



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:

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

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

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 = $100 \times 10 + 10 \times 100 = 2000$

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 orthogonal

QUESTION 10:

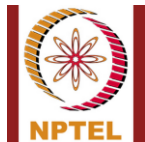
Lets say vectors $\vec{a} = \{2; 4\}$ and $\vec{b} = \{n; 1\}$ forms the first two principle components after applying PCA. Under such circumstances, which among the following can be a possible value of n?

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

Correct Answer: b

Detailed Solution:

Only option (b) makes the two vectors orthogonal.



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