

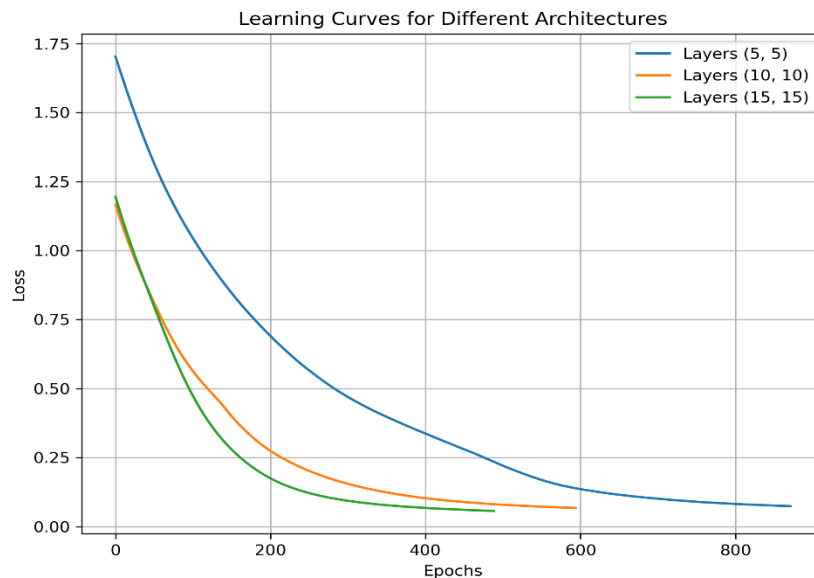
Task 2

1. Effect of Hidden Layers and Neurons

- Increasing the number of neurons increases model capacity.
- For the Iris dataset, all architectures ((5,5), (10,10), (15,15)) achieved very high accuracy (97–100%).
- Larger networks showed slightly faster convergence but no significant accuracy improvement.
- Since the dataset is simple, small architectures are sufficient.

Best configuration:

A moderate architecture such as **(5,5)** or **(10,10)** provides high accuracy with stable and efficient training

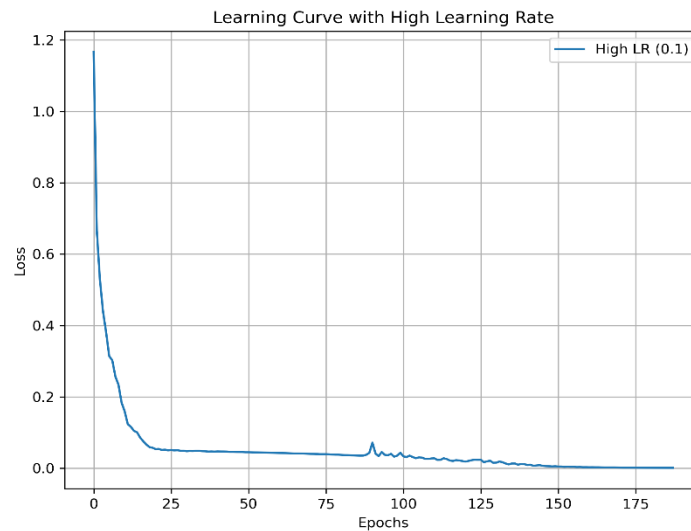


2. Effect of Learning Rate

- Small learning rate → slow but smooth convergence.
- Moderate learning rate (0.001 or 0.01) → stable and balanced training.
- High learning rate (0.1) → faster convergence but fluctuating loss curve.
- Although high learning rate achieved 100% accuracy, the learning curve showed instability due to large weight updates.

Best learning rate:

0.001 or 0.01, as it provides the best balance between convergence speed and model stability.



3. Discussion of Results

- The MLP models with architectures (5,5) and (15,15) achieved 100% accuracy, while the (10,10) model achieved 97%. This shows that increasing the number of neurons does not consistently improve performance. Since the Iris dataset is simple and well-separated, even small networks are sufficient to achieve optimal accuracy.
- When a high learning rate (0.1) was used, the model again achieved 100% accuracy with perfect precision, recall, and F1-score. However, the learning curve showed fluctuations, indicating less stable convergence due to large weight updates.
- Overall, moderate architectures and balanced learning rates provide stable training and optimal performance.

```
(ml_env) (ml_env) PS C:\Users\SAAD_COMPUTER\OneDrive\Desktop\task 2>
(ml_env) (ml_env) PS C:\Users\SAAD_COMPUTER\OneDrive\Desktop\task 2>
(ml_env) (ml_env) PS C:\Users\SAAD_COMPUTER\OneDrive\Desktop\task 2> python mlp_classifier.py
Neurons (5, 5) -> Accuracy: 1.00
Neurons (10, 10) -> Accuracy: 0.97
Neurons (15, 15) -> Accuracy: 1.00

High Learning Rate Accuracy: 1.0

Classification Report (High LR Model):
      precision    recall  f1-score   support

     0         1.00      1.00      1.00        10
     1         1.00      1.00      1.00         9
     2         1.00      1.00      1.00        11

   accuracy          1.00
  macro avg          1.00
 weighted avg          1.00
```