Analysing the performance of neural networks over same data set

Biswajit Jena

Email - biswajitbits@gmail.com

AITS Link-https://www.ai-techsystems.com

AI Tech Systems
Goa,India

***Abstract*—This project was an assignment given by AI Tech Systems during its internship. The objective of the project was to make two neural networks with different neurons and then compare both of their predictions.**

Keywords—neural networks, keras, accuracy, mean squared error, validation set, test set

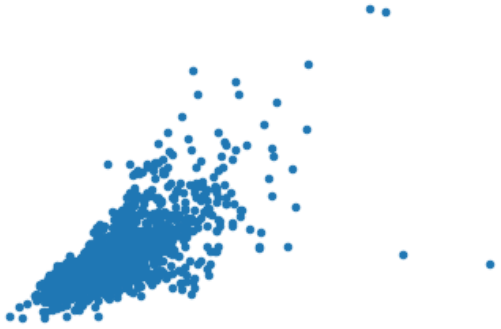
I. Introduction

The neural networks were prepared on the dataset given in a competition of Kaggle named House Prices: Advanced Regression Techniques. The first neural network comprises of three hidden layers and the second one contains five hidden layers. Both the codes were written on keras.

II. DATASET VISUALISATON AND ANALYSIS

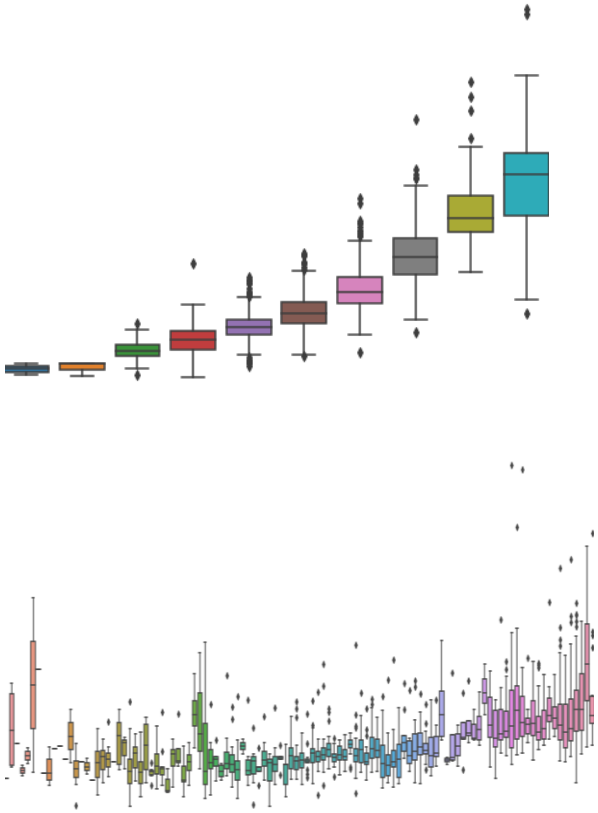
The salesprice show:-
1)Deviate from the normal distribution.
2)Have appreciable positive skewness.
3)Show peakedness.

After analyzing the dataset, following are relationship between variables and salesprice:-
1)SalesPrice and GRlivarea seem to be in a linear relationship.



2)SalesPrice and TotalBMSFarea seem to be in a linear-exponential relationship.

OverallQual and YearBuilt also seem to be related with 'SalePrice'. The relationship seems to be stronger in the case of OverallQual, where the box plot shows how sales prices increase with the overall quality.



III. Removing.Outliers

I used IsolationForest class from skicit learn library for removing the outliers from dataset.
Number of Outliers: 146
Number of rows without outliers: 1314

IV.1ST Neural network

A. *Structure of first neural network*

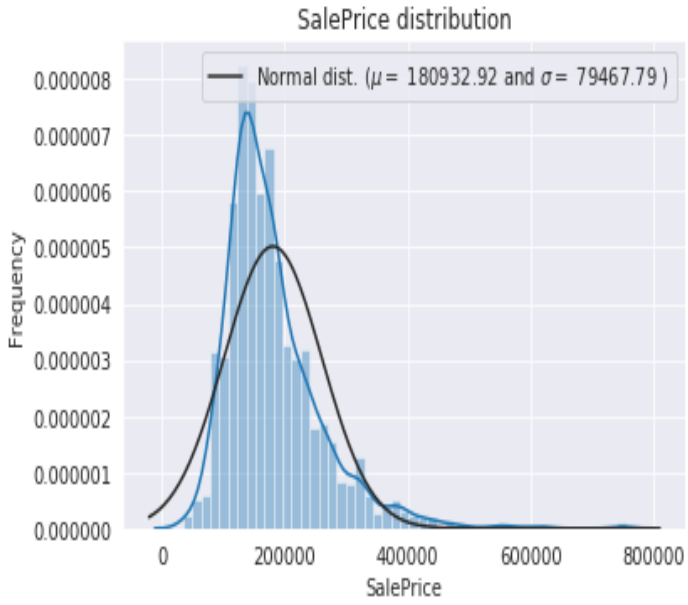
Layer (type)	Output Shape	Param #
dense_1 (Dense)	(None, 1024)	295936
dense_2 (Dense)	(None, 256)	262400
dense_3 (Dense)	(None, 128)	32896
dense_4 (Dense)	(None, 1)	129

Total params: 591,361

Trainable params: 591,361

Non-trainable params: 0

The three hidden layers consisted of 1024,256,128 neurons respectively.



The target variable is right skewed. As (linear) models love normally distributed data , we needed to transform this variable and make it more normally distributed.

We first pre-processed data by converting all sales price by applying log(1+x) with the help of numpy library and then converting back from model predictions.

B. *Performance of first neural network*

Epoch 35/35 - 0s - loss: 4.7113 - mean_squared_error: 4.7113 - val_loss: 8.0514 - val_mean_squared_error: 8.0514

We can see that the neural network ran for 35 epochs with batch size of 100. The validation loss was approximately equal to training loss signifying that the model was neither overfitting nor underfitting.
This was achieved by adding dropout layers between the hidden layers.

Also the loss was very much less as the sales price value is of order 100000.

V 2ND NEURAL NETWORK

A. *Structure of 2nd Neural Network*

Layer (type)	Output Shape	Param #
dense_1 (Dense)	(None, 1024)	295936
dense_2 (Dense)	(None, 512)	524800
dense_3 (Dense)	(None, 256)	131328
dense_4 (Dense)	(None, 512)	131584
dense_5 (Dense)	(None, 512)	262656
dense_6 (Dense)	(None, 1)	513

Total params: 1,346,817

Trainable params: 1,346,817

Non-trainable params: 0

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The three hidden layers consisted of 1024,512,256,512,512 neurons respectively.

We first pre-processed data by converting all sales price by applying log(1+x) with the help of numpy library and then converting back from model predictions.

B. Performance of second neural network

Epoch 35/35 - 0s - loss: 4.5080 - mean_squared_error: 4.5080 - val_loss: 4.3210 - val_mean_squared_error: 4.3210

We can see that the neural network ran for 35 epochs with batch size of 100. The validation loss was approximately equal to training loss signifying that the model was neither overfitting nor underfitting.
This was achieved by adding dropout layers between the hidden layers.

VI. Analysis of both neural networks

Model 2 performed better that model 1 as it consisted of more number of layers and more number of trainable parameters. Neither of the models overfitted the dataset given as can be seen by validation and training losses.

Model 2 scored 1.16 on Kaggle submission whereas model 1 scored 2.14 on Kaggle showing that model 2 performs way better than model 1.

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References

https://www.kaggle.com/c/house-prices-advanced-regression-techniques