**NEURAL NETWORK:**

A simplified network model of the human brain. **Neural networks** are algorithmic sets, loosely modeled to mimic the human brain. These are used to find patterns in a set of data. They enable interpretation of the sensory data; through machine perception, clustering or labeling raw inputs.

The regression model can’t be applied to the dataset since the response variable has only two values 1 (for readmitted), 0 (for not readmitted). Therefore, we use classification model. Firstly, I applied neural network without cross validation, as shown below –

model <- train(readmitted ~ . , train\_df, method='nnet', linout=TRUE, trace = FALSE,

#Grid of tuning parameters to try:

tuneGrid=NULL )

summary(model)

A screenshot of a cell phone

Description automatically generated

We got an accuracy of 62.41% for the sensitivity of 63.54% and specificity of 58.56%.

A screenshot of a social media post

Description automatically generated

Secondly, I applied neural network with 10 fold cross validation, as shown below –

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We got an accuracy of 61.83% which is below the accuracy of Neural network without cross validation. This is an interesting outcome of the above model. We can therefore understand that cross validation is not performing better on the neural network model.

A close up of a map

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The above map is been plotted for the neural network model without cross validation and the area under the curve comes out to be 64.59% (as shown below). **Note:** the range of 3rd dimension goes from -0.15 to 0.65.

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Description automatically generated

**AVERAGED NEURAL NETWORK:**

Averaged Neural Network is the model in which the same neural network model is fit using different random number seeds. All the resulting models are used for prediction. For regression, the output from each network are averaged. Whereas, for classification, (which is the approach we applied during the project) the model scores are 1st averaged, and then translated to predicted classes.

The classification model which is been applied is shown below (over the same dataset) –

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The model output without cross validation for the averaged neural network, captured an accuracy of 61.89% and a sensitivity of 62.69% and a specificity of 58.56%. When compared to the above model the sensitivity reduced nearly 1%, but specificity remain the exact same.

A screenshot of a social media post

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We also tried to observe average neural network with 10-fold cross validation on the same dataset, though it was extremely time consuming. It was significantly the best approach for such a dataset as the one chose for this project.

The model was able to capture an accuracy of about 62.91% which was expected and was above the average neural network without cross validation which was 61.89%.

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Description automatically generated

Also, the values of specificity and sensitivity were interesting where the model was able to predict the actual cases; however, the rate of predicting false positives was equally higher. This is an important point to remember before making best model assumption since we don’t was to a model that gives higher false positives / negatives. These values of precision and recall help us to select best model even though we might capture higher accuracy with them for a short sample size over the real-world problems.

A close up of a map

Description automatically generated

The above map is been plotted for average neural network, the range of 3rd dimension goes from 0.13 to 0.82. The area under the curve comes out to be 65.38%. This is the highest AUC value acquired for any of our models.

A screenshot of a cell phone

Description automatically generated

On the basis of Accuracy and Area Under the Curve Average Neural Network with cross validation performs the best from all other applied neural networks on the same readmission’s dataset.