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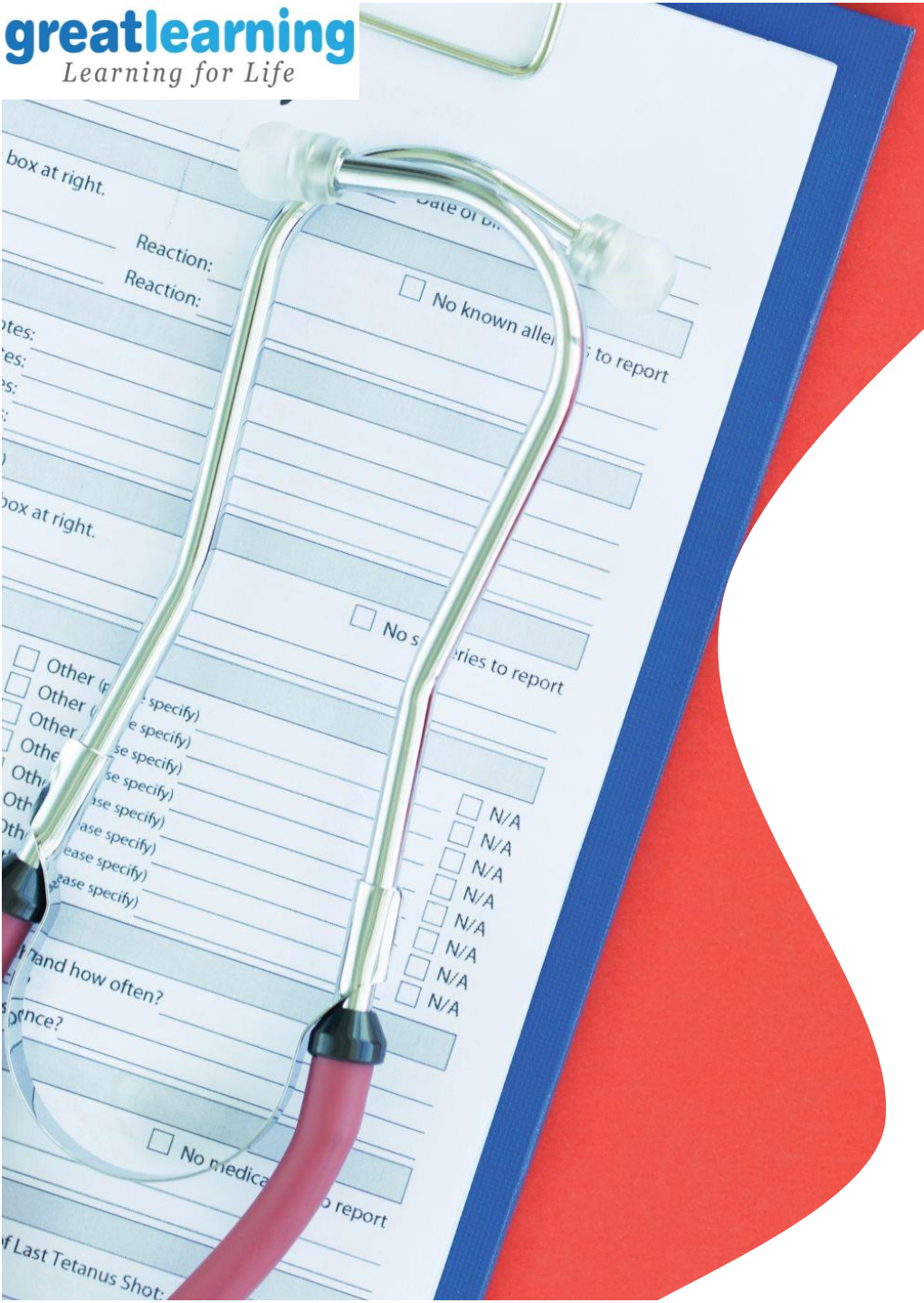

{PGPDSE-GGN-JAN21-GROUP-4 } PRESENTS

DIABETIC PATIENT'S READMISSION PREDICTION

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SRAVAN MALLA

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BUSINESS PROBLEM

To identify the factors that lead to the high readmission rate of diabetic patients within 30 days post discharge and to correspondingly predict the high-risk diabetic patients who are most likely to get readmitted.

Also, to identify the medicines that are the most effective in the treatment.

Why it's needed?

1

Diabetes Mellitus (DM) is a chronic disease where the blood has high sugar level. It is a progressive disease that can lead to a significant number of health complications and profoundly reduce the quality of life.

2

Hospital readmission is a high-priority health care quality measure and target for cost reduction. The burden of diabetes among hospitalized patients, however, is substantial, growing, and costly, and readmissions contribute a significant portion of this burden.

3

Thirty-day readmission rates for hospitalized patients with DM are reported to be between
14.4 and 22.7% much higher than the rate for all hospitalized patients (8.5–13.5%).

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DATASET PREVIEW

The data subset used for analysis covers 10 years of diabetic patients encounters data (1999 – 2008) with over 100,000 diabetic patients and variables including length of stay, medicines, in-patient visits etc. from 130 hospitals in the United States.

