Optimizers

Assignment Questions

PW SKILLS

Objective: Assess understanding of optimization algorithms in artificial neural networks. Evaluate the application and comparison of different optimizers. Enhance knowledge of optimizers' impact on model convergence and performance.

Part 1: Understanding Optimizers

1. What is the role of optimization algorithms in artificial neural networks? Why are they necessary?
2. Explain the concept of gradient descent and its variants. Discuss their differences and tradeoffs in terms of convergence speed and memory requirements.
3. Describe the challenges associated with traditional gradient descent optimization methods (e.g., slow convergence, local minima). How do modern optimizers address these challenges?
4. Discuss the concepts of momentum and learning rate in the context of optimization algorithms. How do they impact convergence and model performance?

Part 2: Optimizer Techniques

5. Explain the concept of Stochastic Gradient Descent (SGD) and its advantages compared to traditional gradient descent. Discuss its limitations and scenarios where it is most suitable.
6. Describe the concept of Adam optimizer and how it combines momentum and adaptive learning rates. Discuss its benefits and potential drawbacks.
7. Explain the concept of RMSprop optimizer and how it addresses the challenges of adaptive learning rates. Compare it with Adam and discuss their relative strengths and weaknesses.

Part 3: Applying Optimizers

8. Implement SGD, Adam, and RMSprop optimizers in a deep learning model using a framework of your choice. Train the model on a suitable dataset and compare their impact on model convergence and performance.
9. Discuss the considerations and tradeoffs when choosing the appropriate optimizer for a given neural network architecture and task. Consider factors such as convergence speed, stability, and generalization performance.

Submission Guidelines:

- **Answer all the questions in a single Jupyter Notebook file (.ipynb).**
- **Include necessary code, comments, and explanations to support your answers and implementation.**
- **Ensure the notebook runs without errors and is well-organized.**
- **Create a GitHub repository to host your assignment files.**
- **Rename the Jupyter Notebook file using the format "date_month_topic.ipynb" (e.g., "12_July_Optimizers_Assignment.ipynb").**
- **Place the Jupyter Notebook file in the repository.**
- **Commit and push any additional files or resources required to run your code (if applicable) to the repository.**
- **Ensure the repository is publicly accessible.**
- **Submit the link to your GitHub repository as the assignment submission.**

Grading Criteria:

1. **Understanding and completeness of answers: 40%**
2. **Clarity and depth of explanations: 25%**
3. **Correct implementation and evaluation of optimizer techniques: 15%**
4. **Analysis and comparison of different optimizers: 10%**
5. **Proper code implementation and organization: 10%**

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.*