

Mid Semester Examination (DLFA)

Instructions

- Exam Time: 11:00 AM -12:55 PM
- Total Questions: 50
- Marks per question: 0.5
- Total Marks: 25
- **ALL QUESTIONS ARE MANDATORY.**
- **No negative marks.**
- **The exam portal will be closed at 12:55 pm.**

Best of luck!!!!

1

An image of size $3 \times 220 \times 220$ is transformed into $5 \times 211 \times 211$ using a Convolution layer with no padding, no bias and a stride of 1. The number of learnable parameters in the layer is: (Consider image size as $C \times H \times W$) *

(0.5 Points)

- 150
- 300
- 1,500
- 2,000

2

What is the size of the input image for a standard LeNet5 architecture? *

(0.5 Points)

3×48×48

3×14×14

5×16×16

1×32×32

3

Ground Truth		
Prediction	+	-
+	9	8
-	x	y

Calculate x and y, given that the F score computed using the confusion matrix given below is 0.5625 for a sample size of 30. *

(0.5 Points)

x = 6; y cannot be computed

x = 7; y = 6

Insufficient information

x = 6; y = 7

4

Find the dimension of output of the convolutional neural network given below,

(Input size is represented as C× H ×W)

(input) 3×28×28 → (conv) 12c3w5s0p → (maxpool) 2w2s0p → (output)?

*

(0.5 Points)

12×3×3

- 6×3×3
- 12×13×13
- 6×13×13

5

Which among the following formulas corresponds to specificity: *
(0.5 Points)

- $TP/(TP+FN)$
- $TP/(TP+FP)$
- $TN/(TN+FP)$
- None of these

6

Which of the below operations is performed in a Vector CNN to aggregate the information across the rotated convolution kernels? *
(0.5 Points)

- Argmax
- Spatial average pooling
- Orientation max pooling
- Spatial max pooling

7

Calculate the number of trainable parameters for the fully-connected neural network (with bias) given as,

(input) 1024 → (fc) 50 → (fc) 30 → (output) 2 *

(0.5 Points)

52,760

52,842

80,648

80,730

8

Suppose a convolutional neural network is trained on MNIST dataset (digits dataset). This trained model is then given a completely white image as an input. The output probabilities for this input would for all classes be (0-9).

*

(0.5 Points)

Will always be different for each of the neurons

Might be equal for each of the neurons

Will always be zero for each of the neurons

None of the above

9

The derivative of the activation function $f(x) = 1 / |x|$ at $x = 0$ is *

(0.5 Points)

1

0

- 0.5
- undefined due to the discontinuity in the function

10

Consider a single-layer Perceptron Network with a Sigmoid activation function. If the network has 3 neurons with weights [0.1, 0.9, 0.5] and a bias of -1.6, what will be the output of the network for the input [2, 1, 4] ? *****
(0.5 Points)

- 0.81
- 0.5
- 1
- None of the above

11

Which among the following is an activation function?

A - Mean Square Error, B – Softmax, C – ReLU, D – Cross Entropy

(0.5 Points)

- A & C
- A & D
- B & D
- B & C

12

If the depth of a network A is increased by a factor α and its width is increased by a factor of β , resulting in a network B. However, it is found that the number of operations, given by OPS(.), of A and B are same, i.e., $OPS(A)=OPS(B)$. Find the relation between α and β . *

(0.5 Points)

- $\alpha=\sqrt{\beta}$
- $\alpha=(1/\sqrt{\beta})$
- $\beta=\sqrt{\alpha}$
- $\beta=(1/\sqrt{\alpha})$

13

What parameters are used to plot the Receiver Operating Characteristics (ROC) curve for a classification model? *

(0.5 Points)

- Sensitivity; F-score
- Specificity; Accuracy
- Specificity; Precision
- Specificity; Sensitivity

14

Which of the following is a popular dataset for hand-written digit recognition *

(0.5 Points)