VARIABLES

Patient identifiers :- encounter_id, patient_nbr

Patient demographics :- race, gender, age, weight ,payer_code

Admission and Discharge details :- admission_source_id ,admission_type_id, discharge_disposition_id

Patient medical history :- number_outpatient ,number_inpatient, number_emergency

Patient Admission details :- medical_speacialty ,diag_1, diag_2 and diag_3, time_in_hospital, number_diagnoses, num_lab_procedures, num_procedures, num_medications

Clinical Results :- max_glu_serum, A1cresult

Medication Details :- diabetesMed, change, 23 features for medications

Readmission Indicator :- readmitted

DATATYPES

Category:36, Numerical:13, Boolean:1

OTHER DETAILS

- Classification Problem
- Total Rows : 101766
- Total Columns : 50

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EXPLORATORY DATA ANALYSIS

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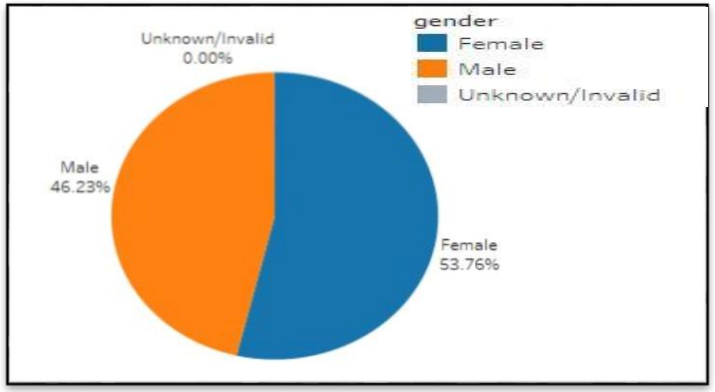
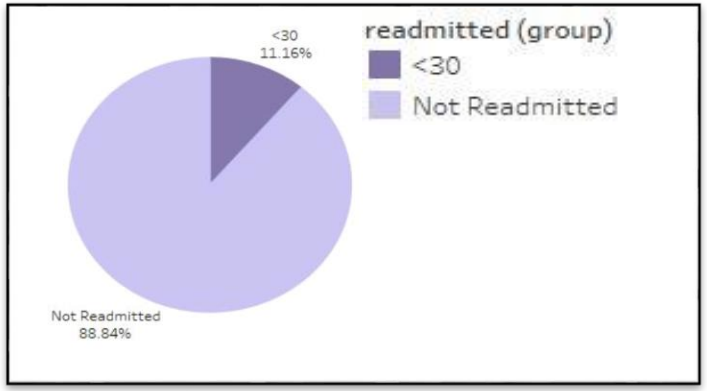
UNIVARIATE ANALYSIS

