

Interpretable Machine Learning of PET Imaging for Individualized Predictions of Seizure Outcomes after Temporal Lobe Epilepsy Surgery

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Huanhua Wu
Prof. Hao Xu*

The First Affiliated Hospital of Jinan University

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Introduction

Background

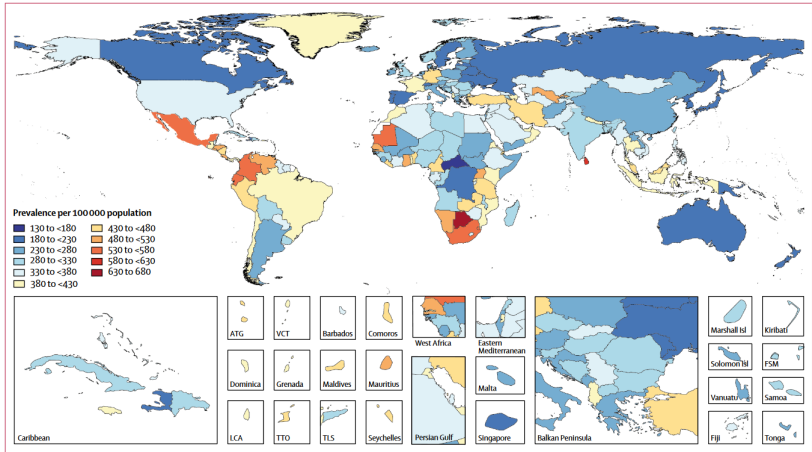


Figure 1: Epilepsy Epidemiology

Aims

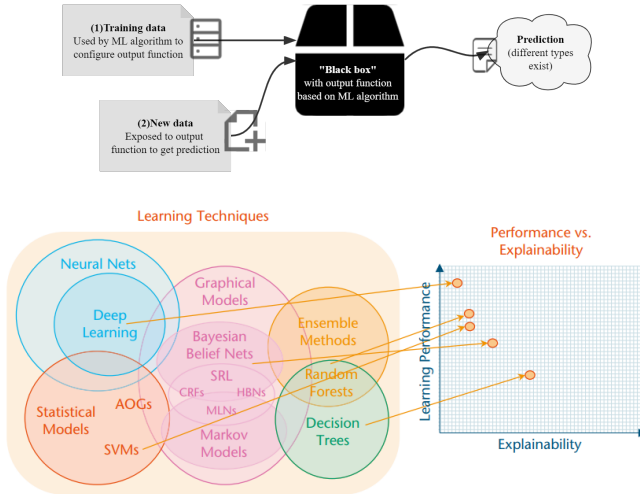


Figure 2: Focus on Interpretability of ML

Scheme

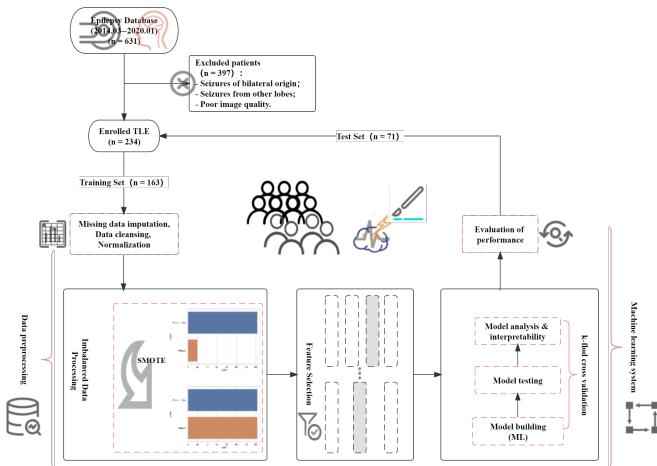


Figure 3: Flowchart of TLE Postsurgical IML

The Data

Combined of PET Radiomics and Clinical Features

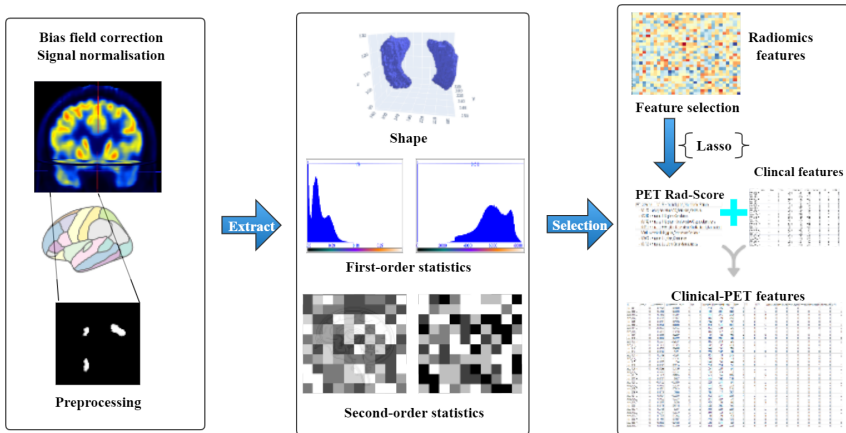


Figure 4: PET Radiomics Score and Clinical-PET Features

Exploratory Data Analysis

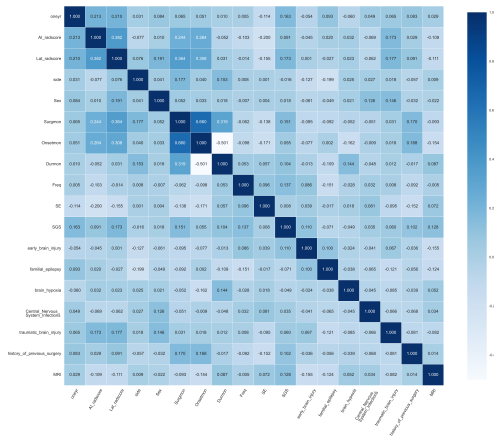


Figure 5: Heatmap of Clinical-PET Features

The Model

Benchmark

Table 1: Performance Comparison Eleven ML algorithms and K-folds Cross-validation of the Selected AdaBoost

Model	Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC	Folds\Tuned_Ada Accuracy	AUC	Recall	Prec.	F1	Kappa	MCC	APC
Ada Boost Classifier	0.883	0.789	0.400	0.433	0.393	0.345	0.357	1	0.882	0.733	0.000	0.000	0.000	0.000	0.361