- NIST-SD19
- MNIST

DIGITS

All of the above

15

_____ denotes the total number of samples from a dataset that is used for calculating the gradient at each iteration in each epoch

*

(0.5 Points)

Epoch

Batch

Samples

None of these

16

What will happen to the weights of a neural network during training if the learning rate is set to zero? *

(0.5 Points)

Weight update will be very slow

Weight update will tend to zero but not exactly zero

Weights will be zero

Weights will not be updated

17

The output of a neural network $f(x) = g(wx + b)$ for an input x is given as $y = f(x)$, where $g(x) = x$. If the value of the mean squared error loss for some arbitrary input x_1 is $L = 0.5$, compute $\partial L / \partial x$. *

(0.5 Points)

- x
- $-2w$
- $-x$
- 0
- $-1.414w$

18

Consider a convolutional layer with 3 kernels with height and width 5. If the layer operates on a image of size $1 \times 115 \times 115$ with no zero padding and stride=2, what will be the size of the output? *

(0.5 Points)

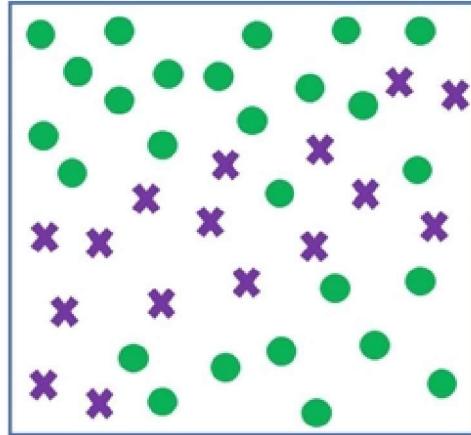
- $1 \times 56 \times 56$
- $1 \times 57 \times 57$
- $3 \times 56 \times 56$
- $3 \times 57 \times 57$

19

A dataset in a two-dimensional feature space is depicted in the diagram below. The dataset is divided into two classes, which are represented by green circles and purple cross, respectively. Which network is most appropriate for this binary classification task?

*

(0.5 Points)



- Multi-layer Perceptron with a linear activation function in the hidden layer.
- Linear Perceptron
- Multi-layer Perceptron with an appropriate non-linear activation function in the hidden layer.
- None of these is sufficient to learn about this binary classification task.

20

What is the size of the output of a max-pooling layer with filter size (3,3) and stride (2,1) for the input size $32 \times 223 \times 223$? *

(0.5 Points)

- $32 \times 111 \times 223$
- $32 \times 111 \times 221$
- $32 \times 110 \times 223$
- $32 \times 110 \times 111$

21

How many learnable parameters does a zero bias neural network with 30 input neurons, 20 hidden neurons and 3 output neurons have? *
(0.5 Points)

320

20

660

420

22

Which among the following is a commonly used software library for deep learning? *
(0.5 Points)

OpenGL

PyQt

OpenCV

PyTorch

23

Which among the following statements is/are TRUE?

Statement 1: MNIST dataset consist of images of handwritten digits, each of which is 28x28 pixels in size and has just one channel.

Statement 2: MNIST dataset consist of 60,000 test images and 10,000 train images.

Statement 3: MNIST dataset consist of images of handwritten digits, each of which is 28x28 pixels in size and has multiple channels.

Statement 4: MNIST dataset consist of 60,000 train images and 10,000 test images. *

(0.5 Points)

- Both statement 2 and 3
- Only statement 2 is true
- Both statement 1 and 4
- Both statement 1 and 2

24

An image of size $3 \times 128 \times 128$ is transformed to $3 \times 31 \times 31$ by a max-pooling layer of size 10×10 with stride 4 and padding 1. Calculate the number of weights that are needed to be learned? *

(0.5 Points)

