Final Exam Format

Final exam will have three section as given below:

- **Part A** [10 x 3 points = 30] : It will have 10 MCQs containing 3 marks each.
- **Part B** [4 x 2 points = 8] : It will have 4 MCQs containing 2 marks each.
- **Part C** [2 x 6 points = 12]: It will have 2 MCQs containing 6 marks each.

Following are few examples of question:

Question 1: Suppose we have trained a regression model on a dataset. During evaluation, we observe the following:

1. The model has high training error and high validation error
2. The model exhibits a simple pattern and fails to capture the complexity of the underlying data
3. The model shows poor performance on both seen and unseen data

Based on these observations, what can be concluded about the model and its relationship with bias, variance, underfitting and overfitting.?

Options:

A. The model is underfitting the data with high bias and low variance.
B. The model is overfitting the data with low bias and high variance.
C. The model is experiencing a balanced tradeoff between bias and variance.

Answer: A. The model is underfitting the data with high bias and low variance.

Explanation: Underfitting occurs when a model is too simplistic to capture the underlying patterns in the data. It leads to poor performance on both training and validation data. In terms of bias-variance tradeoff, underfitting corresponds to high bias and low variance, as the model is not sensitive enough to the variations in the dataset.

Question 2: Consider the following scenarios. For each scenario, determine whether binary cross-entropy (BCE) or multi-class cross-entropy (MCE) is more suitable.

Scenario 1:
A sentiment analysis task where the goal is to classify movie reviews into positive or negative sentiments.

Scenario 2:
A handwritten digit recognition task where the goal is to classify images of digits from 0 to 9.

Scenario 3:
An email spam detection task where the goal is to classify emails into spam or non-spam categories.

Scenario 4:
A flower species classification task where the goal is to classify images of flowers into multiple categories such as roses, sunflowers, and tulips.

Options:

A. BCE for Scenario 1 and Scenario 3, MCE for Scenario 2 and Scenario 4.
B. MCE for Scenario 1 and Scenario 3, BCE for Scenario 2 and Scenario 4
C. BCE for all scenarios
D. MCE for all scenarios

Answer: A. BCE for Scenario 1 and Scenario 3, MCE for Scenario 2 and Scenario 4.

Question 3: How does k-fold cross-validation help to improve model accuracy?

1. It trains on more training samples, allowing the model to learn from more data.
2. It reduces the chance of overfitting by assessing the model's performance on multiple subsets of the data.
3. It improves the generalization ability of the model by evaluating it on different test sets.

Options:

A. Only 1 and 2
B. Only 2
C. Only 3

D. 1, 2 and 3

Answer: D. 1, 2 and 3

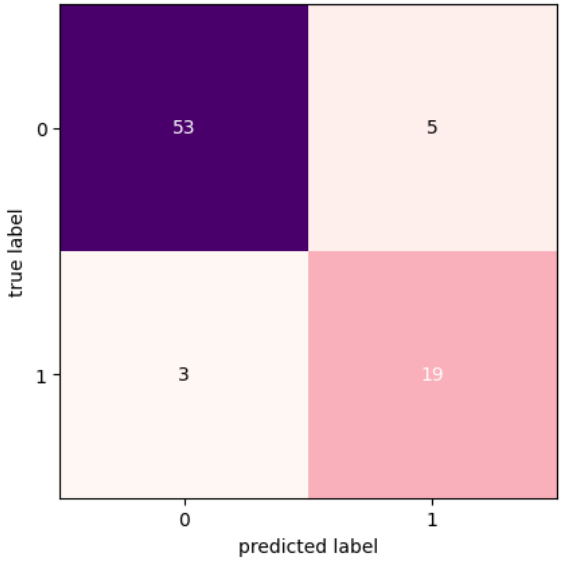
Question 4: Which of the following statements is FALSE regarding transfer learning in machine learning?

Options:

A. Transfer learning involves utilizing pre-trained models that have learned features from a large-scale dataset.
B. Transfer learning can help improve model performance in tasks with limited labeled data.
C. Transfer learning requires discarding the pre-trained model and training the model from scratch.
D. Transfer learning involves fine-tuning a pre-trained model on a target task-specific dataset

Answer: C. Transfer learning requires discarding the pre-trained model and training the model from scratch.

Question 5: The image given below shows a sample confusion matrix plot for a binary image classification problem. While predicting an input image using the trained model, the predicted label would be either 0 or 1. What percentage of samples are predicted correctly out of all the samples that are predicted as the class '0'?



Options:

A. 79%
B. 95%
C. 86%
D. 91%

Answer : B. 95%

Explanation: The question is asking precision for negative class indirectly.

