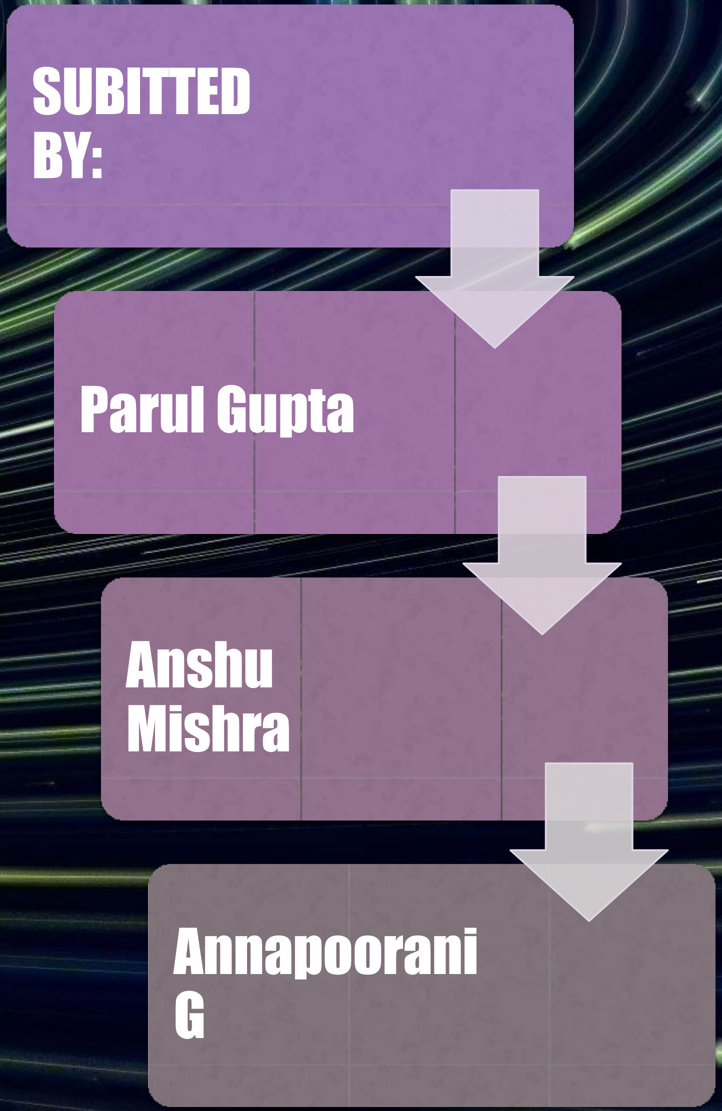
LEAD SCORING CASE STUDY



SUBITTED BY:

