Blood Pressure Detection

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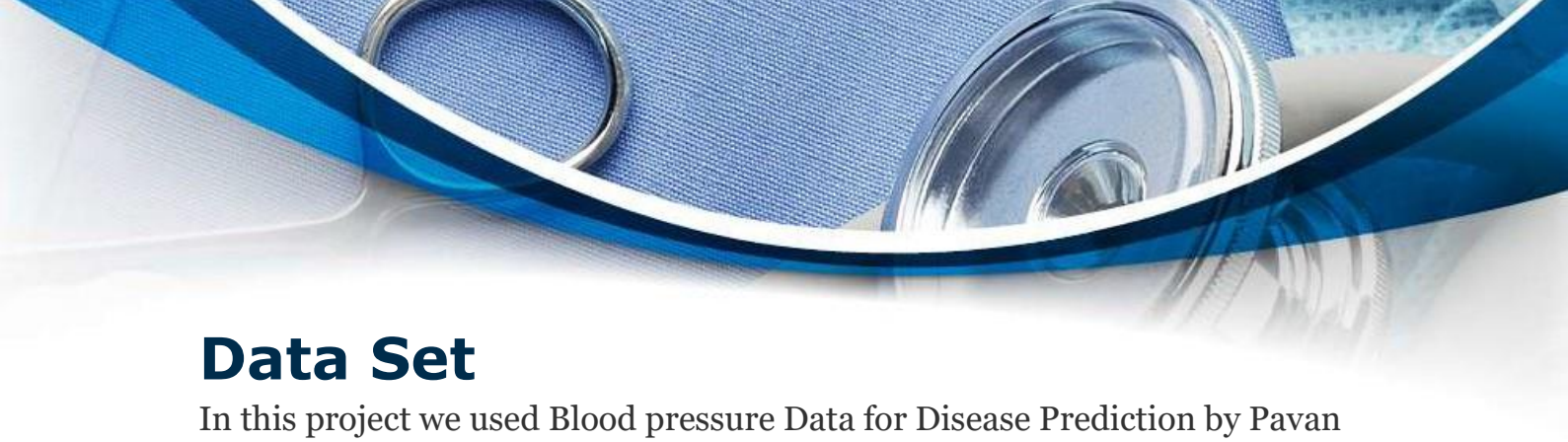
Abstract

In our project we used machine learning technique to predict the systolic blood pressure by correlated variables (Level of Hemoglobin, Genetic Pedigree Coefficient, Exercise, BMI, Age, Sex, Smoking etc.). The raw data are split into two parts, 65% for training and validation and the remaining 35% for testing the performance. We used 10 different Models to detect the best model to give the best result in predicting the systolic blood pressure. Based on the database with 2000 people, the most important feature is Genetic Pedigree Coefficient. The use of Machine learning is helpful to predict systolic blood pressure contributes. Also, as it is known an isolated blood pressure measurement is sometimes not very accurate due to the daily fluctuation, our predictor can provide another reference value to the medical staff [1].

Introduction

Hypertension or high blood pressure is a leading cause of death throughout the world and a critical factor for increasing the risk of serious diseases, including cardiovascular diseases such as stroke and heart failure. Blood pressure is a primary vital sign that must be monitored regularly for the early detection, prevention and treatment of cardiovascular diseases. However, only one-third of the hypertensive population have their BP under control . This is due to the lack of availability and accessibility for reliable and continuous BP monitoring systems. When systolic BP is above 140 mmHg or diastolic BP is above 90 mmHg, it is called hypertension, and such undesirable blood pressures can damage internal body organs when left untreated.Recent advancements in machine learning and artificial intelligence, have opened up exciting new horizons for monitoring of blood pressure.