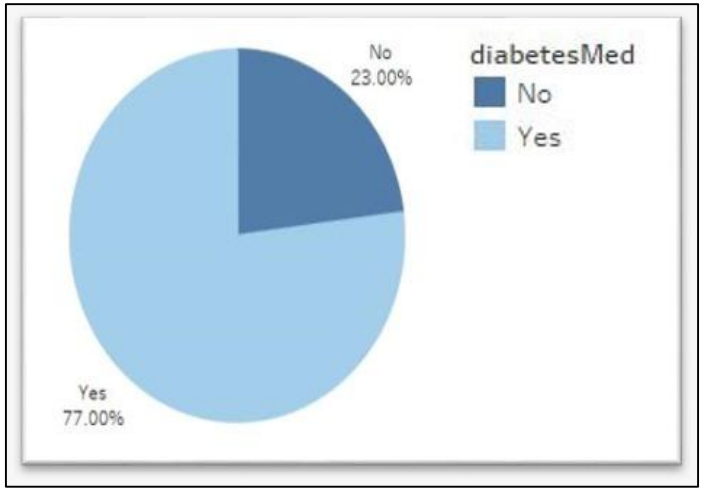
Gender

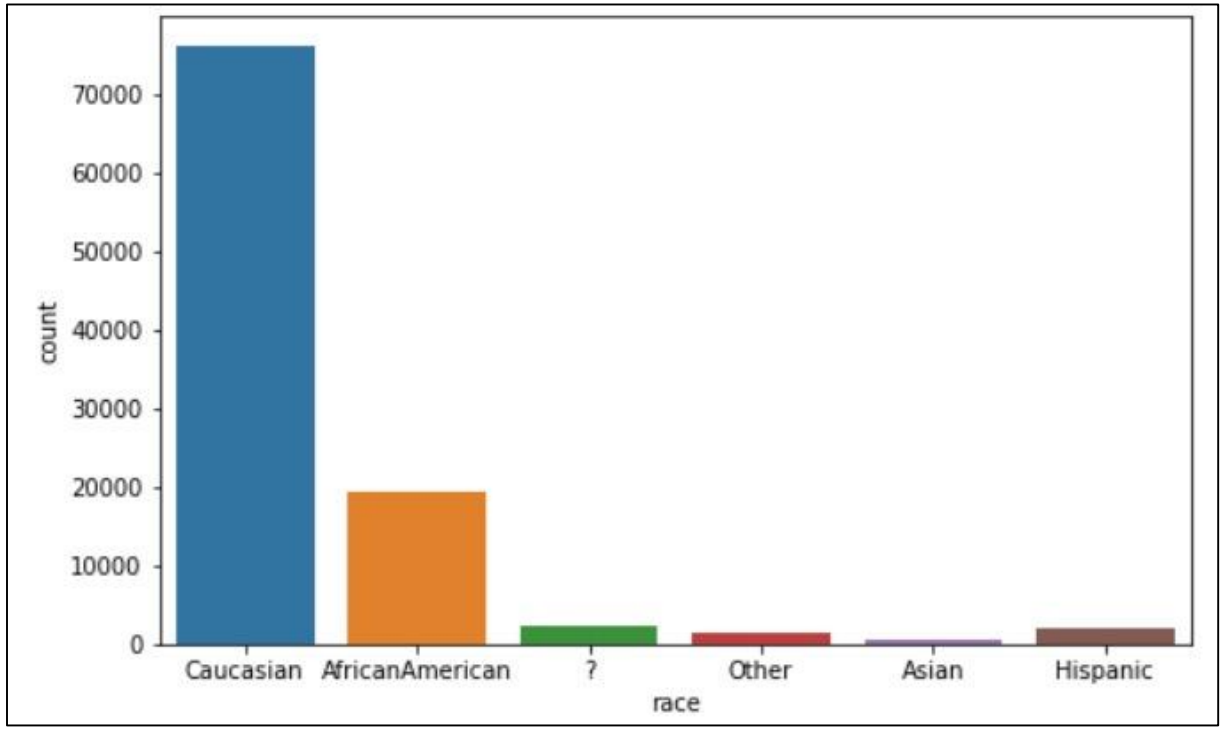


Readmitted



DiabetesMed




70000
60000
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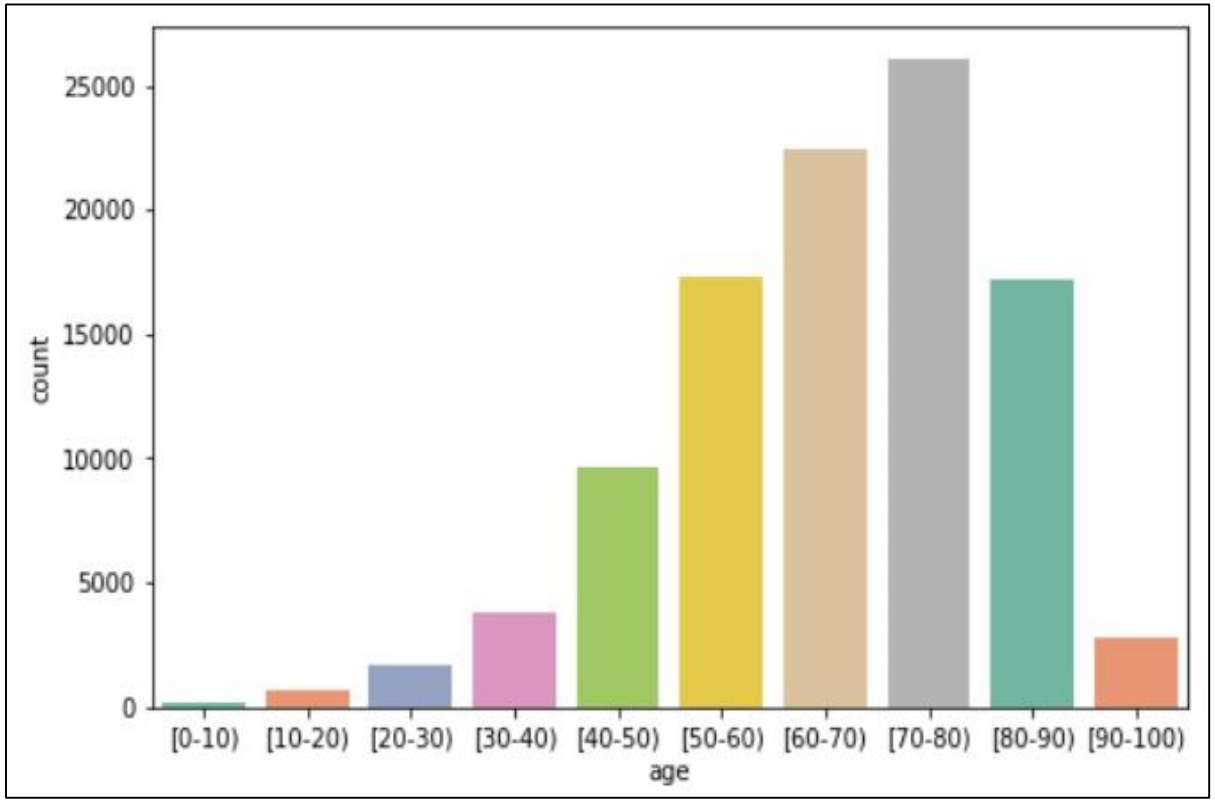
count
Caucasian
AfricanAmerican
?
Other
Asian
Hispanic
race

Race

Age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20000
15000
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count
[0-10)
[10-20)
[20-30)
[30-40)
[40-50)
[50-60)
[60-70)
[70-80)
[80-90)
[90-100)
age

