Assignment 02: Deep Learning Essentials

Question 1: Learning Rate Scheduling in Gradient Descent

Learning rate scheduling is a technique used to adjust the learning rate dynamically during training to improve convergence and
prevent oscillations or getting stuck in local minima. Using an inappropriate learning rate can result in slow training, suboptimal convergence,
or even divergence. Two common techniques to optimize this are:

1. Step Decay

- Reduces learning rate by a fixed factor after a set number of epochs.
- Benefits: Prevents drastic changes, ensures steady convergence.
- Best Use Cases: Effective for CNNs and deep networks.

2. Cyclical Learning Rates (CLR)

- Oscillates the learning rate between a lower and upper bound.
- Benefits: Avoids stagnation, enhances generalization.
- Best Use Cases: Useful in reinforcement learning and deep networks.

Question 2: The Role of Computation Graphs in Backpropagation

Computation graphs visually represent mathematical operations in neural networks, helping in efficient gradient calculation
during backpropagation. Each node represents a mathematical operation, and edges denote dependencies.

Example: Function f(x, y, z) = x * y + z

- df/dx = y
- df/dy = x
- df/dz = 1

Question 3: Applications of Fully Connected Neural Networks

1. Medical Diagnosis

- Used for disease detection from medical images and patient records.
- Challenges: High-dimensional data, interpretability issues.
- Adaptations: Transfer learning, feature selection, explainable AI.

2. Recommendation Systems

- Used in e-commerce and streaming services for personalized content.
- Challenges: Handling large-scale datasets, real-time updates.
- Adaptations: Hybrid models with collaborative filtering and deep learning.

References

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