Clinical and Imaging Analyses to Predict Alzheimer's Disease

Model Metrics

A. Cross-sectional Study

The **K-nearest Neighbors Model** is the model being recommended for the Cross-sectional study from the analyses performed.

The following was used to tune the model:

- optimal k value: k = 3

After tuning the model, several metrics were determined using the Confusion Matrix (Figure 1), and they are summarized in Table 1.

Figure 1. KNN model Confusion Matrix

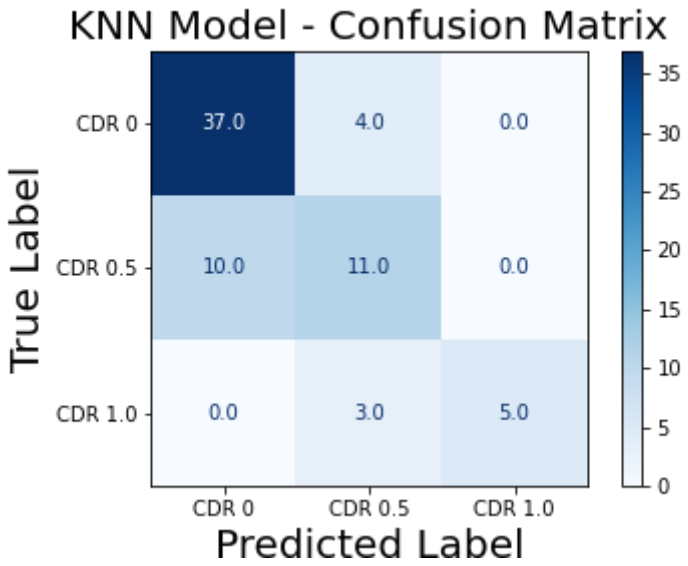

Table 1. Cross-sectional Study Model Metrics

Comparison of Model Metrics

Model	Group	Precision	Recall	F1 score	Accuracy
KNN	CDR 0	0.79	0.9	0.84	0.76
	CDR 0.5	0.61	0.52	0.56	
	CDR 1	1	0.62	0.77	
Random Forest	CDR 0	0.82	0.88	0.85	0.69
	CDR 0.5	0.48	0.48	0.48	
	CDR 1	0.4	0.25	0.31	
OVR(logistic regression)	CDR 0	0.79	0.9	0.84	0.7
	CDR 0.5	0.5	0.43	0.46	
	CDR 1	0.6	0.38	0.46	
OVR(Multi-Layer Perceptron)	CDR 0	0.89	0.8	0.85	0.76
	CDR 0.5	0.57	0.76	0.65	
	CDR 1	0.8	0.5	0.62	

B. Longitudinal Study

The **One vs Rest (Multi-Layer Perceptron) Model** is the model being recommended for the Longitudinal study from the analyses performed.

The following was used to tune the model:

- hidden layers sizes: (30, 30, 30)

After tuning the model, several metrics were determined using the Confusion Matrix (Figure 2), and they are summarized in Table 2.

Figure 2. One vs Rest (MLP) model Confusion Matrix

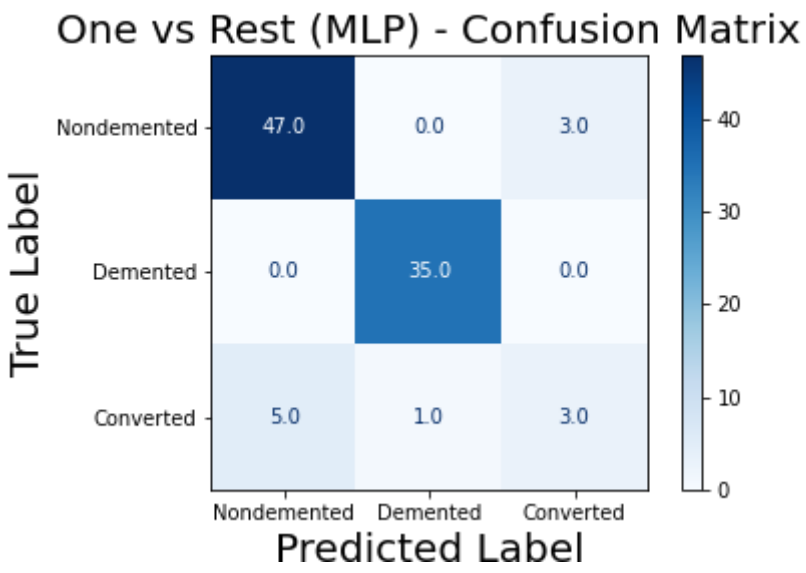

Table 2. Longitudinal Study Model Metrics

Comparison of Model Metrics

Model	Group	Precision	Recall	F1 score	Accuracy
KNN	Non-demented	0.88	1	0.93	0.9
	Demented	0.94	0.94	0.94	
	Converted	1	0.22	0.39	
Random Forest	Non-demented	0.89	0.98	0.93	0.9
	Demented	0.95	1	0.97	
	Converted	0.5	0.11	0.18	
OVR(logistic regression)	Non-demented	0.89	1	0.94	0.91
	Demented	0.95	1	0.97	
	Converted	1	0.11	0.2	
OVR(Multi-Layer Perceptron)	Non-demented	0.9	0.94	0.92	0.9
	Demented	0.97	1	0.99	
	Converted	0.5	0.33	0.4	

C. Imaging Study

The **Convolutional Neural Network (CNN) Model** is the model being recommended for the Imaging study from the analyses performed.

After running the model on training, validation, and testing image sets, the model had a **95.72% accuracy on the validation set** and **95.95% accuracy on the testing set**.

Table 3. Imaging Study Model Metrics

Imaging Model Metrics

Group	Precision	Recall	F1 score	Accuracy
Non-Demented	0.97	0.97	0.97	
Very Mild Demented	0.94	0.96	0.95	0.96
Mild Demented	0.97	0.91	0.94	
Moderate Demented	1	1	1	