Practice Questions for Mid-Semester Test

COMP3010 Machine Learning

Question 1 – Machine learning methods and problem formulation

You are developing a machine learning system to classify the images into two different classes: red images and green images.

- Name a suitable method for this task and justify your answer.
- Use this example with the named method to describe the four important key components of a machine learning algorithm.

Question 2: Multilayer Perception (MLP)

Suppose you are implementing an MLP network with two hidden layers which share both their weights and biases, and a linear output layer, for image classification with 5 classes, and the input image size is 20x20.

2.1. Define the MLP model with nn.sequential().
2.2. Write the encoding of the class labels.
2.3. Name the loss function.
2.4. Draw the computational graph of the forward propagation path.

Question 3. Regularisation

3.1. Explain why regularization methods are required in training neural networks.

3.2. Name two regularisation methods and briefly explain how to use them in training of neural networks

Question 4. **Hyper-parameters**

With an example to explain what hyper-parameters are in training of neural networks and how they should be selected.

Question 5 – Convolutional Neural networks

5.1. Suppose 3x3 convolution kernels are used in a convolutional neural network with three convolutional layers, what is the receptive field of the element in the last convolutional layer? How many layers do we need if a receptive field of 21x21 is required?

5.2. Describe how the neurons of convolutional neural networks and multilayer network are designed differently and why convolutional neural networks are more suitable for image classification tasks.

5.3. Consider the following image

1	1	2	2	2
1	0	0	2	1
1	0	1	0	0
0	0	2	2	0
2	2	2	1	1

and a convolution kernel below with stride 2 and zero padding (2,2).

0	0	1
0	1	0
1	1	0

What is the output of the convolution?

END OF TEST