

SECTION A:

1. What do you mean by convolution or correlation operation in CNN? **1.5 points**
2. What do you mean by max-pooling in CNN? What could be the advantage of it? **1.5 points**
3. How does adam optimizer differ from SGD? **1.5 points**
4. What do you mean by the vanishing gradient issue? What are the different measures you will consider to minimize it? **2 points**
5. What advantages could the transformer model have over LSTM based attention network model? What do you mean by multi-head attention in transformer? **2 points**
6. What do you mean by object localization and classification in the image? What do you mean by Intersection over Union (IoU) metric? What do you mean by average precision (Precision-Recall Curve)? **2.5 points**
7. Describe the NodeDrop Out (layer) in the ANN? what is the use of it? **1.5 points**
8. Draw and Denote the LSTM cell. Why is LSTM preferable over standard RNN architecture? **2 points**
9. Write an algorithm or pseudocode or steps to train Vanilla GAN. Use binary cross entropy as an objective function for the discriminator. **2 points**
10. Give a mathematical expression for logistic regression and associated objective (e.g. loss) function. **1.5 points**
11. Describe the Z-score or standard scalar or z-normalization. Write a mathematical expression for it and denote it. What is the mean, variance and distribution of z-normalized data? **2 points**

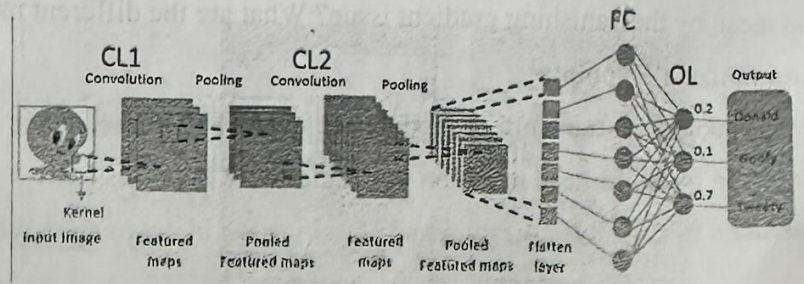
Section B

Note: write a code in Python using Keras or Tensorflow library functions. Here, it assumes that data is pre-processed and normalized. You are not required to show the import of various modules in the code.

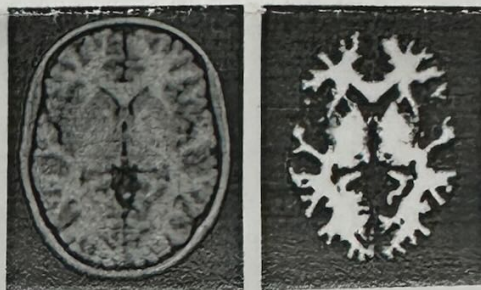
- (1) Define a non-linear multilayer perceptron model for time series prediction. Here, you need to predict x_{t+1} given past ten $(x_t, x_{t-1}, x_{t-2}, \dots, x_{t-9})$ data points. You need to define the number of layers, number of neurons, activation function for each layer, and preferable cost function. For this question, you do not need to write a code. **2 points**
- (2) Write a code for training non-linear regression ANN model. **2 points**
No. of features: 1000
Four hidden layers
Out of four, the middle two hidden layers have a dropout rate of 0.25
No. of output variable: 4

- (3) Write a code for a following CNN image classification model. 2 points

The input image size is 256x256 (grayscale). The kernel/filter size is 3x3 on the CNN layer. There are 32 filters in the CL1 layer and 64 in the CL2 layer. The convolution type or padding is "valid". Pooling is 2x2. Stride is one everywhere in convolution layer, number of class is three.



- (4) You are required to do binary image segmentation using deep learning model. Input image is size of 256X256(gray scale) and corresponding binary image mask is available for training. Write code for CNN encoder-decoder model for it. Model have at least five convolution layers, at least on skip connection, at least on max-pooling layer and some kind of regularization. 2 points



Input Gray Scale Image

Binary Mask

- (5) Compute the number of TP, FP, TN and FN for *Lion* class. 2 points

		Predicted			
	classes	<i>Tiger</i>	<i>Lion</i>	<i>Leopard</i>	<i>Jaguar</i>
Actual	<i>Tiger</i>	400	30	100	10
	<i>Lion</i>	30	200	0	25
	<i>Leopard</i>	0	20	300	50
	<i>Jaguar</i>	10	10	40	100