Predicting Efficacy of Anti-Epileptic Drug Treatment with Machine Learning Algorithms

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Abstract

This work shows the prediction of patients' response to Anti-Epileptic Drugs using Machine Learning Algorithms. Patients' response to Anti-Epileptic Drugs have been studied on the real time data collected from the patients at the time of enrollment during this study. We have tried to predict the seizure type and the epilepsy type using multiple data analysis techniques. This study may facilitate our understanding about Epilepsy.

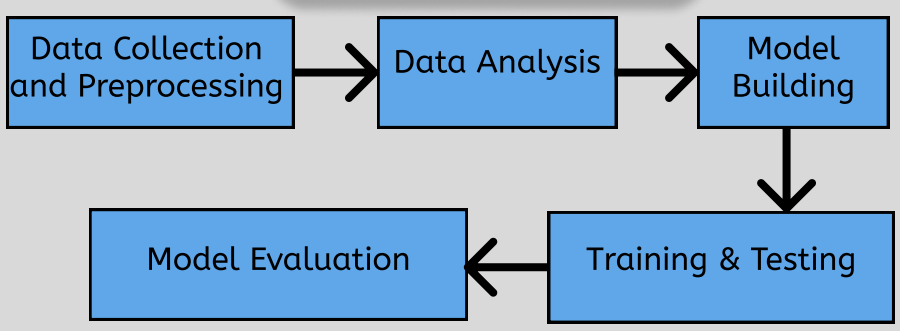
Introduction

Epilepsy is a chronic neurological disorder that affects around 70 million people globally. The selection of anti-epileptic drugs (AEDs) for the management of epilepsy is critical, as it can significantly affect patient outcomes, including seizure control, adverse effects, and quality of life. Recent advancements in machine learning (ML) have shown promise in predicting AED treatment outcomes.

Objectives

The scope of this project is to develop machine learning models that can predict the outcomes of anti-epileptic drug treatment using patient demographic, clinical, and biochemical data. The scope of this project is to develop machine learning models that can predict the outcomes of anti-epileptic drug treatment using patient demographic, clinical, and biochemical data.

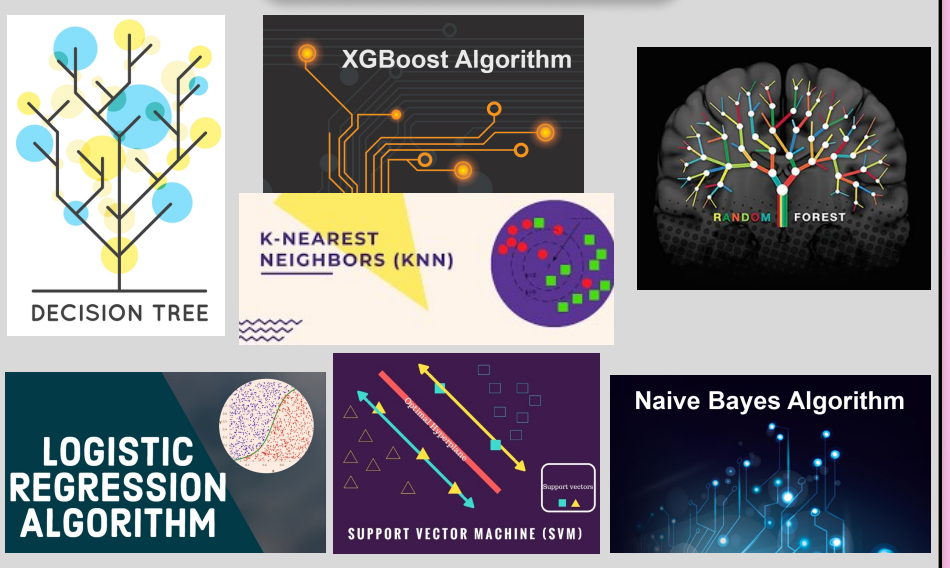
Methodology



Anti-Epileptic drugs for Patients' Response

- Carbamazepine (CBZ)
- Levetiracetam (LEV)
- Valproic acid (VPA)
- Phenobarbital (PB)

Models Used



GR/PR Results

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	61.971831	0.612139	0.619718	0.593145
Extreme Gradient Boost	70.422535	0.701592	0.704225	0.699280
Decision Tree	69.014085	0.687144	0.690141	0.683490
Random Forest	73.239437	0.731377	0.732394	0.731739

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	52.475248	0.461328	0.524752	0.485611
Extreme Gradient Boost	53.465347	0.505515	0.534653	0.518505
Random Forest	57.425743	0.483314	0.574257	0.499736
Support Vector Machine	56.435644	0.513361	0.564356	0.528479

GR/PR in Demographic Data

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	52.475248	0.461328	0.524752	0.485611
Extreme Gradient Boost	53.465347	0.505515	0.534653	0.518505
Random Forest	57.425743	0.483314	0.574257	0.499736
Support Vector Machine	56.435644	0.513361	0.564356	0.528479

GR/PR in Biochemical Data

Seizure Type Results

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	58.823529	0.558396	0.588235	0.551129
Support Vector Machine	55.882353	0.529988	0.558824	0.532667
K-Nearest Neighbour	57.352941	0.560596	0.573529	0.564026
Random Forest	60.294118	0.576738	0.602941	0.562408

Seizure Type in Clinical Risk Data

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	47.058824	0.343440	0.470588	0.393765
Decision Tree	41.176471	0.409858	0.411765	0.409310
Extreme Gradient Boost	44.117647	0.444054	0.441176	0.442057
Support Vector Machine	41.1764	10.3938	40.41176	50.399698

Seizure Type in Demographic Data

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	52.432432	0.283651	0.524324	0.368143
Random Forest	52.972973	0.434759	0.529730	0.379886
Decision Tree	50.810811	0.494965	0.508108	0.494245
Support Vector Machine	49.729730	0.454870	0.497297	0.437417

Seizure Type in Biochemical Data

Epilepsy Type Results

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	52.432432	0.283651	0.524324	0.368143
Decision Tree	50.810811	0.494965	0.508108	0.494245
Random Forest	52.972973	0.434759	0.529730	0.379886
Support Vector Machine	49.72973	0.45487	0.4977	0.43747

Epilepsy Type in Clinical Risk Data

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	55.932203	0.548275	0.559322	0.546719
Decision Tree	72.881356	0.725538	0.728814	0.718905
Random Forest	59.322034	0.581267	0.593220	0.584555
Support Vector Machine	57.627119	0.581419	0.576271	0.578403

Epilepsy Type in Clinical Risk Data

Models	Accuracy	Precision	Recall	F1 Score
Logistic Regression	43.750	0.504051	0.43750	0.367231
Decision Tree	62.500	0.660437	0.62500	0.617770
Random Forest	43.750	0.299107	0.43750	0.321138
Support Vector Machine	49.72973	43.750	0.504051	0.43750

Epilepsy Type in Clinical Risk Data

Conclusion & Future Scope

We successfully developed machine learning models that could predict the outcomes of anti-epileptic drug treatment using patient demo graphic, clinical, and biochemical data.

The model does the prediction of drug responder status, prediction of epilepsy type and prediction of epilepsy type with an accuracy of over 70%.

Future work could focus on collecting more comprehensive data sets and exploring different machine learning algorithms to further improve prediction accuracy.

Acknowledgement

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Appendix

Reference

Github

Report