Department of Data Science
IIT Palakkad

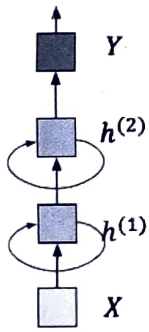
DS5007 : Deep Learning

08:00-08:50 am Test I (18 February, 2025) **Marks : 15**

Instructions

1. Write your answers neatly in Blue/ Black ink. Do not use pencil / Red ink. If your answer is not legible, you will not get any marks for that.
2. Doubts and questions will not be answered during the exam. If you have to make any assumption about unspecified things, write the assumption clearly with justification.
3. Answer all parts of a question together. If the parts of a single question are not together, then only the first part will be evaluated. Other parts will not get any marks.
4. No material and electronic gadgets are permitted in the exam hall.

1. (5 points) Write all update equations for the forward pass of the given architecture in including the activation function considering all input(X), hidden variable($h^{(1)}$ and $h^{(1)}$).



and output(Y) are vectors.

2. (2 points) Write update step according to Adaptive Moment (ADAM) Optimizer to minimize $\log \sigma(\theta^T x)$ with respect to θ.

3. Let us consider datasets of the form $\{[(x_1, \ldots, x_d), y_i]\}_{i=1}^n$, where x_i are data points and y_i are the labels. For a given dataset $\{[(0,0), -1], [(1,0), 1], [(0,1), 1], [(1,1), -1]\}$ derive the Perceptron weights which will minimize the error. Please do the following:
   (a) (1 point) Define your perceptron model specifying all details of the model.
   (b) (4 points) Show the computation steps(forward and back-propagation) to obtain the learned parameters.

4. (a) (1 point) Evaluate the size of a output feature map, given that the image size is 32x32, the filter size is 5x5, stride is 2, and no padding.
   (b) (1 point) What is pooling? Why is it important?
   (c) (1 points) Write down 2D convolution function.