

Custom Artificial Neural Networks vs. Pytorch's Artificial Neural Networks

Introduction

This report evaluates the performance of a custom Artificial Neural Networks implemented from scratch compared to the Artificial Neural Networks provided by the popular machine learning library, Pytorch. The evaluation is based on a dataset regarding to predict the origin of the wine.

Methodology

1. **Data Preprocessing:** The dataset was loaded from a wine.data file and categorical variables were converted into numerical using label encoding.
2. **Model Development:**
 - **Custom Artificial Neural Networks:** Implemented from scratch, including methods for fitting the model and making predictions.
 - **Pytorch's Artificial Neural Networks:** Utilised torch from Pytorch library as a benchmark.

Results

Classifier	Accuracy	Macro avg F1-score	Weighted average F1-score
Custom Artificial Neural Networks	94.44%	0.95	0.94
Pytorch's Artificial Neural Networks	89.81%	0.87	0.80

- **Custom Artificial Neural Networks:**
 - **Best Model:** hidden layer 32 and learning rate 0.1
 - Accuracy: 94.44%
 - Classification Report:

Class	Precision	Recall	F1-score	Support
1	0.93	0.93	0.93	14
2	0.93	0.93	0.93	14

3	1.00	1.00	1.00	8
Macro avg	0.95	0.95	0.95	36
Weighted avg	0.94	0.94	0.94	36

- Pytorch's Artificial Neural Networks:
 - Best Model: hidden layer 32 and learning rate 0.01
 - Accuracy: 89.81%
 - Classification Report:

Class	Precision	Recall	F1-score	Support
1	1.00	0.79	0.88	14
2	0.80	0.86	0.83	14
3	0.80	1.00	0.89	8
Macro avg	0.87	0.88	0.87	36
Weighted avg	0.88	0.86	0.86	36

Conclusion

- Performance Comparison:** custom Artificial Neural Networks slightly outperforms the Pytorch library implementation in terms of accuracy and overall classification metrics.
- Recommendation:** Given the similar performance, it's advisable to utilize any of implementation for this task.
- Further Analysis:** better Hyperparameter tuning could potentially improve the performance of both models.

Hyperparameter Tuning Results

Custom Artificial Neural Networks

Hidden layer size	Learning rate	Accuracy (%)
0	0.1	38.9
0	0.01	38.9
0	0.001	38.9
0	0.0001	38.9
0	0.00001	38.9
32	0.1	94.4
32	0.01	94.4
32	0.001	88.8
32	0.0001	63.2
32	0.00001	19.4

64	0.1	94.4
64	0.01	94.4
64	0.001	88.8
64	0.0001	38.9
64	0.00001	19.4