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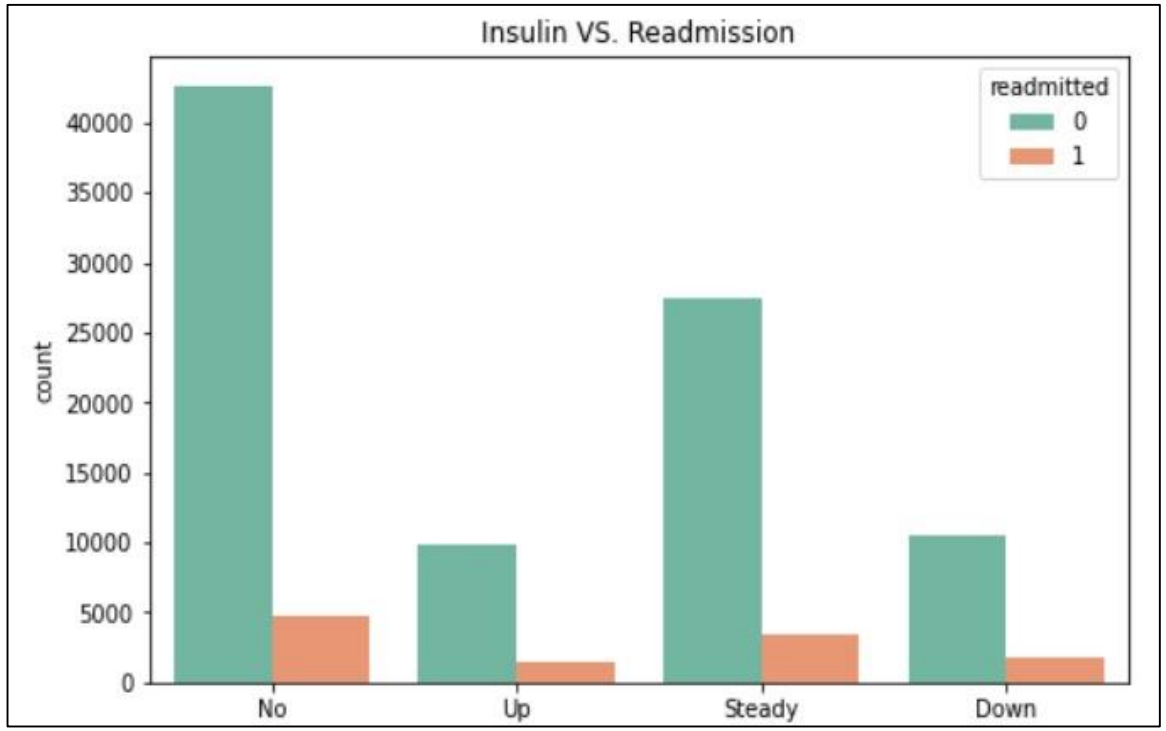
BIVARIATE ANALYSIS

