**Deep Learning Report HW1**

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**1. Regression**

**1)** **Network Architecture**

|  |  |
| --- | --- |
| Network Architecture | [11-15-10-1] |
| Select feature | [0, 1, 2, 3, 4, 6,7] |
| Training RMSE | 0.6895 |
| Testing RMSE | 0.6988 |
| Epoch | 10000 |
| Learning rate | 0.011 |
| Activate function | Layer1: **Relu** Layer2: **Leaky\_Relu** |

**2) Learning Curve**

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自動產生的描述

**3) 4) training RMS error and test RMS error**

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**5) Regression result with training labels**

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**6) Regression result with test labels**

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**7) Question 1-3**

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自動產生的描述

To decide whether the feature has a huge impact on the performance of the model, I removed each feature one by one from the dataset and evaluated the changes in the average RMSE for both training and testing datasets. By comparing the RMSE values before and after the removal of each feature, I could identify which features were critical for the model's performance and which had less influence.

The removal of **Relative Compactness** results in a considerable increase in both training (1.5002) and testing RMSE (1.6586), indicating its crucial role in accurate predictions. Also, removing **Glazing Area** leads to the highest RMSE values, with training RMSE at 2.3567 and testing RMSE at 2.9916, emphasizing its detrimental effect on model accuracy.

Conversely, the feature **Orientation** has a minimal impact on model performance, as indicated by a relatively low training (0.5615) and testing RMSE (0.5703). The feature **Surface Area** also shows promising results, with training RMSE at 0.5322 and testing RMSE at 0.6955, suggesting that its removal does not decrease the model's performance, even improve it. These findings underline the importance of focusing on key features for enhancing model accuracy while being mindful of those that contribute less significantly.

After sorting all the features in the above chart based on their importance, a comparison is made with the Pearson correlation (specifically concerning heating load):

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Based on the data from the table, the Pearson Correlation does not actually align with our training results. Although the linear correlation coefficient for Glazing Area is only 0.26, it has the most significant impact on our model's performance. However, we can't entirely dismiss the Pearson Correlation. For the Orientation feature, the coefficient is less than 0.005, and removing it truly improves the model. Therefore, I believe we can establish a threshold, where if the absolute value of the correlation does not exceed this limit, the feature can be removed for training. This would provide a simple evaluation of the feature.

**2. Classification**

**1)** **Network Architecture**

|  |  |
| --- | --- |
| Network Architecture | [34-20-15-1] |
| Select feature | All |
| Training Accuracy | 100% |
| Testing Accuracy | 92.05% |
| Epoch | 1500 |
| Learning rate | 0.008 |
| Activate function | Layer1: **Relu** Layer2: **Swish** Layer3: **Sigmoid** |

**2) Learning curve**

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**3) Training error rate**

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自動產生的描述 **1.0000 – 1.0000 = 0%**

**4) Test error rate**

**1.0000 - 0.9205 = 0.0795 = 7.95%**

**5) Question 2-3:**

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As the number of neurons in Layer 2 increases from 0 to around 5, test accuracy improves sharply across all configurations, particularly for smaller Layer 1 sizes.

However, beyond 5 neurons in Layer 2, the accuracy stabilizes and fluctuates slightly. These fluctuations are minor, and overall, the test accuracy remains consistent across the different Layer 1 sizes as the number of neurons in Layer 2 grows. The highest observed accuracy hovers around 0.94, suggesting that further increasing the number of neurons in Layer 2 beyond a certain point does not bring significant gains in accuracy. The performance becomes relatively similar across different configurations once the number of neurons in Layer 2 exceeds around 10, indicating a plateau in improvement. 一張含有 文字, 螢幕擷取畫面, 圖書, 樣式 的圖片

自動產生的描述

Even though layer 2’s neurons number reach 480, Test Acuracy still remain at the same level. I suspect this could be due to training for too few epochs, which might be limiting the model's ability to refine its performance further.