q17. Refer Lec. 3.4_3.5 Slide no. 17

Q18. Refer Lec. 3.4_3.5 Slide no. 17

Q19. Refer Lec. 3.4_3.5 Slide no. 17

Q20. Refer Lec. 3.4_3.5 Slide no. 17