

Week 12 - Neural Network

2. Based on the results, which model do you consider as superior, among the deep learning models fit?

The experimental results show how model depth and dataset size affect deep learning performance. On smaller datasets (1,000 to 10,000 samples), the 2-hidden-layer model consistently outperforms the 1-hidden-layer model, with much reduced training and validation errors. For example, with only 1,000 samples, the 2-layer model obtains a validation error of 1.135 versus 10.232 for the 1-layer model, demonstrating its greater capacity to capture complex patterns from minimal data. However, as the dataset size grows to 100,000 samples, the performance gap shrinks. In fact, the 1-hidden-layer model significantly beats the 2-layer model in terms of validation error (0.485 vs. 0.477) and execution time (45.45 vs. 47.71s).

This shows that, while deeper models have an advantage on smaller datasets because of their higher representational capability, simpler architectures may scale better on bigger datasets by training faster and generalizing just as well, if not better. Overall, for high-volume data situations, the 1-hidden-layer model hits the right mix between accuracy and efficiency, making it a more realistic option.

3. Next, report the results (for the particular numbers of observations) from applying xgboost (week 11 – provide the relevant results here in a table). Comparing the results from XGBoost and deep learning models fit, which model would you say is superior to others? What is the basis for your judgment?

XBoost table from week 11:-

DATASET SIZE	ACCURACY	TIME
1000	0.93	0.29
10000	0.97	0.83
100000	0.99	4.02

which model would you say is superior to others?

According to the analysis above, XGBoost is the better model for all three dataset sizes.

Basis for judgment:

1. Accuracy.

XGBoost demonstrated much greater accuracy across all dataset sizes:

93% (1,000), 97% (10,000), and 99% (100,000).

In contrast, deep learning models displayed significantly larger validation errors, particularly at smaller dataset sizes, implying inferior predictive accuracy.

2. Efficiency

XGBoost consistently reduced training time. For the biggest dataset:

XGBoost time: 4.02 seconds

Deep Learning: 45-47 seconds.

This makes XGBoost far more efficient for large-scale applications.

3. Scalability and generalization.

Deep learning has shown some strength on tiny datasets, with the 2-hidden-layer model outperforming others.

However, as the dataset evolved, the 1-hidden-layer model scaled better than the 2-layer one, but it still lacked the accuracy of XGBoost.

XGBoost's performance improved as more data was collected, suggesting good generalization and robustness.

Conclusion

While deep learning models are powerful and adaptable, for this structured dataset and classification job, XGBoost is clearly superior. It improves accuracy, reduces calculation time, and scales well with larger datasets. As a result, it is more suited to real-world applications that require high performance and speed.