Nirma University
Institute of Technology
B. Tech CSE Sem. VI
2CSDE61 – Deep Learning
Additional Test, May 2021

Total Marks: 35 Time: 75 minutes

Roll No. [ ] Supervisor's initial with date [ ]

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever necessary and specify clearly.

Q 1 CO2	Assume a convolutional layer with some input volume (denoted as I, I=$\begin{bmatrix} I11 & I12 & I13 \\ I21 & I22 & I23 \\ I31 & I32 & I33 \end{bmatrix}$) of size 3 x 3. Assume that there is 1 convolutional filter (F = $\begin{bmatrix} F11 & F12 \\ F21 & F22 \end{bmatrix}$) of size 2 x 2, 2P=1 (left-top padding) and stride S=1, producing output volume O = $\begin{bmatrix} O11 & O12 \\ O21 & O22 \end{bmatrix}$ in the forward propagation. During backpropagation, what would be gradients with respect to activations of I? Write equations for these gradients in terms of just the global and local gradients. Please note there would be 9 equations in total which you should state clearly and separately.	[9]
Q 2 CO3	Assume a single Inception V1 module (with dimension reduction). Assume the size of the input volume to this module is 28 x 28 x 192 and the module uses 64 number of 1 x 1 convolution, 96 number of 3 x 3 reduce, 128 number of 3 x 3 convolution, 16 number of 5 x 5 reduce, 32 number of 5 x 5 convolution and 32 number of max pool projections. How many connections (or in other words, ops) are involved in this module? Write the exact value as the answer. Ignore bias in calculation.	[9]
Q 3 CO2	What are anchor boxes in object detection? How are they useful? https://towardsdatascience.com/anchor-boxes-the-key-to-quality-object-detection-ddf9d612d4f9	[4]
Q 4 CO2	Why does LSTM not suffer from vanishing gradient problem?	[3]
Q 5 CO2	In words, state the objective/loss function of generator and discriminator separately. https://neptune.ai/blog/gan-loss-functions	[4]
Q 6 CO1	Differentiate between machine learning and deep learning in brief.	[3]

Q 7 CO3	Differentiate between semantic segmentation, instance segmentation and object detection.	[3]

4. Why does LSTM not suffer from vanishing gradient problem?

In LSTMs, however, the presence of the forget gate, along with the additive property of the cell state gradients, enables the network to update the parameter in such a way that the different sub gradients in (3) do not necessarily agree and behave in a similar manner, making it less likely that all of the T gradients in (3) will vanish, or in other words, the series of functions does not converge to zero:
Summing up, we have seen that RNNs suffer from vanishing gradients and caused by long series of multiplications of small values, diminishing the gradients and causing the learning process to become degenerate. In a analogues way, RNNs suffer from exploding gradients affected from large gradient values and hampering the learning process.
LSTMs solve the problem using a unique additive gradient structure that includes direct access to the forget gate's activations, enabling the network to encourage desired behaviour from the error gradient using frequent gates update on every time step of the learning process.

5. Difference between machine learning and deep learning

5 key differences between machine learning and deep learning
While there are many differences between these two subsets of artificial intelligence, here are five of the most important:

1. Human Intervention
Machine learning requires more ongoing human intervention to get results. Deep learning is more complex to set up but requires minimal intervention thereafter.

2. Hardware
Machine learning programs tend to be less complex than deep learning algorithms and can often run on conventional computers, but deep learning systems require far more powerful hardware and resources. This demand for power has driven has meant increased use of graphical processing units. GPUs are useful for their high bandwidth memory and ability to hide latency (delays) in memory transfer due to thread parallelism (the ability of many operations to run efficiently at the same time.)

3. Time
Machine learning systems can be set up and operate quickly but may be limited in the power of their results. Deep learning systems take more time to set up but can generate results instantaneously (although the quality is likely to improve over time as more data becomes available).

4. Approach
Machine learning tends to require structured data and uses traditional algorithms like linear regression. Deep learning employs neural networks and is built to accommodate large volumes of unstructured data.

5. Applications
Machine learning is already in use in your email inbox, bank, and doctor's office. Deep learning technology enables more complex and autonomous programs, like self-driving cars or robots that perform advanced surgery.