BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Neural Networks & Fuzzy Logic (BITS F312) [1st Semester, 2020-2021]
Comprehensive Exam. – Part-2

Max Time- 45 min | Max Marks - 35 | Date: 15.12.2020

Q1 (a) Covid test is being done on a population of 1 lakh , havng covid prevalence of 5%. Test has both sensitivity and specificity of 90%. [4+2+2=8]

(i) Write values of four entries of confusion matrix
(ii) What percentage of population will receive incorrect result when they test positive?
(iii) What percentage of population will receive incorrect result when they test negative?

Q1 (b) Values of all elements of all weight matrices of LSTM cell is 0.1, bias=0.

$$x_1 = [0.2, 0.3], h_0 = c_0 = [0.1, 0.2, 0.3]$$

All gates are partially open. Find (i) output of forget gate (ii) cell state c_1 (iii) hidden state h_1

[Truncate values after four decimal places, answers without correct dimension will not fetch marks. All steps must be shown] [2+3+2=7]

Q2 (a) A B&W 5x5 image is convolved with 3x3 filter, S=1, padding ”same”

$$\mathrm{Im}age = \begin{matrix} 1 & 2 & 10 & 3 & 10 \\ 8 & 6 & 8 & 10 & 12 \\ 0 & 20 & 5 & 10 & 5 \\ 20 & 0 & 10 & 2 & 1 \\ 10 & 0 & 0 & 5 & 2 \end{matrix}; \qquad Filter = \begin{matrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{matrix}$$

I. Draw the input image on which convolution is performed
II. Find value of the central pixel of the convolved image [2+3=5]

Q2 (b) Feedforward TDNN(Time delay neural network) is being trained to predict sale of 3 items using historical records of previous years. When actual sale at the end of a month along with predicted sale of the same month by TDNN is given, it predicts sale at end of next month.

Normalized sales at the end of January is [0.2,0.3,0.6]. predicted sales by TDNN for month of Jan when sale at the end of month of Dec. was inputted was [0.7,0.2,0.5] and actual sales from records at end of Feb is [1,0,1].

Hyperparameters: One hidden layer with one hidden node, learning rate is unity, activation function at hidden layer is tanh and at output layer is Softplus. All weights are 0.1. No bias. Truncate all values upto four decimal of places.

(i) Draw the architecture of TDNN
(ii) Perform forward pass.
(iii) Calculate error vectors at output and hidden layer
(iv) Calculate change in weights from hidden to output layer [2+4+6+3=15]

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