Assessment 4

1. What is the purpose of the activation function in a neural network, and what are some commonly used activation functions?

The activation function decides whether a neuron should be activated or not by calculating the weighted sum and further adding bias to it. The purpose of the activation function is to introduce non-linearity into the output of a neuron.

2. Explain the concept of gradient descent and how it is used to optimize the parameters of a neural network during training.

Gradient Descent stands as a cornerstone orchestrating the intricate dance of model optimization. At its core, it is a numerical optimization algorithm that aims to find the optimal parameters—weights and biases—of a neural network by minimizing a defined cost function.

3. How does backpropagation calculate the gradients of the loss function with respect to the parameters of a neural network?

Backpropagation computes the gradient of a loss function with respect to the weights of the network for a single input–output example, and does so efficiently, computing the gradient one layer at a time, iterating backward from the last layer to avoid redundant calculations of intermediate terms in the chain rule.

4. Describe the architecture of a convolutional neural network (CNN) and how it differs from a fully connected neural network.

It has three layers namely, convolutional, pooling, and a fully connected layer. It is a class of neural networks and processes data having a grid-like topology. The convolution layer is the building block of CNN carrying the main responsibility for computation.

5. What are the advantages of using convolutional layers in CNNs for image recognition tasks?

- No require human supervision required.
- Automatic feature extraction.
- Highly accurate at image recognition & classification.
- Weight sharing.
- Minimizes computation.
- Uses same knowledge across all image locations.
- Ability to handle large datasets.
- Hierarchical learning.

6. Explain the role of pooling layers in CNNs and how they help reduce the spatial dimensions of feature maps.

Pooling Layers, also known as downsample layers, are an essential component of convolutional neural networks (CNNs) used in deep learning. They are responsible for reducing the spatial dimensions of the input data, in terms of width and height, while retaining the most important information.

7. How does data augmentation help prevent overfitting in CNN models, and what are some common techniques used for data augmentation?

This can be done by applying transformations to the data, such as cropping, rotating, or flipping images. Data augmentation is used to improve the performance of machine learning models by reducing overfitting. Overfitting occurs when a model learns the training data too well and is unable to generalize to new data.

8. Discuss the purpose of the flatten layer in a CNN and how it transforms the output of convolutional layers for input into fully connected layers.

The flatten layer typically appears after the convolutional and pooling layers in convolutional neural network (CNN) architectures. It acts as a bridge between the convolutional/pooling layers, which extract spatial features, and the fully connected layers, which perform classification or regression tasks.