Expression for Precision:

$$\text{Precision} = \frac{\mathbf{TruePositive}}{\mathbf{TruePositive+FalsePositive}}$$

And for Recall:

$$\text{Recall} = \frac{\mathbf{TruePositive}}{\mathbf{TruePositive+FalseNegative}}$$

From the confusion matrix:

True positive count = 19
False positive count =5
False Negative count=3
True negative =53

Precision = 19/(19+5) → 79.1% ~ 79% for class 1 (Positive)
Precision = 53/(53+3) → 94.6% ~ 95% for class 0 (Negative)

Recall =19/(19+3) → 86.3% ~ 86 % for class 1 (Positive)
Recall =53/(53+5) → 91.3% ~91% for class 0 (Negative)

Question 6: Which of the following is necessary for an autoencoder in the context of image data?

Options:

A. Transpose convolution
B. Depth-wise separable convolution
C. Inception layer
D. 1x1 convolution

Answer: A. Transpose convolution

Explanation: In autoencoder, upsampling is required in the decoder part which is achieved through Transpose convolution.

Question 7: For visualizing ConvNet filters, which of the following is correct?

Options:

A. Try to display/plot filters in any layer.
B. Try to get/plot the image that excites the filters most at any layer.
C. Try to display/plot the filters in any layer along with the activations.
D. Try to plot the activations when the filters get most excited.

Answer: B. Try to get/plot the image that excites the filter most at any layer.

Question 8: Consider the following statements.

1. In image segmentation tasks MaxPooling layers are preferred to downsample feature maps.
2. Object Localization is a Regression task
3. Object detection is tasked with localizing the objects present in an image and simultaneously classifying them into different categories, with Intersection Over Union as the loss function.
4. Semantic segmentation will not only classify two pixels belonging to different object instances of the same class category but also identifies their object instance.

Select TRUE option/s:

A. 2 and 4
B. 1 and 2
C. 2 and 3

D. Only 2

Answer: D: Only 2.

Question 9: I have collected 1300 images for the classification task but have labels for only 300 images. Now, what might be the most suitable approach for building the model without labeling the remaining 1000 images?

Options:

A. Use only 300 labeled images and build the model & train.
B. Train an auto-encoder with unlabeled 1000 images. Copy the complete auto-encoder with trained parameters (non_trainable), add trainable layers on top of it, and train with 300 labeled data.
C. Train an auto-encoder with unlabeled 1000 images. Copy the encoder with trained parameters (non_trainable), add trainable layers on top of it, and train with 300 labeled data.
D. Train an auto-encoder with unlabeled 1000 images. Copy the decoder with trained parameters (non_trainable), add trainable layers on top of it, and train with 300 labeled data.

Answer: C. Train an auto-encoder with unlabeled 1000 images. Copy the encoder with trained parameters (non_trainable), add trainable layers on top of it, and train with 300 labeled data.

Question 10: Consider the following architecture of Convolutional Neural Network.

Layer-1:Conv2D Number of Filters = 10, Filter Size = 3 X 3, Stride = 1, Padding = valid
Layer-2:Conv2D Number of Filters = 20, Filter Size = 5 X 5, Stride = 2, Padding = valid
Layer-3:Conv2D Number of Filters = 40, Filter Size = 5 X5 , Stride = 2, Padding = valid
Layer-4: Flatten

Determine the number of units in a Flatten layer when an RGB image of size 39 × 39 passes through the network.

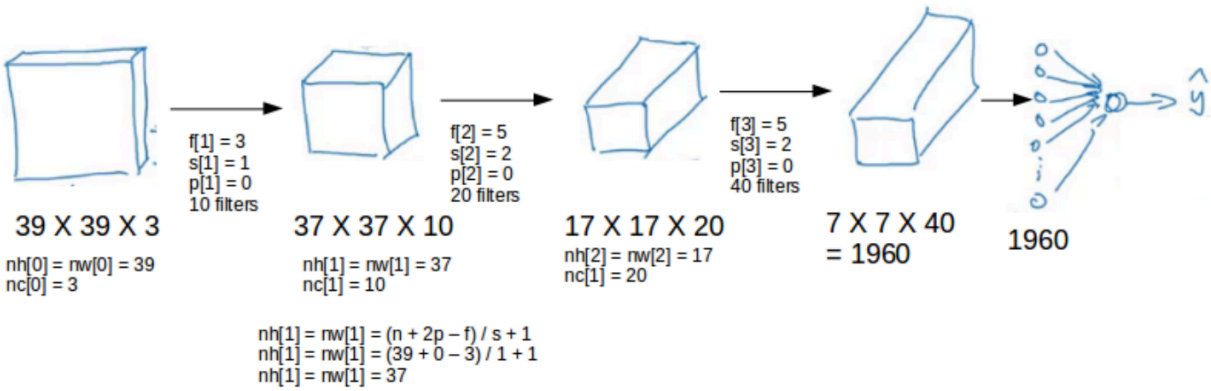
Options:

A. 1860
B. 1900
C. 1960

D. 1800

Answer: C: 1960

Explanation:



nh[1] = nw[1] = (n + 2p – f) / s + 1
nh[1] = nw[1] = (39 + 0 – 3) / 1 + 1
nh[1] = nw[1] = 37