- 100
- 3
- 20
- 0

25

```
class LeNet(nn.Module):
    def __init__(self):
        super(LeNet, self).__init__()
        self.conv1 = nn.Conv2d(1, 6, 5)
        self.pool = nn.MaxPool2d(2, 2)
        self.conv2 = nn.Conv2d(6, 16, 5)
        self.fc1 = nn.Linear(16 * 5 * 5, 120)
        self.fc2 = nn.Linear(120, 84)
        self.fc3 = nn.Linear(84, 10)

    def forward(self, x):
        x = self.pool(F.relu(self.conv1(x)))
        x = self.pool(F.relu(self.conv2(x)))
        x = x.view(-1, 16 * 5 * 5)
        x = F.relu(self.fc1(x))
        x = F.relu(self.fc2(x))
        x = self.fc3(x)
        return F.log_softmax(x)
```

Code snippet given below shows the architecture definition of standard LeNet-5 CNN for MNIST digit classification using PyTorch. What is the modification that needs to be made to train the network on CIFAR10 dataset? (CIFAR10 dataset contains RGB images) *

(0.5 Points)

- Remove the max-pooling layers.
- Change definition of layer 'conv1' to nn.Conv2d(3, 6, 5).
- Change definition of layer 'fc3' to nn.Linear(84, 100).
- Change definition of layer 'conv1' to nn.Conv2d(1, 6, 3).

26

Which of the following is/are TRUE about hidden layers in Neural Network? *
(0.5 Points)

- Hidden layers are not responsible for feature extraction.
- As the number of hidden layer increases, the accuracy of the network also increases.
- Hidden layer gives the abstract representation of the training data.
- All of these.

27

For a given input tensor x , a rotation operation ' $g(.,\theta)$ ' and another operation ' $f(.)$ ' which when applied on x produces valid output tensors.
Which of the following represents the rotational invariance of x ? *

(0.5 Points)

- $f(g(x,\theta))=g(f(x),\emptyset)$
- $g(x,\theta)=f(x)$
- $f(g(x,\theta))=g(f(x),\theta)$
- $f(g(x,\theta))=f(x)$

28

The basic element in the output tensor of an orientation pooling layer of Vector CNN is a _____. *
(0.5 Points)

vector

scalar

29

State whether the following statement is True or False. There always exists an analytical solution to the equation representing a neural network. *
(0.5 Points)

False

True

30

Which of the following cost functions is symmetric? (Consider p = target output and \hat{p} = predicted output) *
(0.5 Points)

$\|p - \hat{p}\|$

$p \log(p/\hat{p})$

Both of these cost function

None of these

31

Which of the following is TRUE about padding in CNN? *(0.5 Points)

- Padding is used in fully connected layer as well as in convolutional layer.
- Padding is used in pooling layer as well as in convolutional layer.
- Padding is used only in pooling layer.
- Padding is used in pooling layer as well as in fully connected layer.

32

Non linearity is introduced into the neural networks by
*
(0.5 Points)

- only non zero bias terms
- only activation functions
- both non zero bias terms and activation functions
- None of these

33

For a network A with a depth of 152, if the number of operations are 9 Billion. Compute the approximate number of operations for a similar network B with a depth of 101. *
(0.5 Points)

- Cannot be determined.
- 5.98 billion
- 13.54 billion

 9 billion

34

In a convolutional layer with $N \times N$ sized 1 channel input and $m \times m$ sized filter, what is the size of the output when operated under single stride and no padding? *
(0.5 Points)

- $(N-m+1) \times (N-m+1)$
- $(N+m+1) \times (N+m+1)$
- $(N-m-1) \times (N-m+1)$
- $(N-m+1) \times (N-m-1)$

35

Which of the following is a library to use NVIDIA GPUs? *
(0.5 Points)

- Pytorch
- CUDA
- Tensorflow
- None of the above

36

What will be the number of input neurons when classifying a three channel color image of size 28x28 using a fully connected neural network ? *
(0.5 Points)

- 3,072
- 784

2,352

1,024

37

Which of the following layers in a deep neural network does not have learnable parameters? *(0.5 Points)

Only MaxPool

Only ReLU

Both MaxPool & ReLU

None of these

38

Which CNN Architecture below uses 1×1 convolutions to introduce channel mixing in the model? *

(0.5 Points)

AlexNet

VGGNet

GoogLeNet

All of the above

39

Which of the following is/are TRUE about AlexNet? *(0.5 Points)

Only AlexNet contains 5 convolutional layer and 3 fully connected layers

Only First convolutional layer filters the $3 \times 224 \times 224$ input image with 96 kernels.

