Deep Learning

Assignment- Week 2

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 10 **Total mark: 10 X 2 = 20**

QUESTION 1:

Suppose if you are solving an n-class problem, how many discriminant function you will need for solving?

a. n-1
b. n
c. n+1
d. n-2

Correct Answer: b

Detailed Solution: For n class problem we need n number of discriminant function.

QUESTION 2:

If we choose the discriminant function $g_i(x)$ as a function of posterior probability. i.e. $g_i(x) = f(p(w_i/x))$. Then which of following cannot be the function $f(\,)$?

a. $f(x) = a^x, where\ a > 1$
b. $f(x) = a^{-x}, where\ a > 1$
c. $f(x) = 2x + 3$
d. $f(x) = \exp(x)$

Correct Answer: b

Detailed Solution:

The function f () should be a monotonic increasing function.

QUESTION 3:

What will be the nature of decision surface when the covariance matrices of different classes are identical but otherwise arbitrary? (Given all the classes has equal class probabilities)

a. Always orthogonal to two surfaces
b. Generally not orthogonal to two surfaces
c. Bisector of the line joining two mean, but not always orthogonal to two surface.
d. Arbitrary

Correct Answer: c

Detailed Solution:

Options are self-explanatory.

QUESTION 4:

The mean and variance of all the samples of two different normally distributed class ω_1 and ω_2 are given

$$\mu_1 = \begin{bmatrix}3\\6\end{bmatrix};\ \Sigma_1 = \begin{bmatrix}1/2 & 0\\0 & 2\end{bmatrix}\ and\ \mu_2 = \begin{bmatrix}3\\-2\end{bmatrix};\ \Sigma_2 = \begin{bmatrix}2 & 0\\0 & 2\end{bmatrix}$$

What will be the value expression of decision boundary between these two classes if both the class has equal class probability 0.5? For the input sample $x = \begin{bmatrix}x_1\\x_2\end{bmatrix}$ consider $g_i(x) = x^t - \frac{1}{2}\Sigma_i^{-1}x + \Sigma_i^{-1}\mu_i x - \frac{1}{2}\mu_i^t\Sigma_i^{-1}\mu_i - \frac{1}{2}\ln|\Sigma_i| + \ln|P(\omega_i)|$

a. $x_2 = 3.514 - 1.12x_1 + 0.187x_1^2$
b. $x_1 = 3.514 - 1.12x_2 + 0.187x_2^2$
c. $x_1 = 0.514 - 1.12x_2 + 0.187x_2^2$
d. $x_2 = 0.514 - 1.12x_2 + 0.187x_2^2$

Correct Answer: a

Detailed Solution:

This is the most general case of discriminant function for normal density. The inverse matrices are

$$\Sigma_1^{-1} = \begin{bmatrix} 2 & 0 \\ 0 & 1/2 \end{bmatrix}, and\ \Sigma_2^{-1} = \begin{bmatrix} 1/2 & 0 \\ 0 & 1/2 \end{bmatrix}$$

Setting $g_1(x) = g_2(x)$ we get the decision boundary as $x_2 = 3.514 - 1.12x_1 + 0.187x_1^2$

QUESTION 5:

For a two class problem, the linear discriminant function is given by $g(x) = a^t y$. What is the updating rule for finding the weight vector a. Here y is augmented feature vector.

a. Adding the sum of all augmented feature vector which are misclassified multiplied by the learning rate to the current weigh vector.

b. Subtracting the sum of all augmented feature vector which are misclassified multiplied by the learning rate from the current weigh vector.

c. Adding the sum of the all augmented feature vector belonging to the positive class multiplied by the learning rate to the current weigh vector.

d. Subtracting the sum of all augmented feature vector belonging to the negative class multiplied by the learning rate from the current weigh vector.

Correct Answer: a

Detailed Solution:

$$a(k+1) = a(k) + \eta \sum y$$

For derivation refer to video lectures.

QUESTION 6:

For minimum distance classifier which of the following must be satisfied?

a. All the classes should have identical covariance matrix and diagonal matrix.
b. All the classes should have identical covariance matrix but otherwise arbitrary.
c. All the classes should have equal class probability.
d. None of above.

Correct Answer: c

Detailed Solution: Options are self-explanatory.

QUESTION 7:

Which of the following is the updating rule of gradient descent algorithm? Here ∇ is gradient operator and η is learning rate.

a. $a_{n+1} = a_n - \eta \nabla F(a_n)$

b. $a_{n+1} = a_n + \eta \nabla F(a_n)$

c. $a_{n+1} = a_n - \eta \nabla F(a_{n-1})$

d. $a_{n+1} = a_n + \eta \nabla F(a_{n-1})$

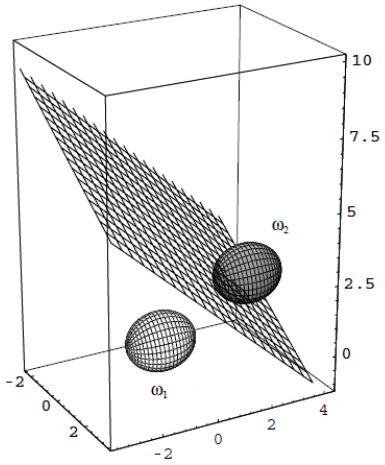
Correct Answer: a

Detailed Solution:

Gradient descent is an optimization algorithm used to minimize some function by iteratively moving in the direction of steepest descent as defined by the negative of the gradient.

QUESTION 8:

The decision surface between two normally distributed class ω_1 and ω_2 is shown on the figure. Can you comment which of the following is true?



a. $p(\omega_1) = p(\omega_2)$

b. $p(\omega_2) > p(\omega_1)$

c. $p(\omega_1) > p(\omega_2)$

d. None of the above.

Correct Answer: c

Detailed Solution:

If the prior probabilities are not equal, the optimal boundary hyperplane is shifted away from the more likely mean.

QUESTION 9:

In k-nearest neighbour's algorithm (k-NN), how we classify an unknown object?

a. Assigning the label which is most frequent among the *k* nearest training samples.
b. Assigning the unknown object to the class of its nearest neighbour among training sample.
c. Assigning the label which is most frequent among the all training samples except the k farthest neighbor.
d. None of this.

Correct Answer: a

Detailed Solution:

Options are self-explanatory.

QUESTION 10:

What is the direction of weight vector w.r.t. decision surface for linear classifier?

a. Parallel
b. Normal
c. At an inclination of 45
d. Arbitrary

Correct Answer: b

Detailed Solution:

Options are self-explanatory.

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