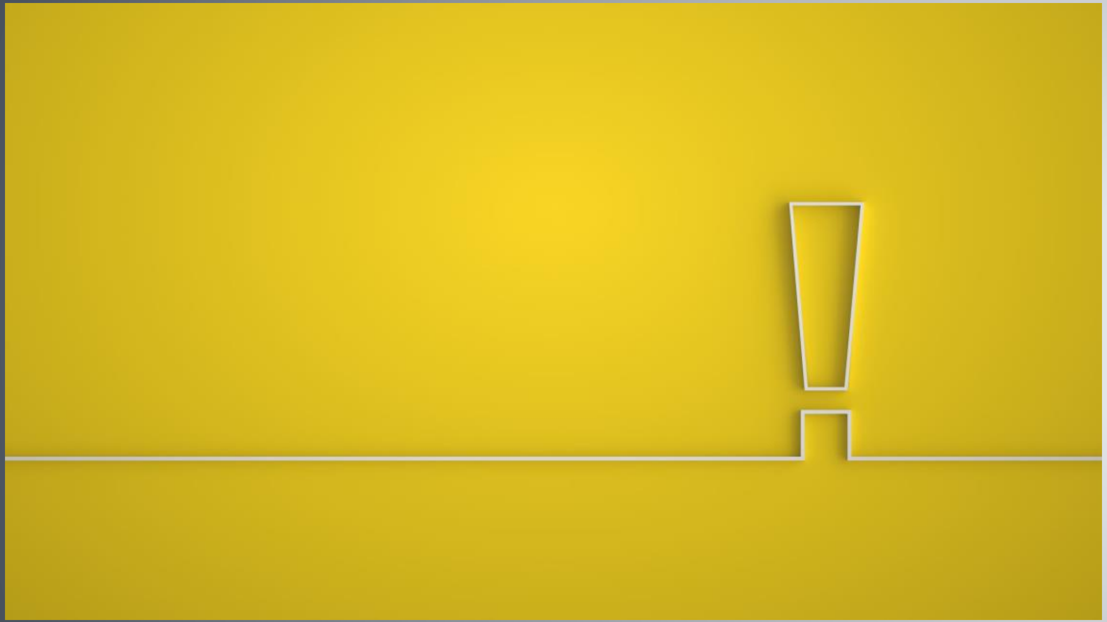
Parul Gupta

Anshu Mishra

Annapoorani G

Table of Contents

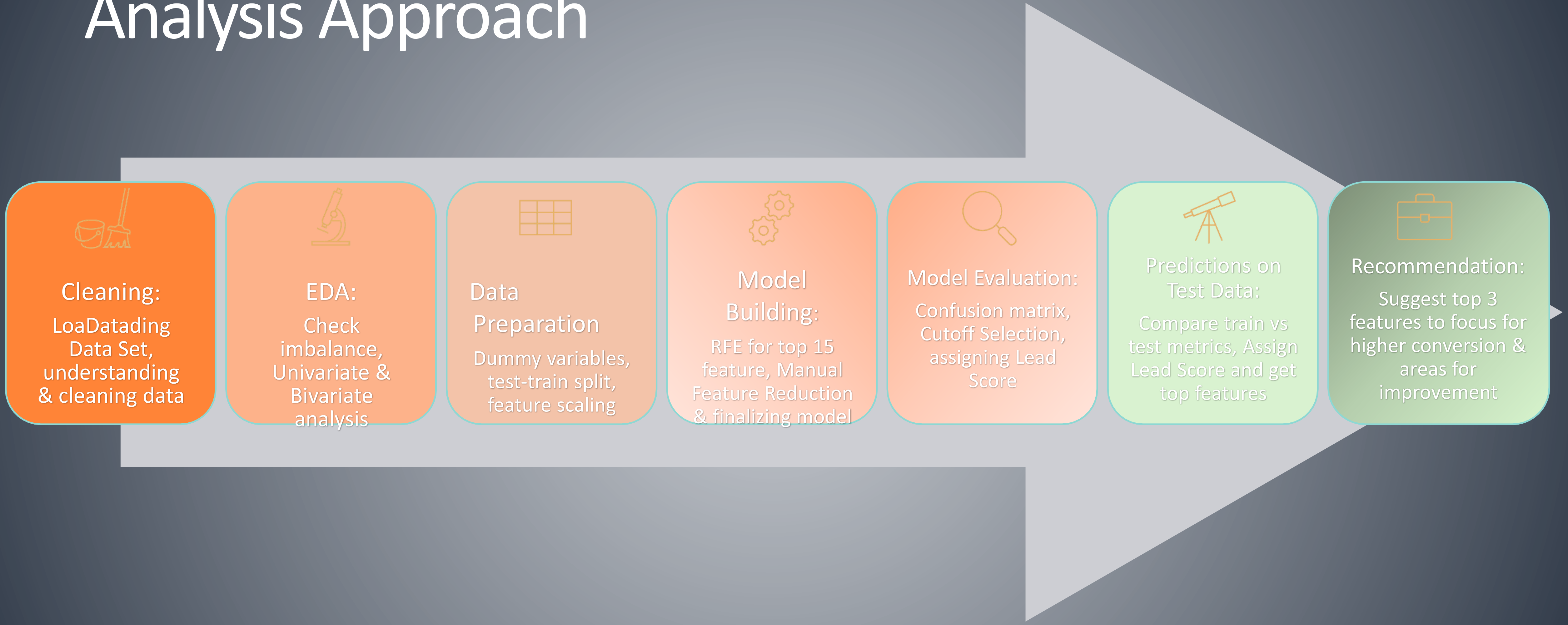
- Problem Statement
- Analysis Approach
- Data Cleaning
- EDA
- Data Preparation
- Model Building (RFE & Manual fine tuning)
- Model Evaluation
- Recommendations



Problem Statement

- X Education gets a lot of leads, its lead conversion rate is very poor at around 30%
- X Education wants to make lead conversion process more efficient by identifying the most potential leads, also known as Hot Leads
- Their sales team want to know these potential set of leads, which they will be focusing more on communicating rather than making calls to everyone.

Analysis Approach



Cleaning:
LoaDatading Data Set, understanding & cleaning data

EDA:
Check imbalance, Univariate & Bivariate analysis

Data Preparation
Dummy variables, test-train split, feature scaling

Model Building:
RFE for top 15 feature, Manual Feature Reduction & finalizing model

Model Evaluation:
Confusion matrix, Cutoff Selection, assigning Lead Score

Predictions on Test Data:
Compare train vs test metrics, Assign Lead Score and get top features

Recommendation:
Suggest top 3 features to focus for higher conversion & areas for improvement

Data Cleaning

"Select" level represents null values for some categorical variables, as customers did not choose any option from the list.

Columns with over 40% null values were dropped.

Missing values in categorical columns were handled based on value counts and certain considerations.