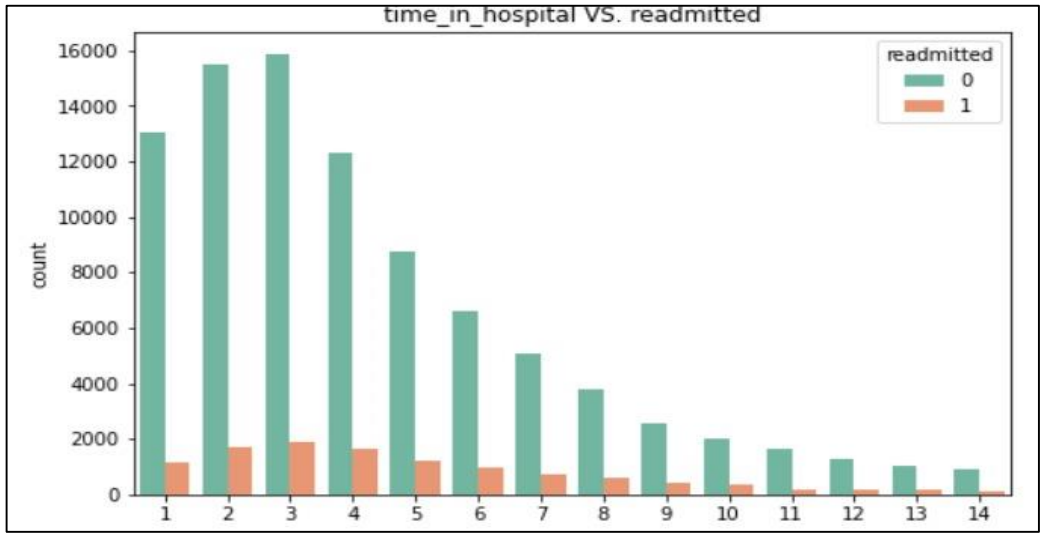
Insulin Vs Readmission

No. of Counts



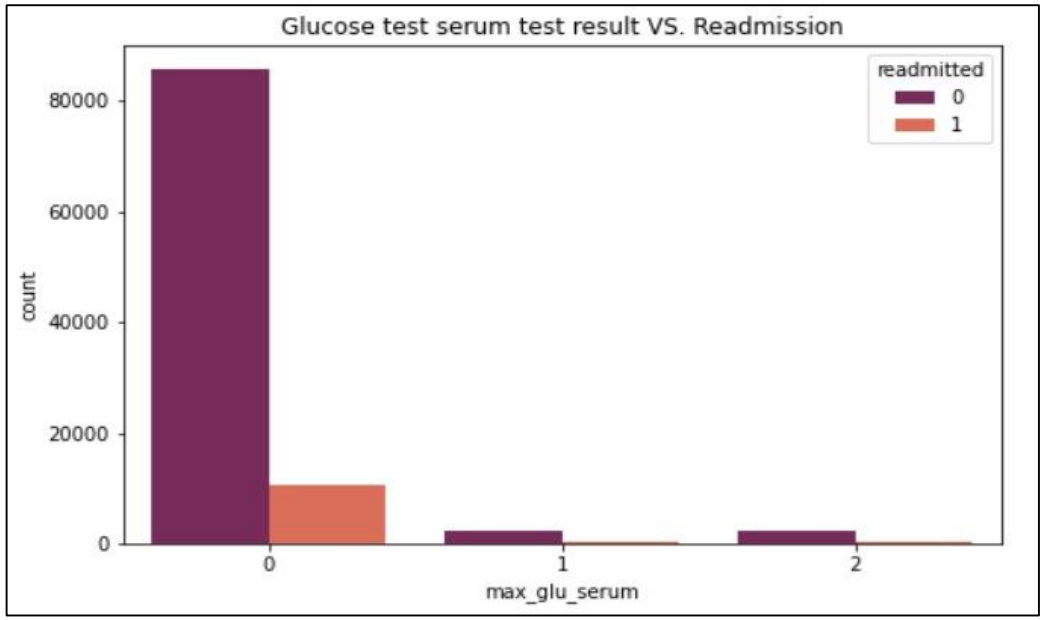
Time Vs Readmission

No. of Counts



Max_Glucose_serum Vs Readmission

No. of Counts



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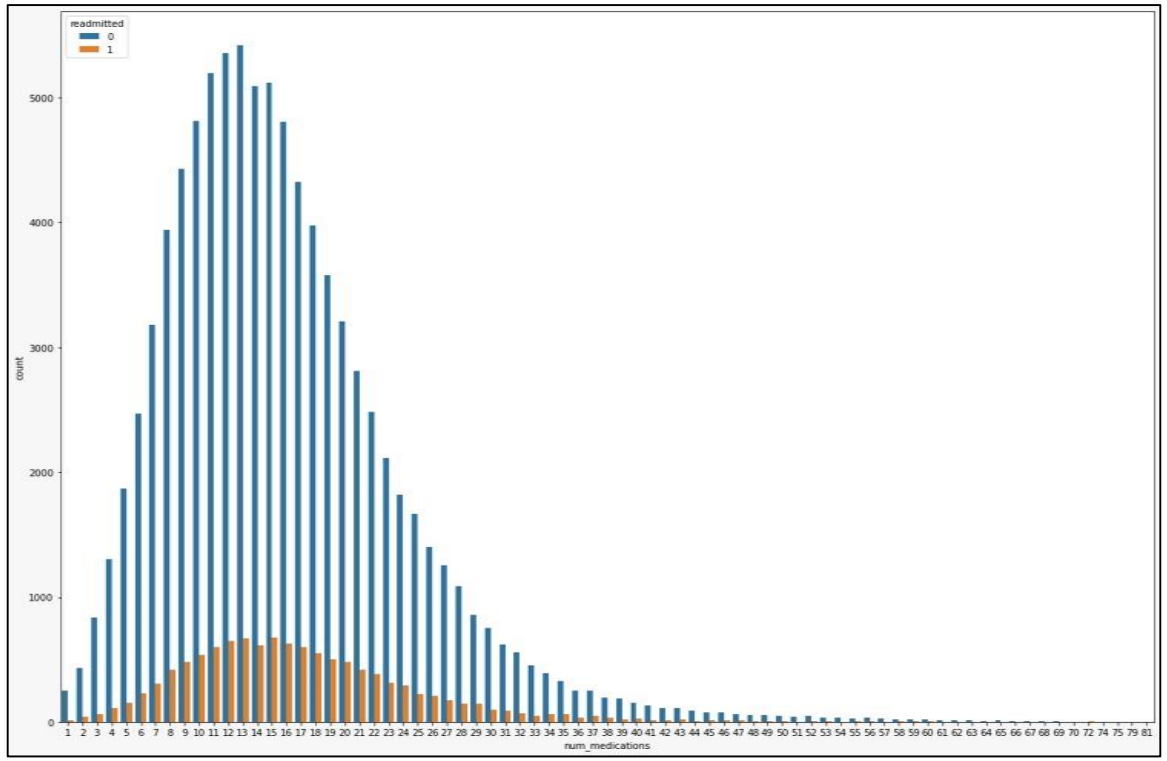
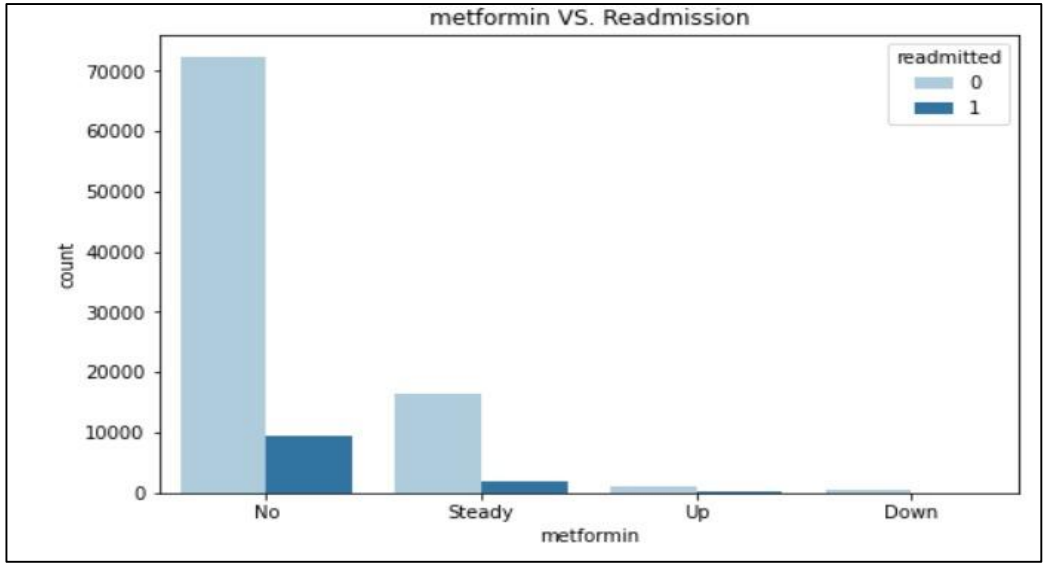
Num_Medications Vs Readmission

