Exam.Code:0924
Sub. Code: 6580

2054

B.E. (Information Technology) Sixth Semester

OEIT-601: Deep Learning

Time allowed: 3 Hours | Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

x-x-x

1. Attempt the following:-

a. What role do activation functions play in a multilayer perceptron?
b. Explain the concept of weight initialization in the context of a feedforward neural network.
c. Describe the key difference between stochastic gradient descent and batch gradient descent in training a neural network.
d. What is the purpose of regularization techniques such as L1 or L2 regularization in training autoencoders?
e. What are the main advantages of using the Adam optimization algorithm compared to traditional gradient descent methods in training neural networks?
f. How does dataset augmentation contribute to improving the performance of a neural network model?
g. What role does batch normalization play in training deep neural networks, and how does it address the vanishing/exploding gradient problem?
h. Explain how convolutional neural networks (CNNs) can capture spatial hierarchies and patterns in image data.
i. How do recurrent neural networks (RNNs) differ from feedforward neural networks, and what types of tasks are RNNs particularly well-suited for?
j. What is the purpose of an attention mechanism in a neural network, and how does it improve the performance of sequence-to-sequence models? (10x1)

PART - A

2. You are a data scientist working for a financial institution. The company is interested in predicting whether a loan applicant is likely to default based on various financial and personal features. You decide to use a multilayer perceptron (MLP) for this task.

   Explain how you would design the architecture of the MLP to effectively capture the representation power needed to predict loan default risk. In your answer, discuss the number of layers, the size of each layer, the choice of activation functions, and any additional techniques you would employ to enhance the MLP's representation power.(10)

3. You are a researcher working on a computer vision project involving image recognition. Your team is exploring the use of eigenvalues and eigenvectors for dimensionality reduction.

   Describe how eigenvalues and eigenvectors can be utilized in the context of dimensionality reduction for image recognition tasks. Explain the significance of eigenvalues and eigenvectors in this process and how they help preserve the most important information while reducing the computational complexity of the data. Additionally, discuss any potential challenges or limitations associated with using eigenvalues and eigenvectors for dimensionality reduction in image recognition. (10)

P.T.O.

4. a) Explain the concept of sparsity in the context of autoencoders. Discuss how sparse autoencoders differ from traditional autoencoders and outline the mechanisms used to enforce sparsity during training.

b) Describe the backpropagation algorithm used in training neural networks. Explain the key steps involved in backpropagation, including forward pass, backward pass, and weight updates. Discuss the role of the chain rule in calculating gradients and how it enables efficient optimization of neural network parameters. (2x5)

PART - B

5. a) Provide a comprehensive explanation of ResNet architecture, including its fundamental building blocks such as residual blocks and skip connections. Discuss how ResNets address the vanishing gradient problem and enable the training of extremely deep neural networks.

b) Explain the concept of dropout and how it works during the training process. Discuss the intuition behind dropout and how it helps prevent overfitting in neural networks. (2x5)

6. a) Provide a detailed explanation of the DeepArt algorithm, including its underlying principles and key components. Discuss how DeepArt combines deep neural networks with optimization techniques to transfer the style of one image onto another while preserving the content.

b) Explain the concept of L2 regularization and how it is applied to the training process. Discuss the role of the regularization parameter (lambda) in controlling the strength of regularization and its impact on the model's performance. (2x5)

7. You are a data scientist working for a healthcare company that specializes in remote patient monitoring. Your team is tasked with developing a predictive model to forecast patient health outcomes based on time-series data collected from wearable devices. Due to the sequential nature of the data, you decide to use Long Short-Term Memory (LSTM) networks for this task.

Outline the architecture and functioning of LSTM networks in the context of predicting patient health outcomes from time-series data collected from wearable devices. Describe the key components of LSTM units, such as memory cells, input and forget gates, and output gates, and explain how they facilitate learning long-term dependencies in sequential data. (10)

x-x-x