- Only Output of the last fully-connected layer is fed to a 1000-way softmax.
- All of these

40

Consider a convolutional kernel of size 3×3 applied on an input tensor x with a stride of 1 and padding 1 to get the output tensor y . Which of the following statement is true? *

(0.5 Points)

- The spatial dimensions of the output tensor y will be same as the input tensor x .
- The spatial dimensions of the output tensor y will not be same as the input tensor x .
- Both the spatial dimensions and the number of channels of the output tensor y will change
- The output tensor y will have less number of channels than the input tensor x .

41

Consider a perceptron with weights $[1,2,-2,-1;-1,-3,7,1]$ and bias $[-2; 1]$. Find the output if input to the network is $[4;3;2;1]^T$ *

(0.5 Points)

- [3,3]
- [2,3]
- [-1,1]
- [1,2,5,4]

42

*

(0.5 Points)

Identify the cost function given below,

$$J(.) = -\frac{1}{K} \sum_{k=1}^K \log (1 + e^{-o_k t_k})$$

(Consider o_k =output of the neural network, t_k = target response desired, and K= number of classes)

- Margin Loss
- Soft Margin loss
- Binary Cross-entropy loss
- Cross-entropy loss

43

State whether the following statement is True or False. The inception v3 block in GoogLeNet has convolutional filters of size 1×1 , 3×3 , 5×5 and combines their output using addition. *

(0.5 Points)

- False
- True

44

In a 10-class image classification problem, what is size of the one-hot target vector? *

(0.5 Points)

- 1×2
- 10×1
- 10×10
- None of these

45

Which of the following operations performed in Vector CNN is analogous to maxpooling operation performed in 2D CNN? *(0.5 Points)

- Min. Pooling
- Average Pooling
- Spatial Pooling
- Argmax

46

What is the function of Local Response Normalization (LRN) layer in VGG Net? *
(0.5 Points)

- It normalizes activations within a channel.
- It normalizes activations in a batch.
- It normalizes activations along the channels.
- It normalizes activations between different layers of the network.

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*(0.5 Points)

Identify the loss function

$$J(.) = -\frac{1}{K} \sum_{k=1}^K t_k \log \left(\frac{t_k}{o_k} \right)$$

Consider K= number of classes, t_k = target response and o_k = predicted response

- Negative Log Likelihood Loss.

- Binary Cross Entropy Loss.
- Kullback-Leibler Divergence Loss
- Soft Margin Loss

48

The Cross Entropy loss evaluates the *
(0.5 Points)

- The absolute difference between predictions with respect to the ground truths.
- The information of the ground truths with respect to the predictions.
- The difference between log predictions with respect to the ground truths.
- The information of the predictions with respect to the ground truths.

49

Which of the following is NOT a hyperparameter in a neural network? *
(0.5 Points)

- Weights and bias
- Learning Rate and momentum
- Number of neurons in a hidden layer and number of hidden layers
- Dropout factor

50

In a 10-fold cross validation setting for a dataset with 1.23M samples, what is the cardinality of the train and validation sets in an experiment and how many experiments will be performed in total? *
(0.5 Points)

- $|\text{train set}| = 1.107\text{M}$; $|\text{validation set}| = 0.123\text{M}$; 10 experiments.

- |train set|= 0.123M; |validation set|=0.123M; 10 experiments.
- |train set|= 1.107M; |validation set|=0.123M; 9 experiments.
- Insufficient information for calculation train-validation splits.
- |train set|= 0.123M; |validation set|=0.123M; 9 experiments.

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