No. of Counts



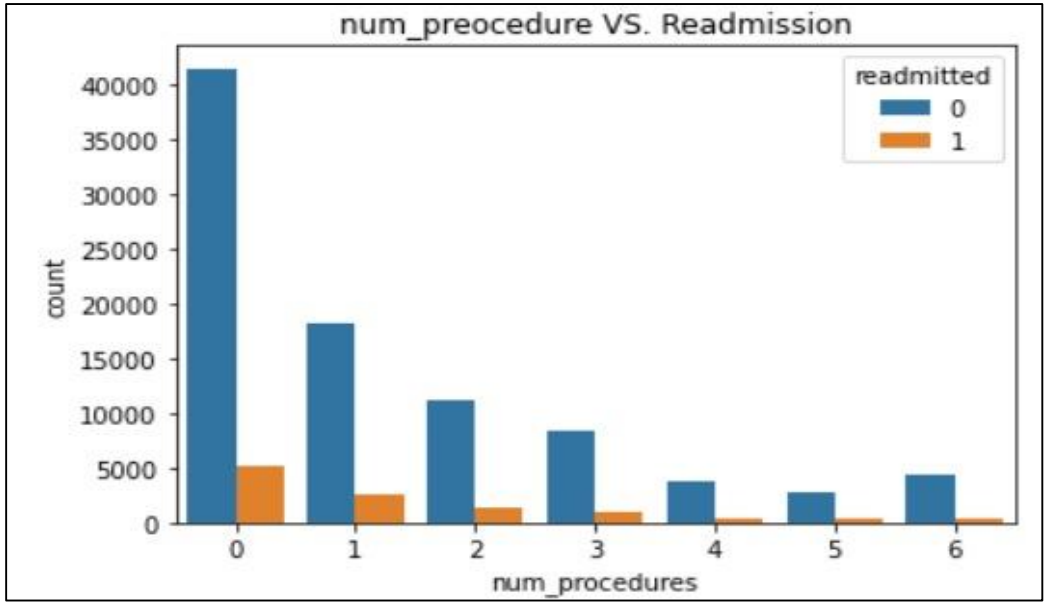
Metformin Vs Readmission

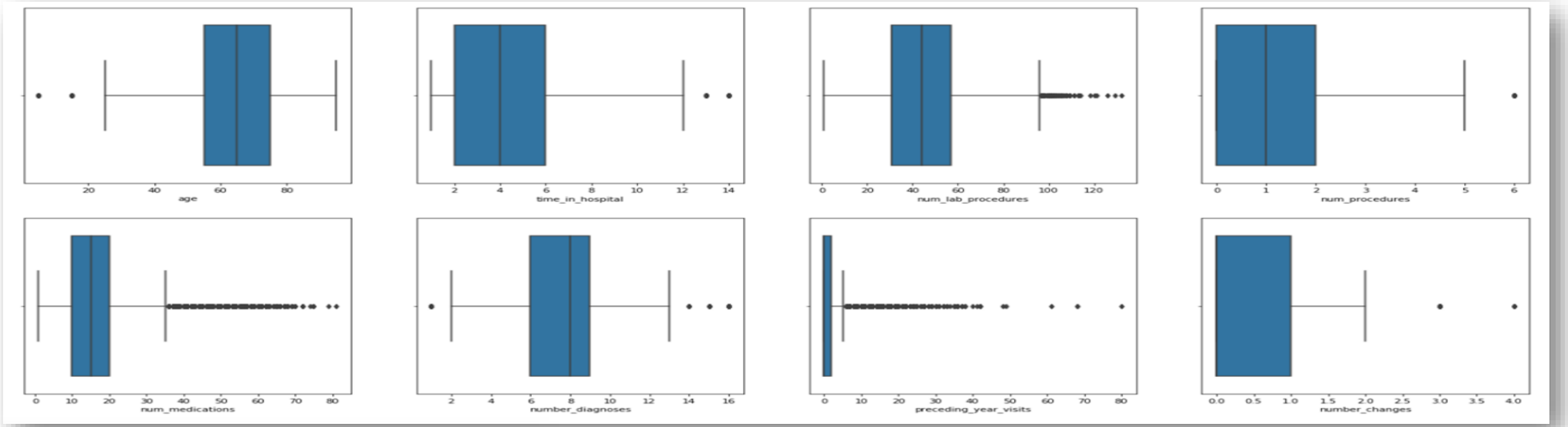
No. of Counts

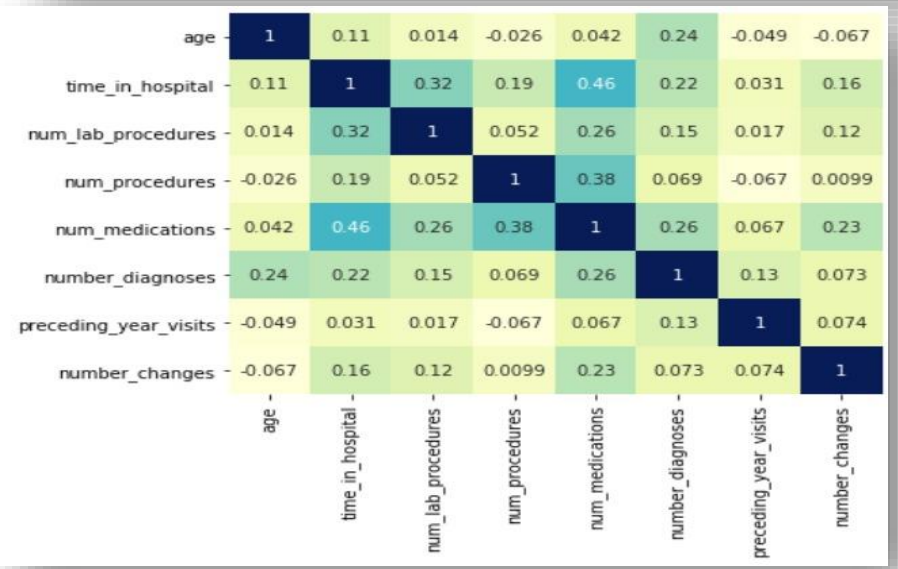


Num_Procedure Vs Readmission

No. of Counts







SUMMARY

- Age has Outliers, having low values indicating that , it's is left skewed.
- Time, Number of procedure, Number of Lab procedure and preceding year visits have Outliers with high value making the distribution right skewed .
- Independents Correlation has been shown through Heatmap.

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Missing Values

Weight
Payer_Code
Medical_specialty

They all have more than 40% missing value

Encoding

Gender	
Female	0
Male	1

Diabetes Med	
No	0
Yes	1

Age	
[0-10)	5
[10-20)	15
[20-30)	25
[30-40)	35
[40-50)	45
[50-60)	55
[60-70)	65
[70-80)	75
[80-90)	85
[90-100)	95

Feature Engineering

Number_Outpatient
Number _Inpatient
Number _Emergency

All combine to form
Service_utilization

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MODELS WITH BALANCED DATA WITHOUT TUNING

Logistic Regression (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	59.23%	59.90%
F-1 Score	25.50%	26.10%
Precision_Score	16.10%	16.60%
Recall_Score	61.10%	61.20%
AUC_ROC Score	60%	60.53%

Decision Tree Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	80.5%	80.47%
F-1 Score	99.9%	14.06%
Precision_Score	99.9%	40.29%
Recall_Score	100%	13.8%
AUC_ROC Score	99.9%	51.5%

Random Forest Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	88.57%	88.44%