Drop columns that don't add any insight or value to the study objective (tags, country)

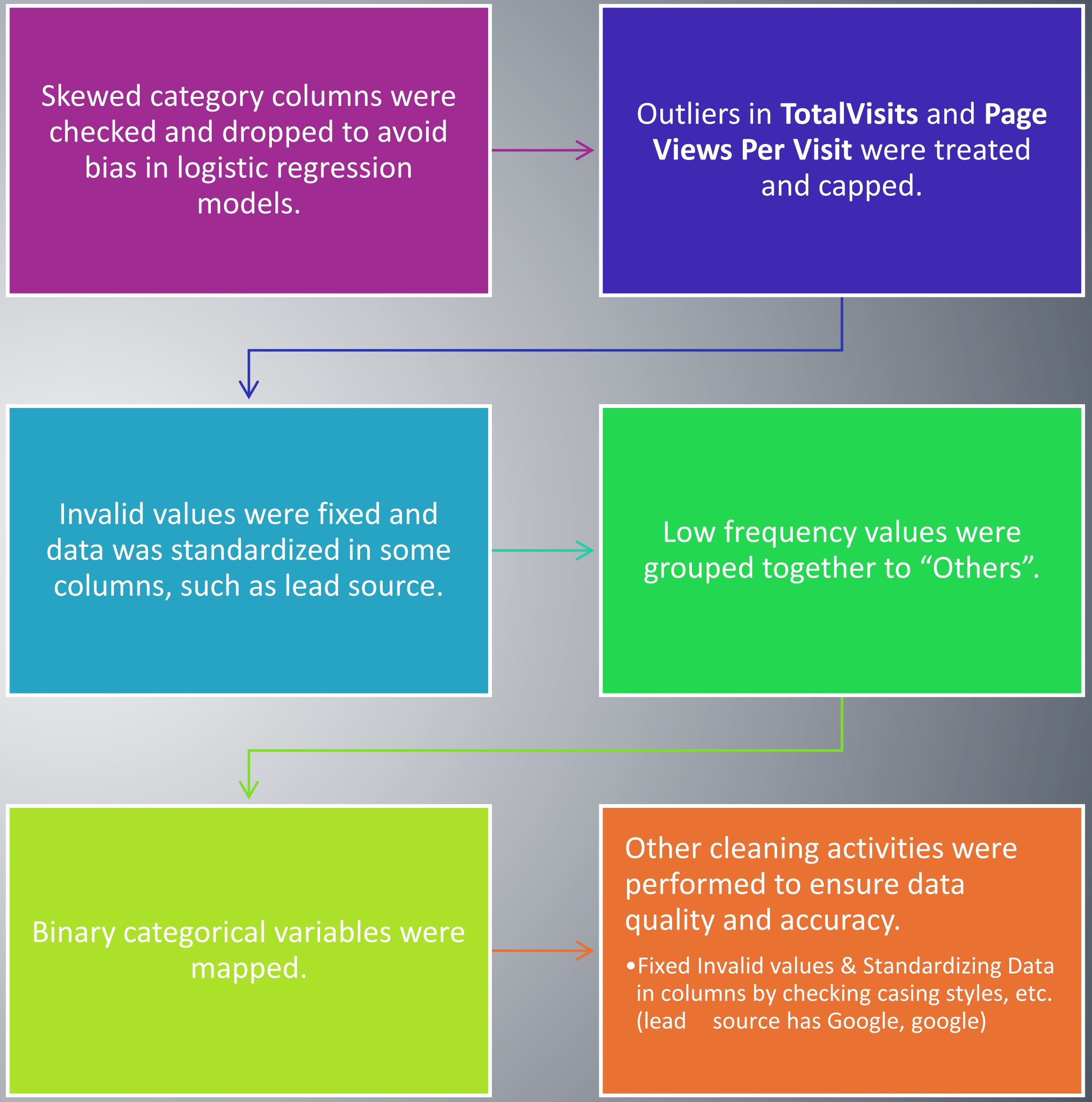
Imputation was used for some categorical variables.

Additional categories were created for some variables.

Columns with no use for modeling (Prospect ID, Lead Number) or only one category of response were dropped.

Numerical data was imputed with mode after checking distribution.

Data Cleaning



Skewed category columns were checked and dropped to avoid bias in logistic regression models.

Outliers in **TotalVisits** and **Page Views Per Visit** were treated and capped.

Invalid values were fixed and data was standardized in some columns, such as lead source.

Low frequency values were grouped together to "Others".

