Batch Normalization

Assignment Questions

Objective: The objective of this assignment is to assess students' understanding of batch normalization in artificial neural networks (ANN) and its impact on training performance.

Q1. Theory and Concepts:

1. Explain the concept of batch normalization in the context of Artificial Neural Networks.
2. Describe the benefits of using batch normalization during training.
3. Discuss the working principle of batch normalization, including the normalization step and the learnable parameters.

Q2. Implementation:

1. Choose a dataset of your choice (e.g., MNIST, CIFAR-10) and preprocess it.
2. Implement a simple feedforward neural network using any deep learning framework/library (e.g., TensorFlow, PyTorch).
3. Train the neural network on the chosen dataset without using batch normalization.
4. Implement batch normalization layers in the neural network and train the model again.
5. Compare the training and validation performance (e.g., accuracy, loss) between the models with and without batch normalization.
6. Discuss the impact of batch normalization on the training process and the performance of the neural network.

Q3. Experimentation and Analysis:

1. Experiment with different batch sizes and observe the effect on the training dynamics and model performance.
2. Discuss the advantages and potential limitations of batch normalization in improving the training of neural networks.

Submission Guidelines:

- **Complete the assignment in a Jupyter Notebook.**
- **Include necessary comments and explanations to make your code understandable.**
- **Provide visualizations, tables, and explanations for your analysis and findings.**
- **Create a GitHub repository to host your assignment files.**
- **Rename your Jupyter Notebook file using the format "date_month_topic.ipynb" (e.g., "12_July_Regression.ipynb").**
- **Place your Jupyter Notebook file (.ipynb) in the repository.**
- **Ensure that the notebook runs without errors.**
- **Commit and push any additional files or resources required to run your code (if applicable) to the repository.**
- **Make sure the repository is publicly accessible.**

Grading Criteria:

- **Understanding of Batch Normalization (30%)**
- **Implementation and Experimental Analysis (40%)**
- **Analysis and Interpretation (20%)**
- **Organization, Clarity, and Presentation (10%)**

Note: The actual grading may vary based on specific guidelines and requirements.

Note: *Create your assignment in Jupyter notebook and upload it to GitHub & share that uploaded assignment file link through your dashboard. Make sure the repository is public.*