

Assignment 6 – Review

1. What is the vanishing gradient problem in deep learning and how can it be mediated?

Answer: -

Deep learning has lot of hidden layers. As we take derivative of the loss function the value becomes very small numerically to be precise it tends to zero. One of the ways to mediate is by carefully choosing the weights at random. The should neither be too small or too big.

2. [5 Marks] What is the result when convolving the array A with the filter B without padding?

```
A= array([[0, 0, 0, 2],
          [2, 1, 0, 0],
          [2, 1, 0, 2],
          [2, 2, 2, 1]])
And    B= array([[2, 0, 1],
                 [0, 0, 0],
                 [2, 0, 1]])
```

Answer: -

A convolution B = array([[4, 6], [10, 7]])

First step of convolution process:

$$0*2 + 0*0 + 0*1 + 2*0 + 1*0 + 0*0 + 2*2 + 1*0 + 0*1 = 4$$

This step gives us the first element of the process.

Same way we repeat until we get less elements than the filter size (here B)

This output is taken from the program done for assignment 5.

3. What is a pooling operation in convolution neural networks and why is this operation important?

Answer: -

Once we have a convolved image, we try to divide this image into $i \times j$ disjoint regions and apply statistical functions (mean, variance, median, standard deviation, and others) over this region to get a single scalar quantity. This process is repeated until we have covered all the feature from the convolved image. Values of i and j can be selected as per user.

Pooling helps in representing an image at a higher level or in other words it helps to identify more high-level characteristics of the given image.

4. What is a gated recurrent network? Name an example of such a neural network.

Answer: -

As we understand that the basic RNN has the form of memory that takes earlier states into account. But this memory is kept for a very short term. This is not always sufficient for some applications (eg., natural language processing). To be more specific this memory should kick in at appropriate time and we need to keep this in memory for longer time. LSTM (Long Short Term Memory), GRU (Gated Recurrent Unit) which is a simplified version of LSTM are few examples of such a neural network.

5. In reinforcement learning, what is a policy?

Answer: -

Policy or control policy specifies which action 'a' to take from each state 's' at a given time. It can be defined mathematically as below,

$$\text{Policy: } a_t = \pi(s_t)$$

6. Explain the difference between the SARSA and Q-Learning algorithm.

Answer: -

SARSA (State Action Reward State Action) works with **on-policy** method. It means that this algorithm follows a policy. It also uses back propagation i.e., it updates the previous state's value of action by revisiting that state from the next state.

Q-learning works with **off-policy** method. It means we check all the possible actions from the state that we evaluate and update the value function with the maximal expected return. As we need to explore the environment we use exploration methods such as epsilon greed or softmax exploration strategy.

7. Briefly explain 'dropout' and why it is used in deep networks.

Answer: -

Dropout means omitting certain number of the units from the hidden layers along with their connections from the neural network during training.

It is a regularization technique which helps to solve the overfitting of the model.