F-1 Score	99.98%	0.29%
Precision_Score	99.98%	41.66%
Recall_Score	99.97%	0.14%
AUC_ROC Score	99.98%	50.06%

XG Boost Classifier(scale_pos_weight=7.73)		
Metrics	Train Set Result	Test Set Result
Accuracy_score	68.37%	67.80%
F-1 Score	40.50%	25.78%
Precision_Score	27.38%	17.56%
Recall_Score	77.74%	48.43%
AUC_ROC Score	75.58%	59.38%

LightGBM Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	63.64%	64.09%
F-1 Score	32.10%	27.06%
Precision_Score	20.84%	17.68%
Recall_Score	69.81%	57.70%
AUC_ROC Score	67.82%	65.51%

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MODELS WITH BALANCED DATA WITH TUNING

Decision Tree Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	60.61%	62.03%
F-1 Score	26.44%	26.34%
Precision_Score	16.95%	16.97%
Recall_Score	60.05%	58.79%
AUC_ROC Score	61.06%	60.62%

Random Forest Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	63.67%	67.19%
F-1 Score	25.43%	25.76%
Precision_Score	17.10%	17.43%
Recall_Score	49.56%	49.29%
AUC_ROC Score	59.30%	59.41%

XG Boost Classifier(scale_pos_weight=7.73)		
Metrics	Train Set Result	Test Set Result
Accuracy_score	62.42%	62.81%
F-1 Score	28.26%	26.80%
Precision_Score	18.17%	17.34%
Recall_Score	63.49%	58.96%
AUC_ROC Score	63.32%	61.14%

LightGBM Classifier (class_weight="balanced")		
Metrics	Train Set Result	Test Set Result
Accuracy_score	61.28%	61.79%
F-1 Score	27.04%	26.79%
Precision_Score	17.25%	17.20%
Recall_Score	62.25%	60.56%
AUC_ROC Score	61.93%	61.26%

