

## Case 2 Report

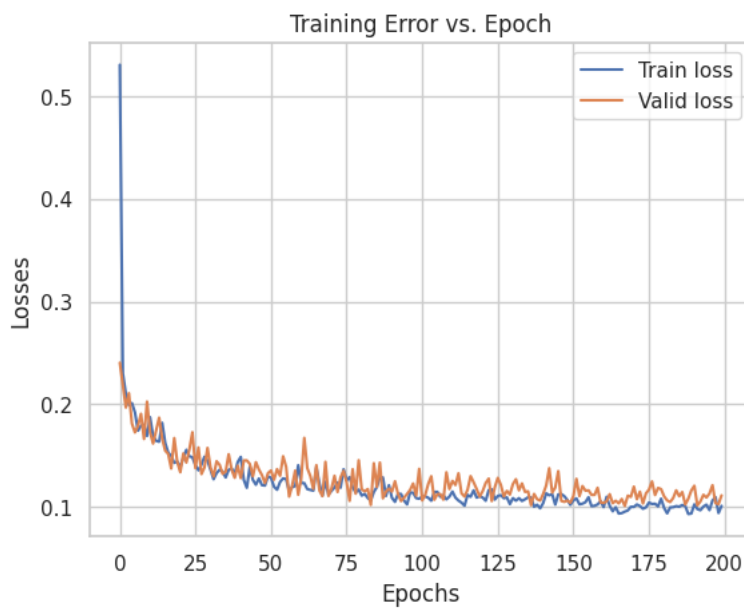
Section A Team 9

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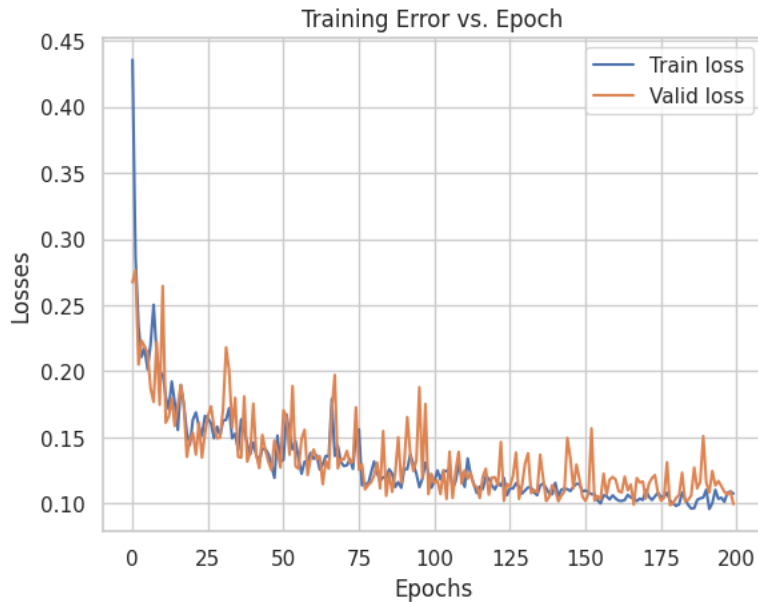
Our benchmark model is Linear Regression with 200 epochs and 0.0001 learning rate.



1. A plot of the training errors and validation errors over epochs for a base multilayer perceptron model with 2 hidden layers of sizes 256 and 128.



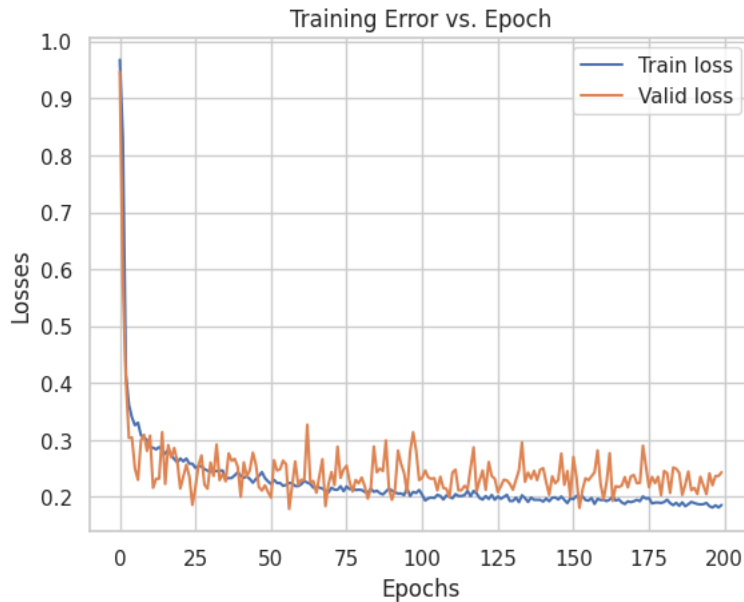
2. A plot of the training errors and validation errors over epochs for a multilayer perceptron model with 4 hidden layers of sizes 512, 256, 128, 64.



