

Q1)

1. C
2. A
3. $\notin A$
4. B
5. A
6. A
7. B
8. C
9. C
10. B
11. C
12. B
13. A
14. A
15. A
16. A
17. B
18. A

Q2)

1)

A) **Parameters:** Are the values the network is trying to learn by minimizing a cost function, Examples: Weights and biases

Hyperparameters: are values controlling different aspects of the learning process and must be set by the user training the neural network
Examples: learning rate, number of epochs, network architecture

B) **Dropout:** is a regularization technique that works by shutting random sample of neurons in a layer to prevent overfitting

DropConnect: is considered a generalization of the dropout in which the weight connections are shut down instead of complete neurons

C) **Machine Learning:** Is the set of methods used to make computers learn to model data by learning underlying patterns and functions.
In machine learning feature extraction must be done explicitly by the user

Deep Learning: is a subset field of machine learning based on the Neural Networks machine learning algorithm
In Deep learning the feature extraction is done implicitly in the layers of the neural networks

2)

- Attempting different network architectures and initialization methods
- Train and test an ensemble of networks then use the average output of them
- Using Momentum in the GD

3)

$$YOLO\ output = S \times S \times (5 \times B + C)$$

$$S = 7 \quad B = 3 \quad C = 10$$

$$Output = 7 \times 7 \times (5 \times 3 + 10) = 7 \times 7 \times 25$$

Q3)

Input size = $50 \times 50 \times 3$ (colored images)

Neurons = 5 *Kernel(K)* = 5×5

Stride(S) = 1

Padding = "same"

A)

$$\text{Output} = \frac{\text{Input} - K + 2P}{S} + 1$$

Since padding is set to "same", $\text{Output} = \text{Input} = 50$, replace in the equation to get the pad

$$50 = \frac{50 - 5 + 2P}{1} + 1, \quad 2P = 49 - (50 - 5)$$

$$P = 2$$

B)

Output = same dimensions of input $\times$ neurons

$$\text{Output} = 50 \times 50 \times 5$$

C)

Weights per neuron: *kernel size* $\times$ *input depth* + *bias* = $5 \times 5 \times 3 + 1 = 76$

Total Weights = $76 \times 5(\text{neurons}) = 380$

D)

To produce the same output volume:

$$\text{neurons} = 50 \times 50 \times 5 = 12500$$

Weights: input image pixels count $\times$ output neurons count + biases

$$\text{Weights} = (50 \times 50 \times 3) \times 12500 + 12500 = 93,762,500$$

E)

The weights in the fully connected are larger

- Since in convolution layers the neuron will connect to $5 \times 5 \times 3$ chunk and have $5 \times 5 \times 3$ weights
- Convolutional layers allow the sharing of parameters between neurons