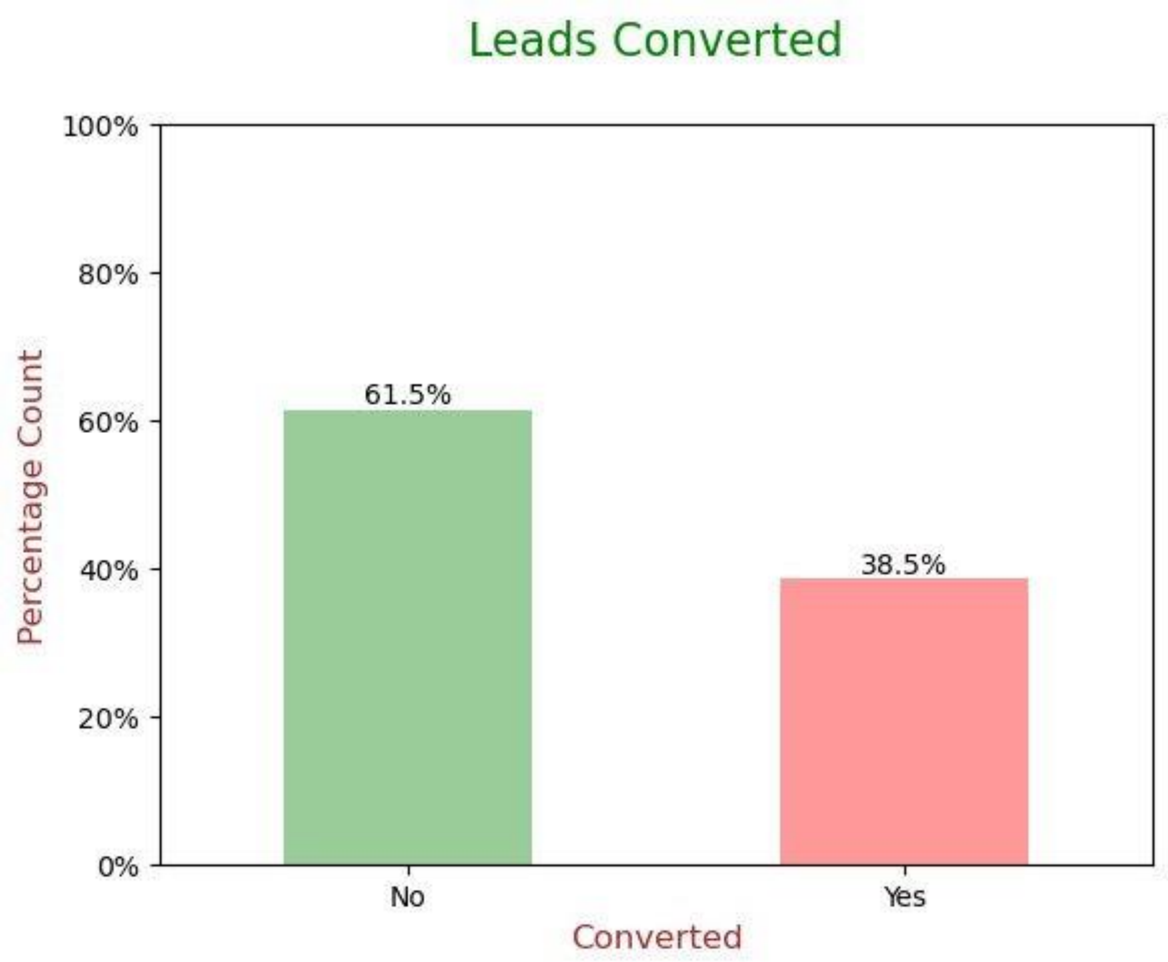
Binary categorical variables were mapped.

Other cleaning activities were performed to ensure data quality and accuracy.

- Fixed Invalid values & Standardizing Data in columns by checking casing styles, etc. (lead source has Google, google)

EDA

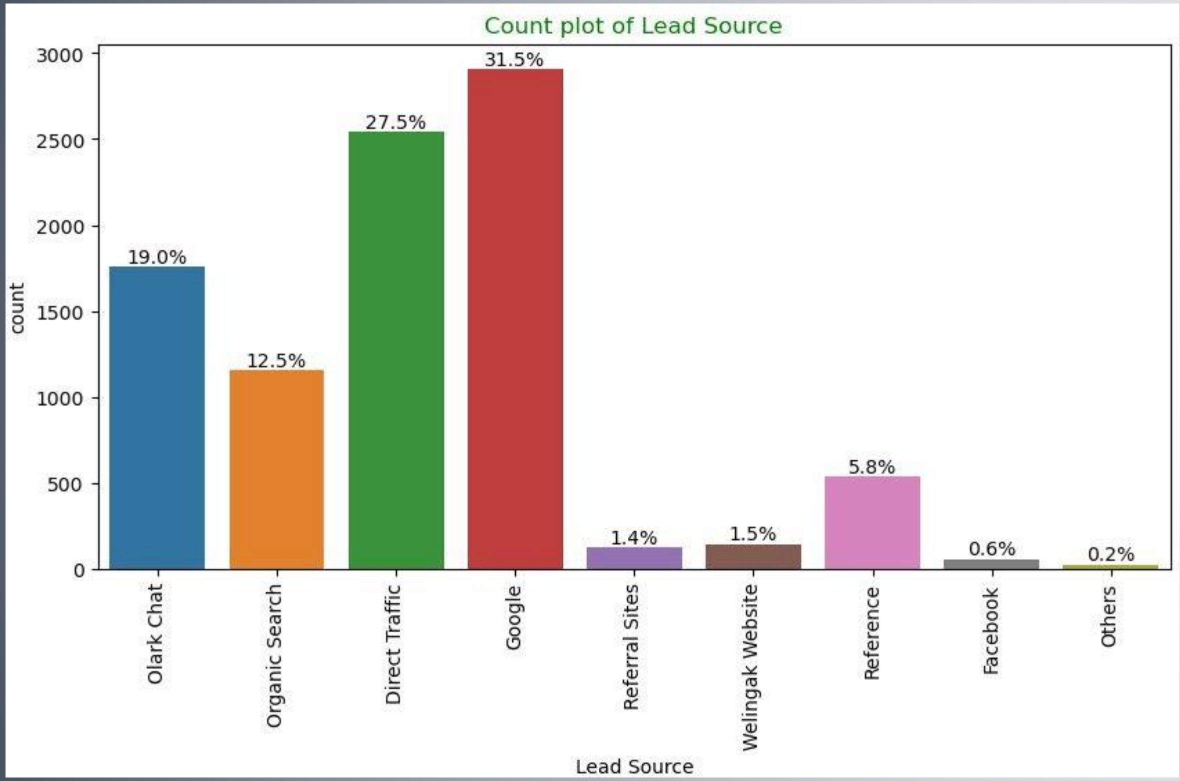
- Data is imbalanced while analyzing target variable.