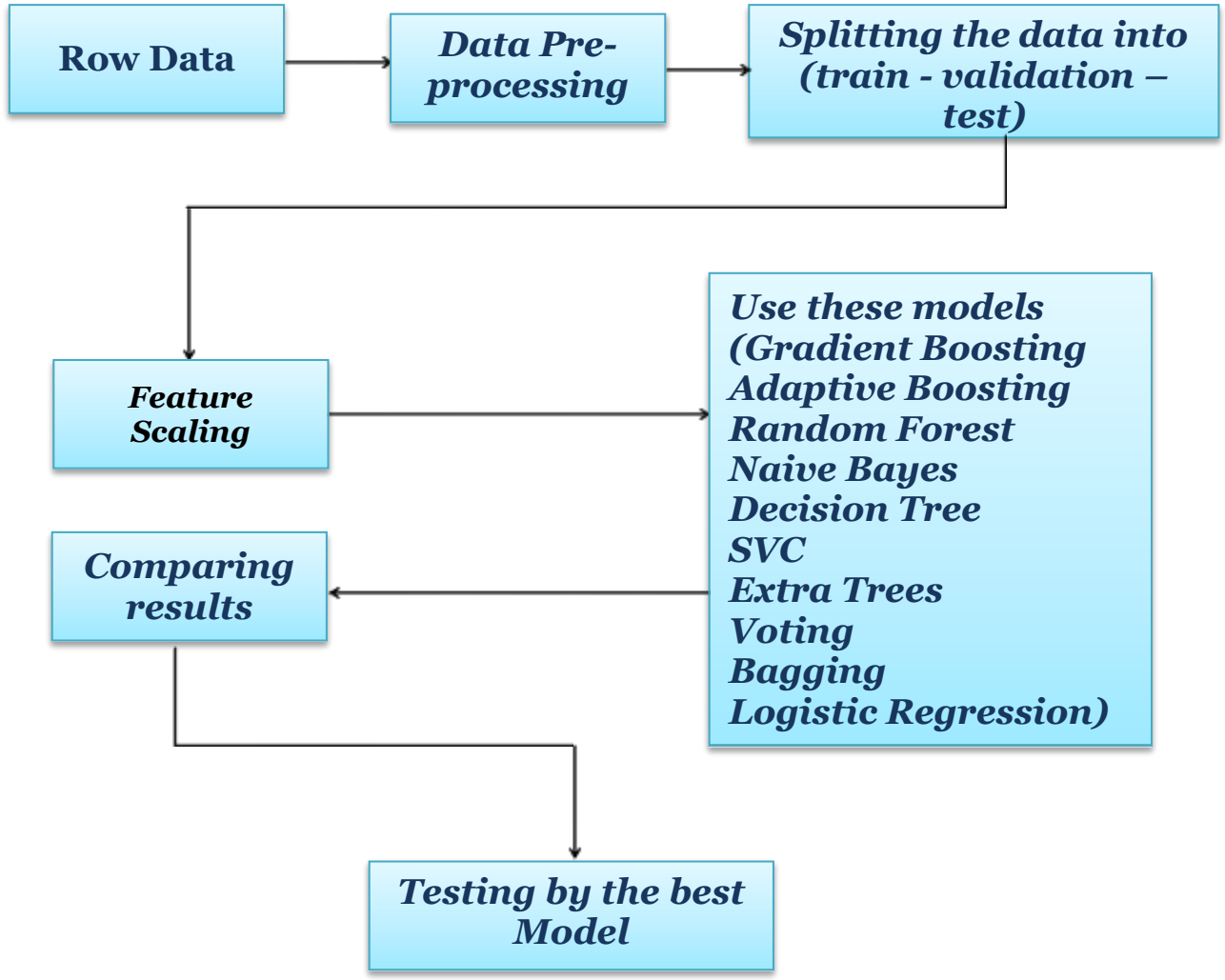
Data Set

In this project we used Blood pressure Data for Disease Prediction by Pavan Bondanki and here is the link of the data set https://www.kaggle.com/pavanbodanki/blood-press . This data set has information from a study on 2000 patient. The data set has 15 columns. The columns are Patient_number, Blood_Pressure_Abnormality, Level_of_Hemoglobin , Genetic_Pedigree_Coefficient , Age, BMI, Sex, Pregnancy, Smoking, Physical_activity, salt_content_in_the_diet, alcohol_consumption_per_day,Level_of_Stress,Chronic_kidney_disease, Adrenal_and_thyroid_disorders .

	Patient_Number	Blood_Pressure_Abnormality	Level_of_Hemoglobin	Genetic_Pedigree_Coefficient	Age	BMI	Sex	Smoking	Physical_activity
0	1	1	11.28	0.90	34	23	1	0	45961
1	2	0	9.75	0.23	54	33	1	0	26106
2	3	1	10.79	0.91	70	49	0	0	9995
3	4	0	11.00	0.43	71	50	0	0	10635
4	5	1	14.17	0.83	52	19	0	0	15619

salt_content_in_the_diet	alcohol_consumption_per_day	Level_of_Stress	Chronic_kidney_disease	Adrenal_and_thyroid_disorders
48071	NaN	2	1	1
25333	205.0	3	0	0
29465	67.0	2	1	0
7439	242.0	1	1	0
49644	397.0	2	0	0

