**Reflection Report**

My initial neural network regression model was comprised of four layers: one input layer, two hidden layers with 32 and 16 respectively, and an output layer, with a total of 2,209 trainable parameters.

For testing approaches to optimizing the model, I started by adding another hidden layer of 8 neurons. This brought the number of parameters up to 2,337 and increased the training time from 74.95 seconds to 83.22 seconds. The model's performance was greatly improved, with the Root Mean Squared Error (RMSE) decreasing from 86,511.19 to 68,521.76 on the training data and from 86,377.94 to 68,347.84 on test data. The R² measure also improved from 0.82 to 0.88 on training data and 0.89 on test data.

On this basis, I further enhanced the initial model by adding two more hidden layers with 64 and 8 neurons, making the total parameter count 6,081. Despite this increased complexity, training time did not change much, at 82.59 seconds. This more complex model performed even better: RMSE fell to 60,976.08 on the training set and 60,830.3 on the test set, with an R² score of 0.91 on both. Mean Absolute Error and Mean Absolute Percentage Error improved consistently across all experiments as model complexity was increased.

In summary, adding more hidden layers generally led to better performance by allowing the model to learn more complex relationships in the data. The relatively small increase in training time shows that deeper models can achieve better accuracy. However, I think it’s still important to watch out for overfitting as the models become more complex.

***Table that summarizes the model results***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **With 2 hidden layers** | | **With 3 hidden layers** | | **With 4 hidden layers** | |
|  | **Train** | **Test** | **Train** | **Test** | **Train** | **Test** |
| **Root Mean Squared Error** | 86511.19 | 86377.94 | 68521.76 | 68347.84 | 60976.08 | 60830.3 |
| **Mean Absolute Error** | 65021.85 | 64858.78 | 50155.65 | 50088.57 | 44092.62 | 43978.12 |
| **Mean Absolute Percentage Error** | 10.82 | 10.81 | 8.22 | 8.23 | 7.16 | 7.15 |
| **R2 score** | 0.82 | 0.82 | 0.88 | 0.89 | 0.91 | 0.91 |

***Parameters and training time***

Initial Model,

A screenshot of a computer

AI-generated content may be incorrect.



Modified Model, with 3 hidden layers

A screenshot of a computer

AI-generated content may be incorrect.



Modified Model, with 4 hidden layers

A screenshot of a computer

AI-generated content may be incorrect.