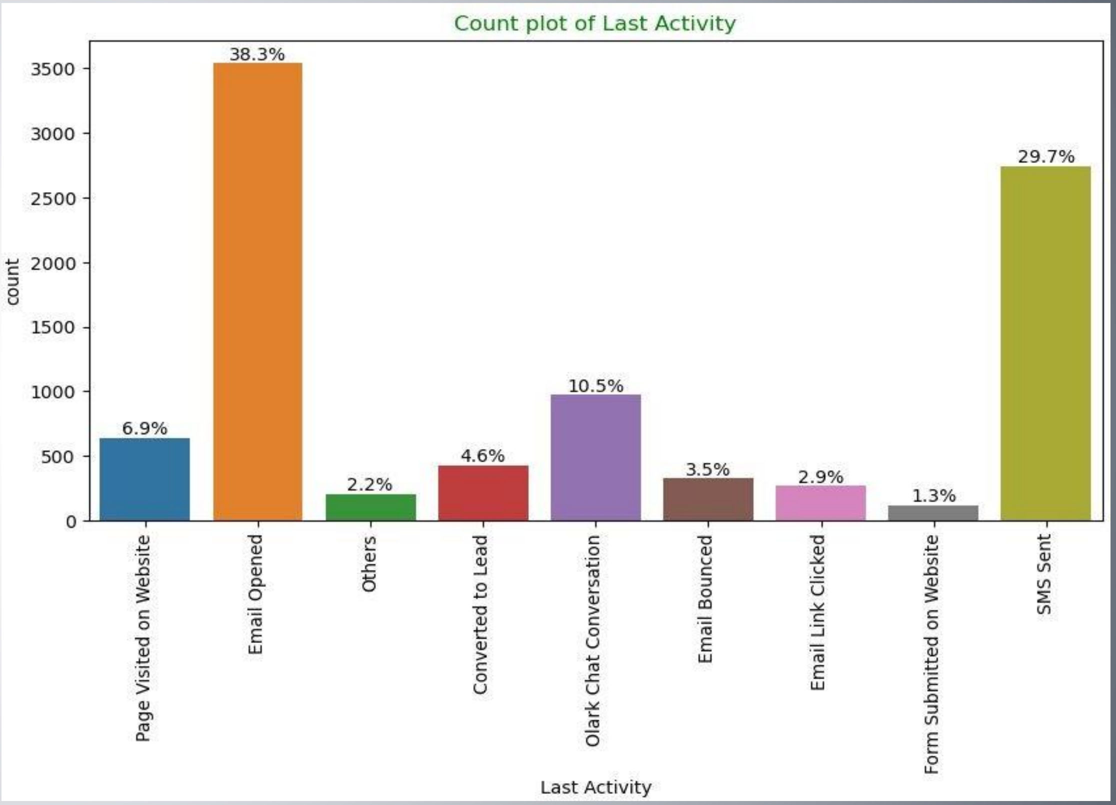


- Conversion rate is of 38.5%, meaning only 38.5% of the people have converted to leads.(Minority)
- While 61.5% of the people didn't convert to leads. (Majority)

