Risk Prediction and Factor Analysis of Alzheimer's Disease

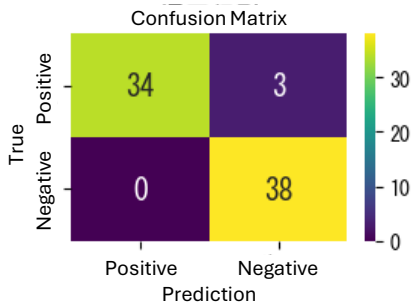
Alzheimer's disease is challenging to detect in its early stages. However, early prediction is critical for timely treatment and intervention. This study presents a risk prediction model using clinical and brain imaging data, developed with the Multi-Sigma®'s neural network. Key predictive factors were identified through contribution analysis.

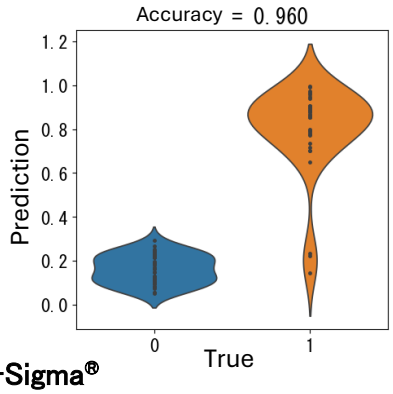
1. Data Used for Analysis

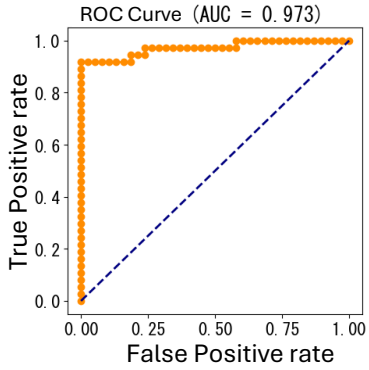
We used a public dataset from Kaggle, featuring cognitive assessments (MMSE, CDR), brain imaging data (eTIV, nWBV, ASF), gender (female: 0, male: 1), age, years of education, and socioeconomic status (1 to 5). The target variable was binary: healthy (0) or dementia/progression to dementia (1).

2. Alzheimer's Disease Risk Prediction Using Multi-Sigma®

The prediction model based on Multi-Sigma®'s neural network achieved a high accuracy of 96.0% and demonstrated excellent classification performance with an AUC of 0.973. Of the 75 test cases, the model yielded 34 true positives (TP), 38 true negatives (TN), 0 false positives (FP), and 3 false negatives (FN).



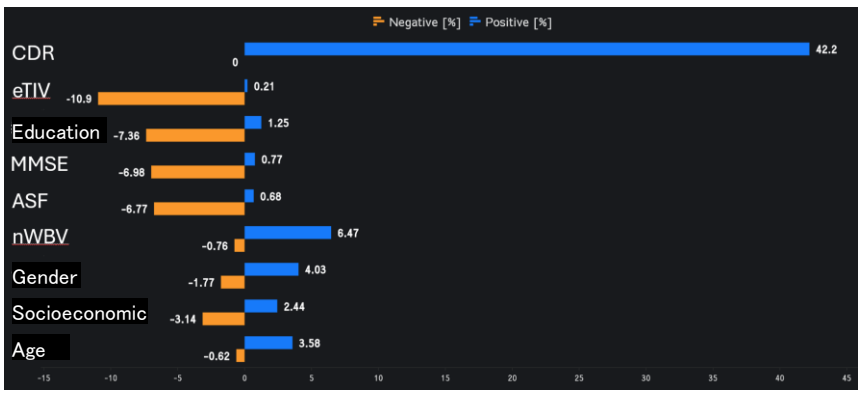




3. Contribution Analysis Using Multi-Sigma®

Multi-Sigma®'s contribution analysis feature revealed the impact of each variable on the prediction of Alzheimer's disease risk. In particular, the Clinical Dementia Rating (CDR) showed a strong positive influence of 42.2%.

On the other hand, negative influences were observed for estimated total intracranial volume (eTIV) at −10.9%, years of education at −7.36%, and the Mini-Mental State Examination (MMSE) at −6.98%, suggesting that these factors may be associated with a reduced risk of Alzheimer's disease.



4. Conclusion

The neural network model built with Multi-Sigma® achieved 96.0% accuracy in predicting Alzheimer's disease risk. Among the variables, CDR was identified as the most important predictive factor, with eTIV, years of education, and MMSE also making significant contributions to risk prediction. These indicators may support earlier intervention in disease progression.

(Data source) Kaggle：Alzheimer Features （https://www.kaggle.com/datasets/brsdincer/alzheimer-features）