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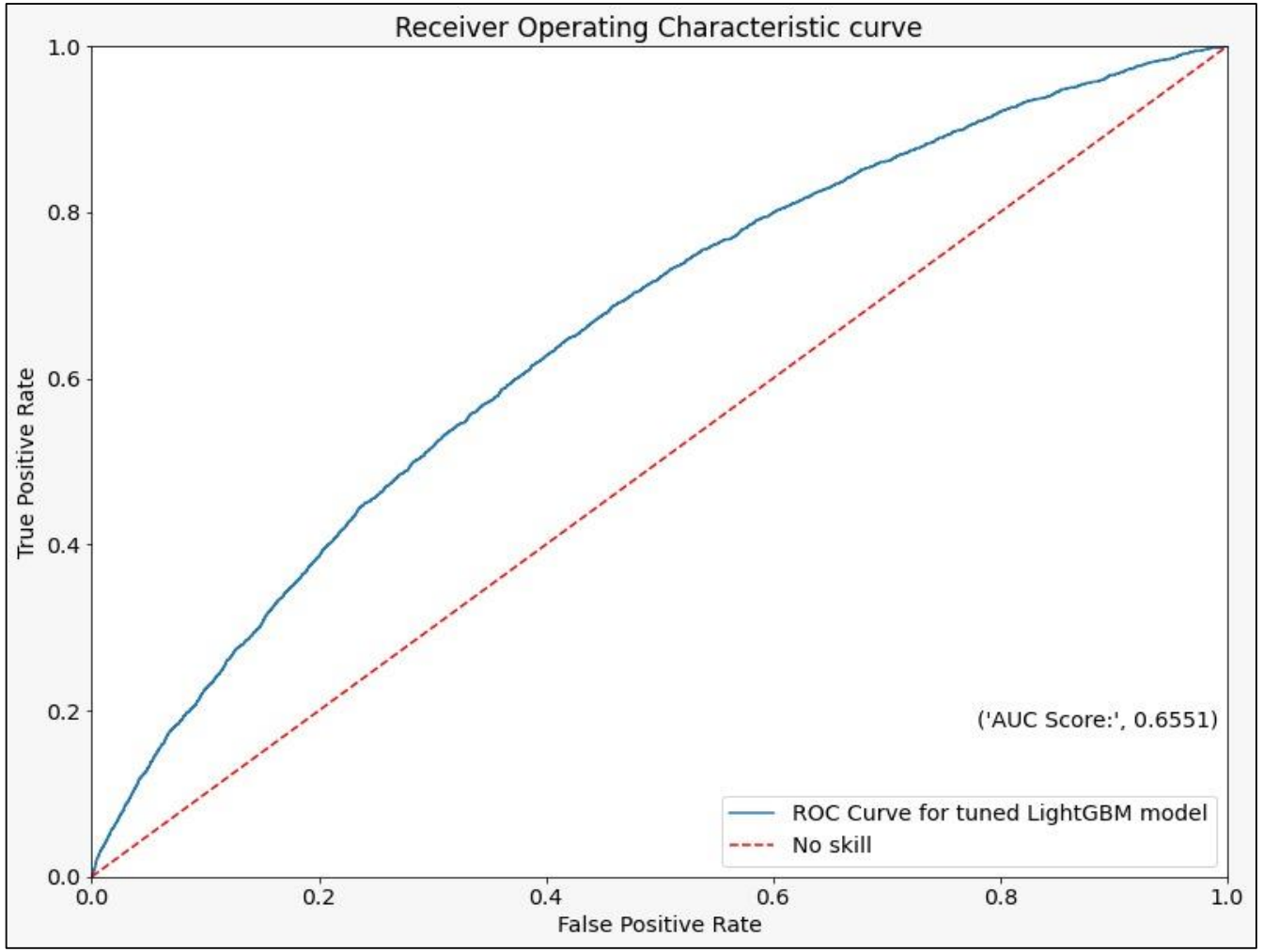
SELECTED MODEL

LightGBM Classifier (class_weight="balanced")		
Metrics	**Train Set Result**	**Test Set Result**
Accuracy_score	61.28%	61.79%
F-1 Score	27.04%	26.79%
Precision_Score	17.25%	17.20%
Recall_Score	62.25%	60.56%
AUC_ROC Score	61.93%	65.51%
Final Model Chosen is LGBM !!!!!		

CONFUSION MATRIX

16080	9874
1336	2052



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FINDINGS

If the patient has the following characteristics he has a high probability of being readmitted :

- High preceding year visits.
- If the patient is discharged to another medical facility or discharged to home with health services.
- High number of diagnoses.
- If the patient is given diabetes medicines.
- If the primary diagnosed disease was of circulatory system.
- If Metformin and/or insulin is not being given or the dosage is low.
- If secondary diagnosis was coming to be Diabetes.
- If A1C test was not performed.

CHALLENGES ENCOUNTERED

- The major challenge was to acquire sufficient domain knowledge of the medical world.
- Huge amount of Data
- Different Imputation methods
- Imbalanced Data
- Reductants Features
- Hyper parameter tuning

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BUSINESS RECOMMENDATION

- Medical facilities can take precautionary measures with patients during their initial admission by making A1C and Maximum Glucose Serum test compulsory and providing the treatment accordingly.
- Providing extra attention and care to high-risk patients.
- A follow-up with the discharged patients should be done to keep a track of their health and to counsel them from time-to-time.
- High-risk patients' current medicines' regime should be re-evaluated and the most effective medicines should be considered.
- Most Effective Medications :- Metformin, Glipizide, Insulin.
- The annual plans, financials and infrastructure / inventory should be planned accordingly by taking into account the predicted readmissions.

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THANK YOU