EDA

- Univariate Analysis – Categorical Variables



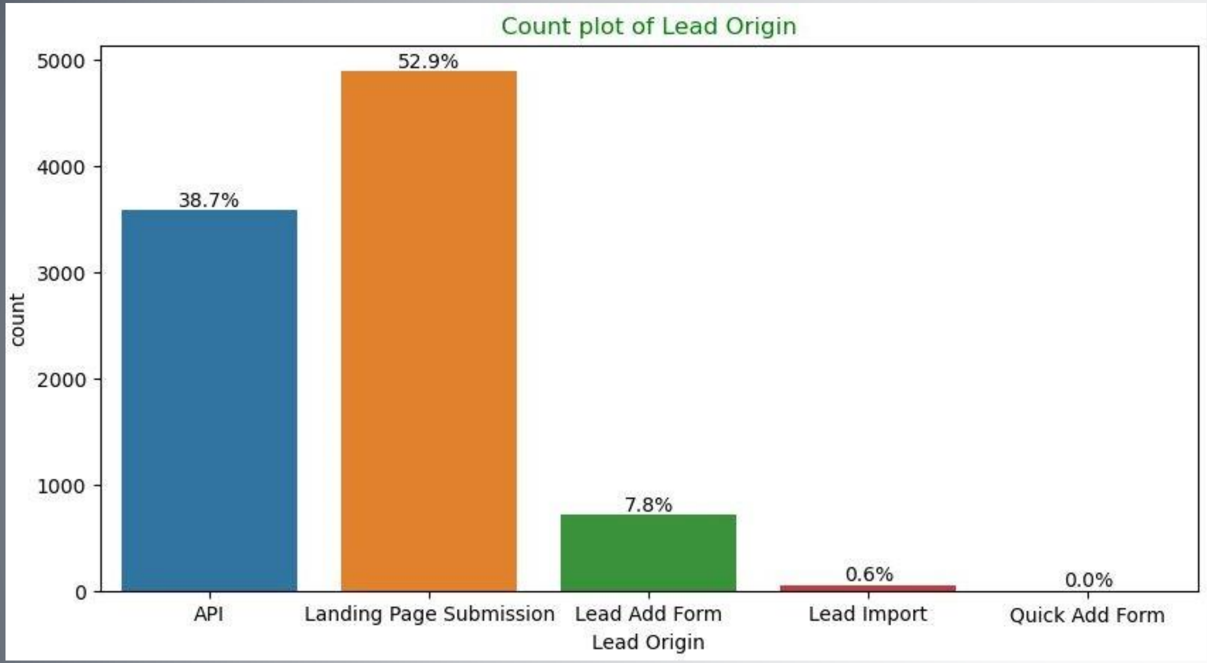


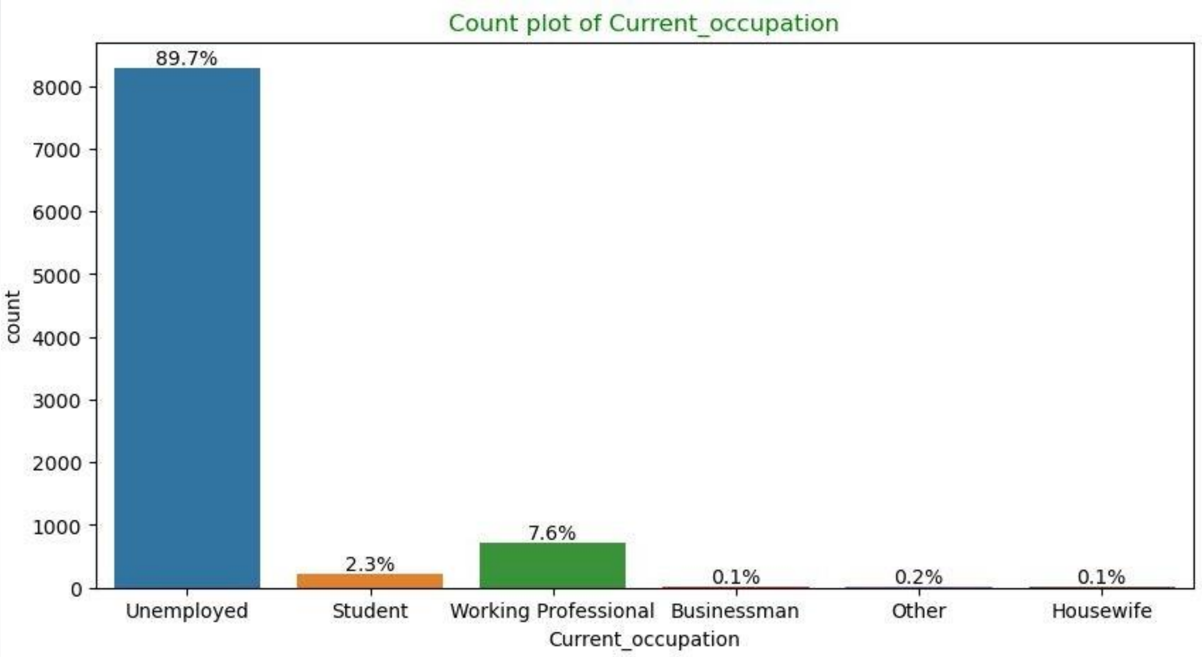
- **Lead Source:** 58% Lead source is from Google & Direct Traffic combined.

- **Last Activity:** 68% of customers contribution in SMS Sent & Email Opened activities.

