Deep Learning

Assignment- Week 6

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 10 **Total mark: 10 X 1 = 10**

QUESTION 1:

Suppose a neural network has 3 input nodes, a, b, c. There are 2 neurons, X and Y. X = a+ b and Y = X * c. What is the gradient of Y with respect to a, b and c? Assume, (a, b, c) = (6, -1, -4).

a. (5, -4, -4)
b. (4, 4, -5)
c. (-4, -4, 5)
d. (3, 3, 4)

Correct Answer: c

Detailed Solution:

$$\boldsymbol{Y = X.c,\ \ \frac{\partial Y}{\partial c} = X = a + b = 5}$$

$$\boldsymbol{Y = X.c = (a + b).c,\ \ \frac{\partial Y}{\partial a} = c = -4,\ \ \ \frac{\partial Y}{\partial b} = c = -4}$$

QUESTION 2:

$y = \max(a, b)$ and $a > b$. What is the value of $\frac{dy}{da}$ and $\frac{dy}{db}$?

a. $1, 0$
b. $0, 1$
c. $0, 0$
d. $1, 1$

Correct Answer: a

Detailed Solution:

$y = \max(a, b)$ and $a > b$.

Now $y = a$. So $\frac{dy}{da} = 1$ and $\frac{dy}{db} = 0$

QUESTION 3:

PCA reduces the dimension by finding a few_____.

a. Hexagonal linear combination
b. Orthogonal linear combinations
c. Octagonal linear combination
d. Pentagonal Linear Combination

Correct Answer: b

Detailed Solution:

Direct from classroom lecture

QUESTION 4:

Consider the four sample points below, $X_i \in \mathbb{R}^2$.

$$X = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 5 & 4 \\ 1 & 0 \end{bmatrix}.$$

We want to represent the data in 1D using PCA. Compute the unit-length principal component directions of X, and then choose from the options below which one the PCA algorithm would choose if you request just one principal component.

a. $[1/\sqrt{2} \quad 1/\sqrt{2}]^T$
b. $[1/\sqrt{2} \quad -1/\sqrt{2}]^T$
c. $[-1/\sqrt{2} \quad 1/\sqrt{2}]^T$
d. $[1/\sqrt{2} \quad 1/\sqrt{2}]^T$

Correct Answer: d

Detailed Solution:

Centering X,

$$\begin{pmatrix} 1 & -1 \\ -1 & 1 \\ 2 & 2 \\ -2 & -2 \end{pmatrix}$$

The above matrix is X_c. Now,

$$X_c^T X_c = \frac{1}{4}\begin{bmatrix} 10 & 6 \\ 6 & 10 \end{bmatrix}.$$

Now eigen vector with eigen value 16 is $[1/\sqrt{2} \quad 1/\sqrt{2}]^T$

Now eigen vector with eigen value 4 is $[1/\sqrt{2} \quad -1/\sqrt{2}]^T$

QUESTION 5:

Which of the following is FALSE about PCA and Autoencoders?

a. Both PCA and Autoencoders can be used for dimensionality reduction
b. PCA works well with non-linear data but Autoencoders are best suited for linear data
c. Output of both PCA and Autoencoders is lossy
d. None of the above

Correct Answer: b

Detailed Solution:

Options are self-explanatory

QUESTION 6:

What is true regarding backpropagation rule?

a. It is a feedback neural network
b. Gradient of the final layer of weights being calculated first and the gradient of the first layer of weights being calculated last
c. Hidden layers is not important, only meant for supporting input and output layer
d. None of the mentioned

Correct Answer: b

Detailed Solution:

Option is self explanatory

QUESTION 7:

Which of the following is true for PCA? Tick all the options that are correct.

a. Rotates the axes to lie along the principal components
b. Is calculated from the covariance matrix
c. Removes some information from the data
d. Eigenvectors describe the length of the principal components

Correct Answer: a,b,c

Detailed Solution:

See the definition

Direct from classroom lecture

QUESTION 8:

A single hidden and no-bias autoencoder has 100 input neurons and 10 hidden neurons. What will be the number of parameters associated with this autoencoder?

a. 1000
b. 2000
c. 2110
d. 1010

Correct Answer: b

Detailed Solution:

As single hidden layer and no-bias autoencoder,

Input neurons = 100, Hidden neurons = 10. So Output neurons = 100

Total number of parameters = 100*10+10*100=2000

QUESTION 9:

Which of the following two vectors can form the first two principal components?

a. $\{2; 3; 1\}$ and $\{3; 1; -9\}$
b. $\{2; 4; 1\}$ and $\{-2; 1; -8\}$
c. $\{2; 3; 1\}$ and $\{-3; 1; -9\}$
d. $\{2; 3; -1\}$ and $\{3; 1; -9\}$

Correct Answer: a

Detailed Solution:

Only in option (a), the vectors are othogonal

QUESTION 10:

Lets say vectors $\vec{a} = \{2; 4\}$ and $\vec{b} = \{n; 1\}$ forms the first two principle components after applying PCA. Under such circumstances, which among the following can be a possible value of n?

a. 2
b. -2
c. 0
d. 1

Correct Answer: b

Detailed Solution:

Only option (b) makes the two vectors orthogonal.

**********END*******