3. A plot of the training errors and validation errors over epochs for a multilayer perceptron model with 4 hidden layers of sizes 512, 256, 128, 64 and norm regularization.



4. A plot of the training errors and validation errors over epochs for a multilayer perceptron model with 4 hidden layers of sizes 512, 256, 128, 64 and norm regularization and dropout layers.



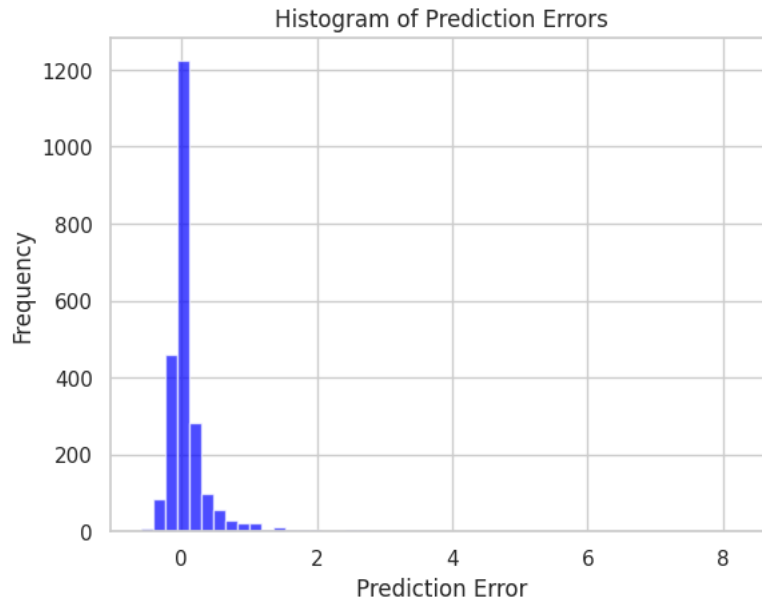
5. A table listing all the model hyperparameters that you have tried with the corresponding validation errors that you found.

Epochs	Learning Rate	Norm Regularization	Dropout	Validation errors
200	0.0001	None	0	0.12
200	0.0001	0.0001	0	0.11
200	0.0001	0.001	0.2	0.093
400	0.001	None	0.1	0.091
300	0.0001	0.00001	0.05	0.086
1000	0.0009	None	0.05	0.081
1000	0.00012	0.00001	0.05	0.079
718	0.00011	0.000001	0.1	0.787

6. Your profit analysis of the the iBuyer business model based on the predicted price on the valid data and answers to the four questions therein.

- a. Question 1: what is the bias of the prediction errors? Include the histogram of prediction errors and the bias in your report.

The bias of the prediction errors is 0.083507. The histogram below shows a distribution with a skew to the right, suggesting that our model is likely to predict a higher price than the actual price (overestimation).



- b. Question 2: Consider the hypothetical scenario where the offers are all accepted regardless of their values, what is the average percentage profit? Do you see a big difference compared to the profit margin  $\alpha$ ? Include your answers in the report.

Based on the conducted analysis, we observed that the average percentage profit stands at 9.92%, exhibiting a modest deviation from the targeted profit margin of 12%. This variance suggests that while our predictive model is reasonably effective, it does not achieve absolute accuracy. However, it is important to acknowledge that perfect prediction accuracy is an unrealistic expectation for any model. Therefore, achieving close proximity to the targeted margin, as we have, can still be considered a successful outcome in the context of predictive modeling.

- c. Question 3: Based on the sale price in the valid data and the acceptance rule, what is the mean percentage profit among all accepted offers? Do you see a big difference compared to the targeted profit margin  $\alpha$ ? Include your answers in your report.

The average percentage profit for accepted offers is -5.57% which causes a total loss to that deal. Therefore, giving a 10% discount rate to the homeowner might not be an effective strategy in this case.

Further analysis reveals that the break-even discount factor, at which we can consider purchasing properties, is 14%. This implies that we are prepared to accept offers where the purchase price is 14% less than our model's predicted value. This adjustment in the discount factor suggests a more cautious approach to offer pricing, aiming to balance profitability with the likelihood of offer acceptance.

- d. Question 4: What is the bias of the prediction errors when restricting to those properties whose owners accepted the offer? Based on the histogram and bias, can you explain your answers to Question 3?

Examining the histogram of accepted offers reveals a slight leftward skew, suggesting that our model tends to undervalue houses on average. This pattern of underestimation is reflected in the offers we make, which are often too low to yield a profitable outcome. Consequently, this leads to a negative average profit margin for the offers that get accepted. The bias in our prediction errors for these accepted offers is around -0.1407, indicating a minor but consistent negative bias in our model's estimations for this particular group of properties. This trend of underpricing, as evidenced by the histogram's skewness, highlights a potential area for adjustment in our predictive modeling approach.