EDA

- **Univariate Analysis – Categorical Variables**

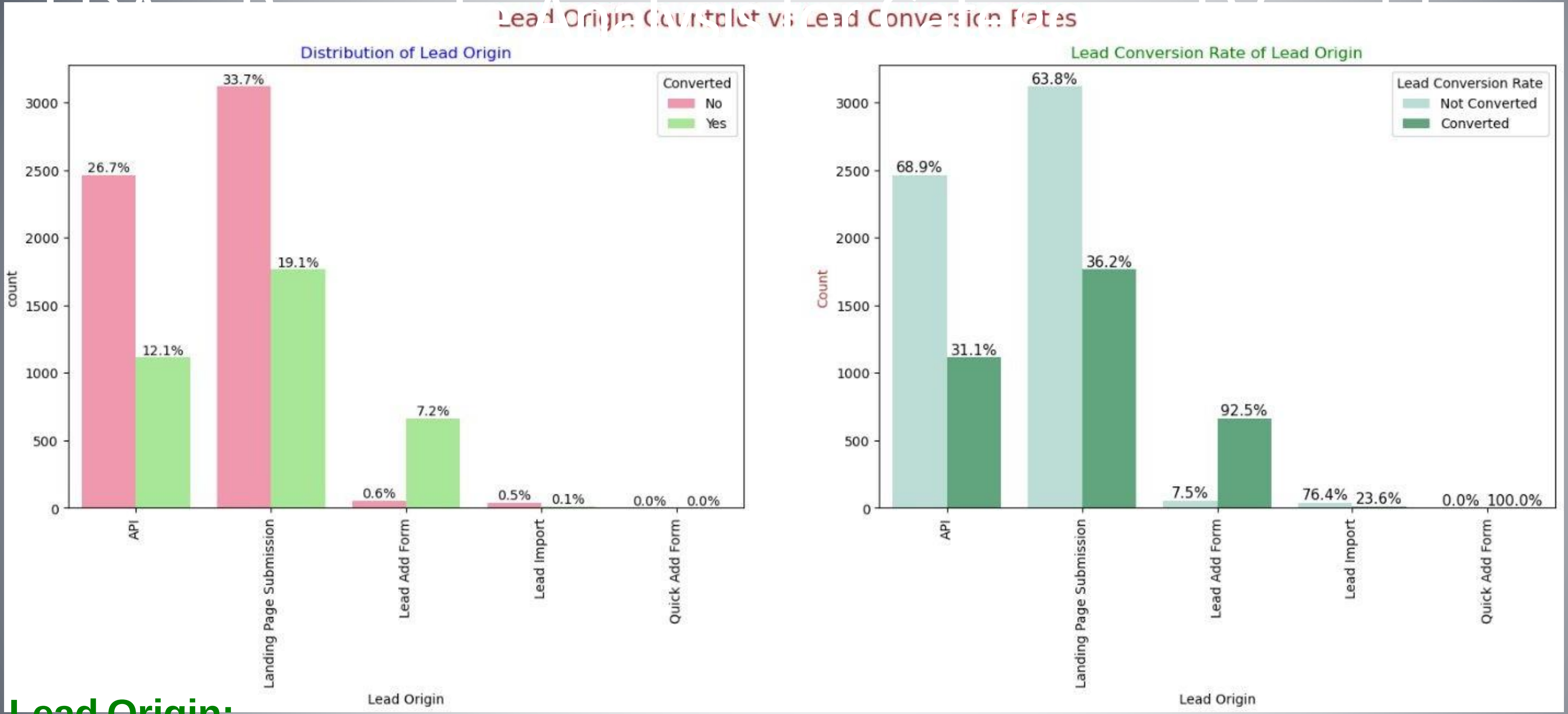




- **Lead Origin:** "Landing Page Submission" identified 53% of customers, "API" identified 39%.

- **Current_occupation:** It has 90% of the customers as Unemployed.

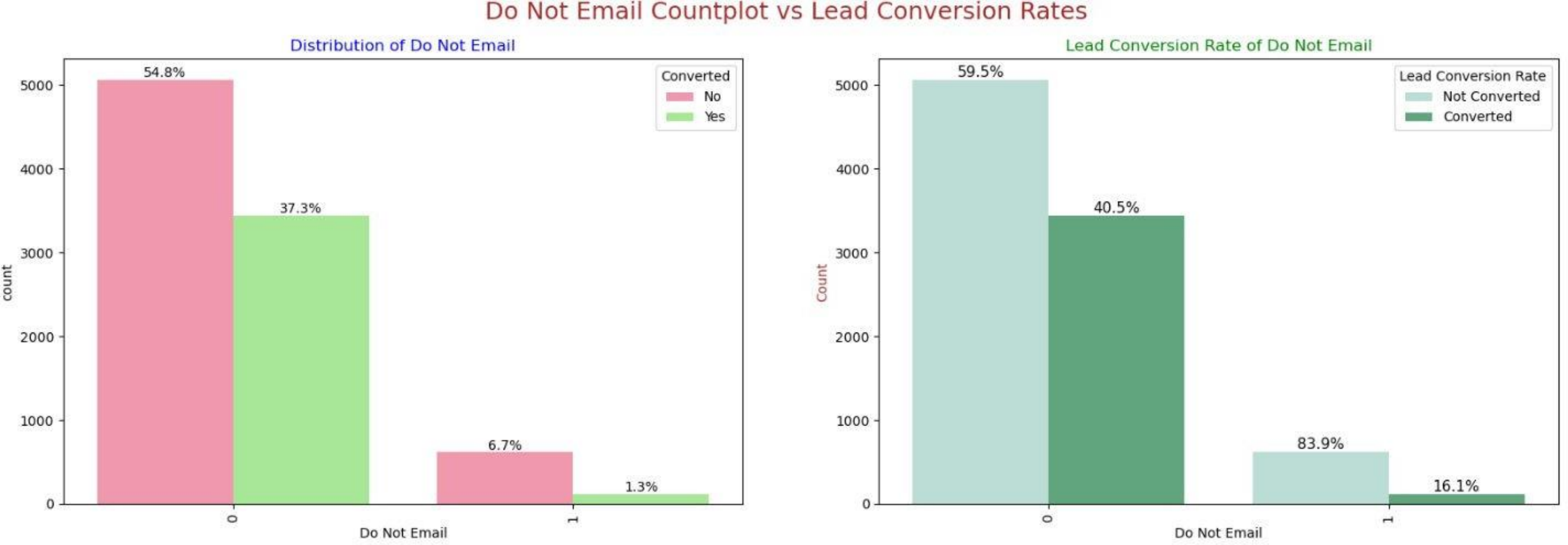
EDA – Bivariate Analysis for Categorical Variables