Methods

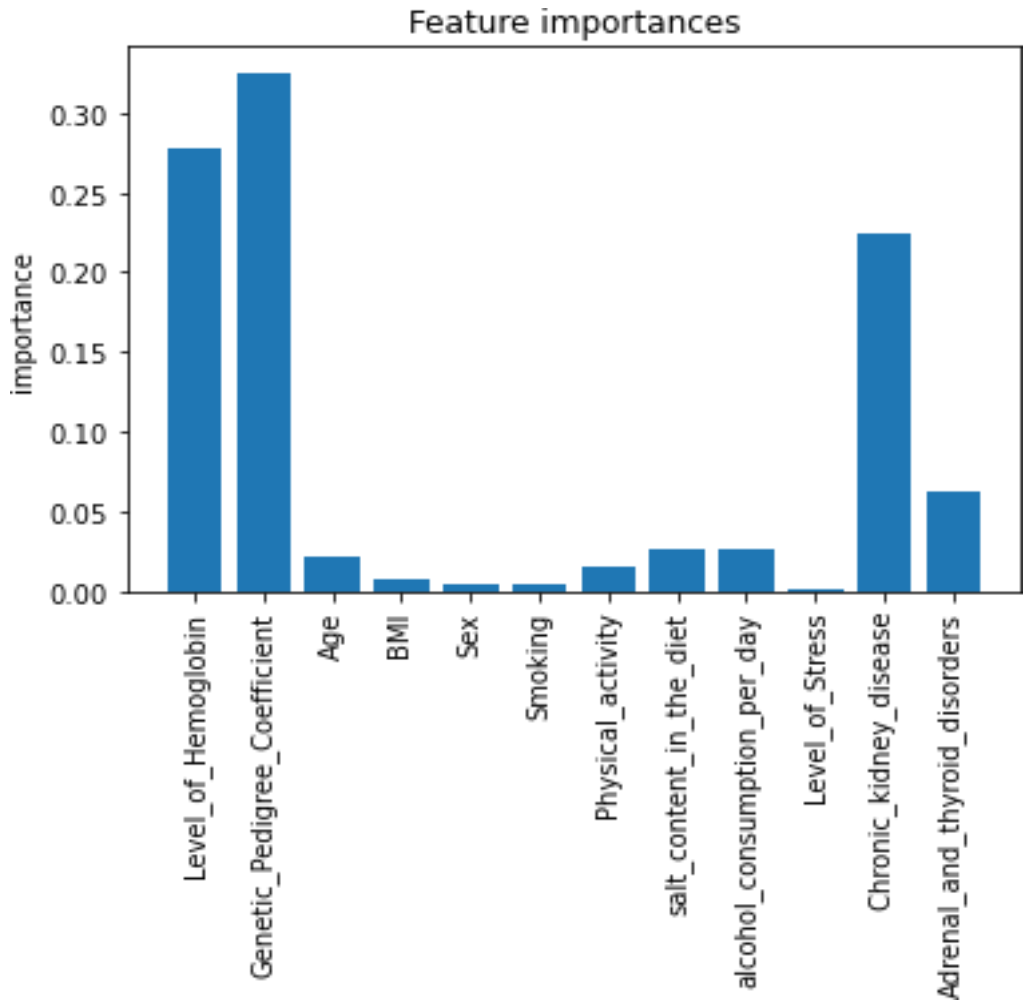


Results

The best Model to predict Blood Pressure is Gradient Boosting by

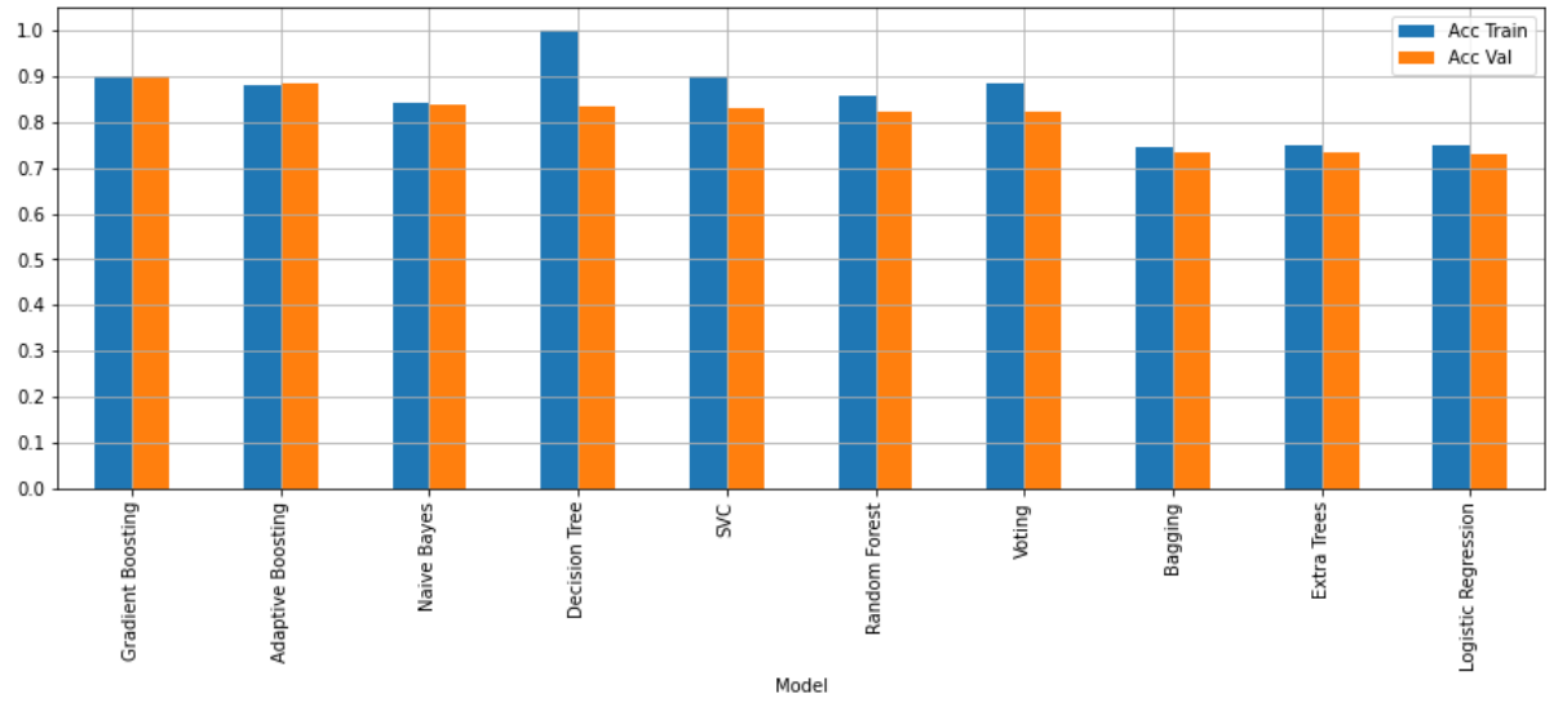
- Training accuracy equal 0.900592
- Validation accuracy equal 0.898901
- Testing accuracy equal 0.8842857142857142
- Precision: 0.9088235294117647
- Recall: 0. 0.8607242339832869
- F1Score: 0.8841201716738197

Features Importance:



The comparison between all used models:

	Model	Acc Train	Acc Val
0	Gradient Boosting	0.900592	0.898901
1	Adaptive Boosting	0.881657	0.883516
2	Naive Bayes	0.843787	0.837363
3	Decision Tree	1.000000	0.832967
4	SVC	0.898225	0.830769
5	Random Forest	0.856805	0.824176
6	Voting	0.884024	0.821978
7	Bagging	0.745562	0.731868
8	Extra Trees	0.750296	0.731868
9	Logistic Regression	0.747929	0.729670



Conclusion

Blood pressure is dangerous and may cause death and a critical factor for increasing the risk of serious diseases. The machine learning and artificial intelligence have opened up exciting new horizons for monitoring of blood pressure. Machine learning and artificial intelligent help at the early detection of the blood pressure disease which make the benefit role of them appear at helping in the medication industry.

References

[1] Wu, T. H., Pang, G. K. H., & Kwong, E. W. Y. (2014). Predicting Systolic Blood Pressure Using Machine Learning. 7th International Conference on Information and Automation for Sustainability. Published. https://doi.org/10.1109/iciafs.2014.7069529

[2] *A review of machine learning techniques in photoplethysmography for the non-invasive cuff-less measurement of blood pressure*. (2020, April 1). ScienceDirect. https://linkinghub.elsevier.com/retrieve/pii/S1746809420300264