

Assignment 02

Deep Learning Essentials

Instructions:

Answer the following questions based on the concepts covered in the lectures. Use external resources to research (i.e. Google) to explore and expand your understanding. Each question should be answered in **150–200 words**.

Question 1: Learning Rate Scheduling in Gradient Descent

In the lecture on Gradient Descent, we learned about the importance of the learning rate in optimizing neural networks. However, using a fixed learning rate can sometimes lead to suboptimal results. Research and describe **two learning rate scheduling techniques** (e.g., Learning Rate Decay, Cyclical Learning Rates, or Step Decay). Explain how these techniques adjust the learning rate during training, their benefits, and in what scenarios they are most effective.

Question 2: The Role of Computation Graphs in Backpropagation

The lecture on Forward and Backward Propagation introduced computation graphs as a way to visualize the flow of calculations in neural networks. Research and explain **how computation graphs are used in backpropagation** to calculate gradients efficiently. Provide an example of a simple computation graph e.g., for a function like

$$f(x,y)=x \cdot y+z$$

and show how gradients are computed using the chain rule.

Question 3: Applications of Fully Connected Neural Networks

In the lecture on Fully Connected Neural Networks (FCNNs), we discussed their structure and basic applications. However, FCNNs are used in many advanced real-world applications. Research and describe **two advanced applications of FCNNs** (e.g., medical diagnosis, autonomous driving, or recommendation systems).

Explain how FCNNs are adapted to handle the specific challenges of these applications and what makes them suitable for these tasks.

Grading Criteria

Each question is worth **10 marks**, and the assignment is graded out of a total of **30 marks**. The grading will be based on the following criteria:

1. Accuracy and Depth of Explanation (4 marks):

- The answer should accurately explain the concepts and provide sufficient depth.
- Use of relevant examples or applications to support the explanation.

2. Clarity and Organization (3 marks):

- The answer should be well-structured, clear, and easy to follow.
- Proper use of paragraphs, headings, and bullet points (if applicable).

3. Research and Exploration (2 marks):

- Evidence of research beyond the lecture content.
- Use of credible external resources to enhance the explanation.

4. Originality and Reflection (1 mark):

- The answer should demonstrate original thought and personal reflection.
- Avoid copying directly from sources; paraphrase and synthesize information.

Total Marks: 30

- Question 1: 10 marks
- Question 2: 10 marks
- Question 3: 10 marks

Good luck!