Extreme Gradient Boosting	0.884	0.777	0.300	0.400	0.333	0.287	0.295	2	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Random Forest Classifier	0.884	0.763	0.200	0.350	0.250	0.217	0.230	3	0.824	0.550	0.000	0.000	0.000	-0.085	-0.091
Gradient Boosting Classifier	0.890	0.762	0.350	0.483	0.390	0.346	0.360	4	0.875	0.893	0.000	0.000	0.000	0.000	0.500
Light Gradient Boosting Machine	0.859	0.749	0.250	0.325	0.267	0.211	0.221	5	0.938	0.929	0.500	1.000	0.667	0.636	0.683
Logistic Regression	0.878	0.669	0.050	0.100	0.067	0.055	0.059	6	0.938	0.964	0.500	1.000	0.667	0.636	0.683
Extra Trees Classifier	0.884	0.662	0.100	0.200	0.133	0.118	0.127	7	0.875	0.554	0.000	0.000	0.000	0.000	0.321
K Neighbors Classifier	0.865	0.646	0.200	0.200	0.183	0.140	0.149	8	0.938	0.964	0.500	1.000	0.667	0.636	0.683
Linear Discriminant Analysis	0.884	0.642	0.100	0.200	0.133	0.119	0.128	9	0.938	1.000	0.500	1.000	0.667	0.636	0.683
Naive Bayes	0.251	0.586	0.900	0.129	0.226	0.014	0.072	10	0.938	0.679	0.500	1.000	0.667	0.636	0.683
Decision Tree Classifier	0.798	0.584	0.300	0.264	0.259	0.158	0.167	Mean	0.914	0.827	0.350	0.600	0.433	0.410	0.432
								Std	0.047	0.172	0.320	0.490	0.367	0.368	0.200