Lead Origin:

- Around 52% of all leads originated from *"Landing Page Submission"* with a **lead conversion rate (LCR) of 36%**.
- The *"API"* identified approximately 39% of customers with a **lead conversion rate (LCR) of 3fi%**.

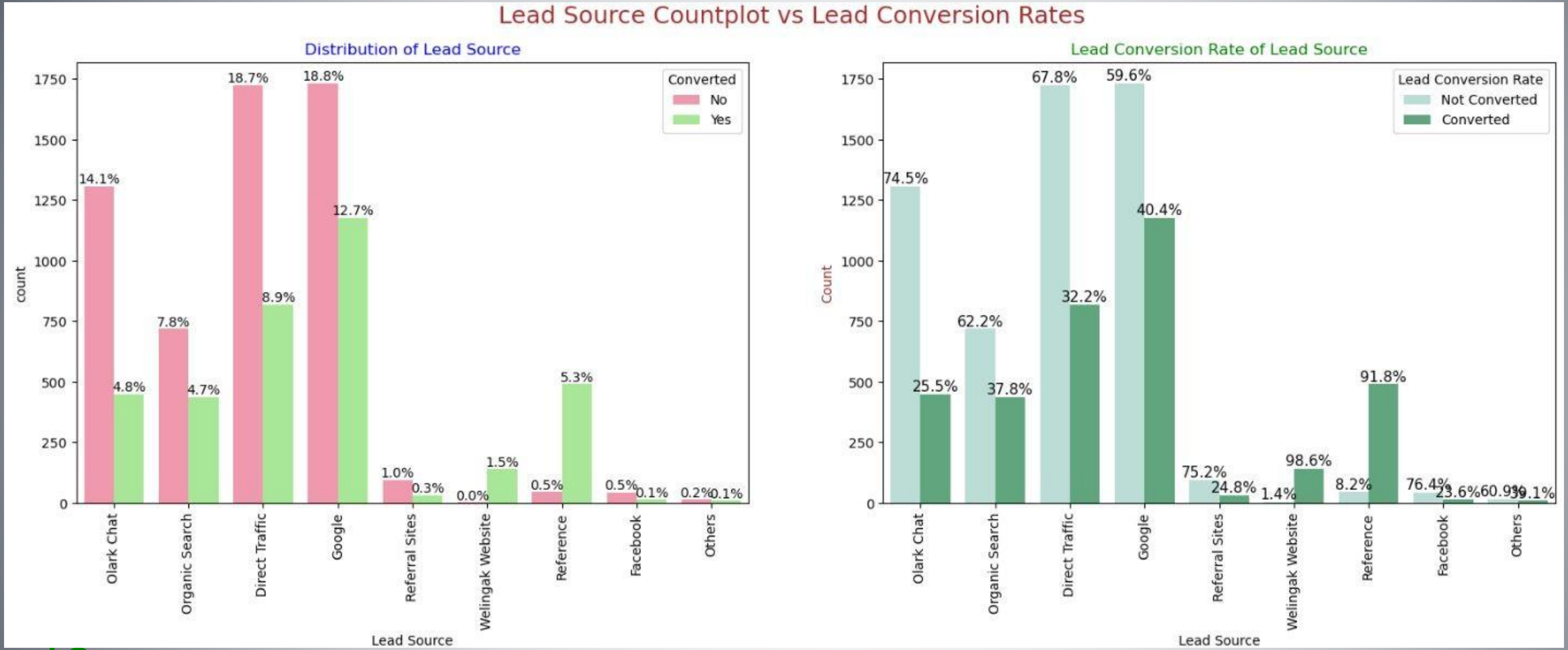
EDA – Bivariate Analysis for Categorical Variables



Do Not Email:

- 92% of the people has opted that they don't want to be emailed about the course & 40% of them are converted to leads.

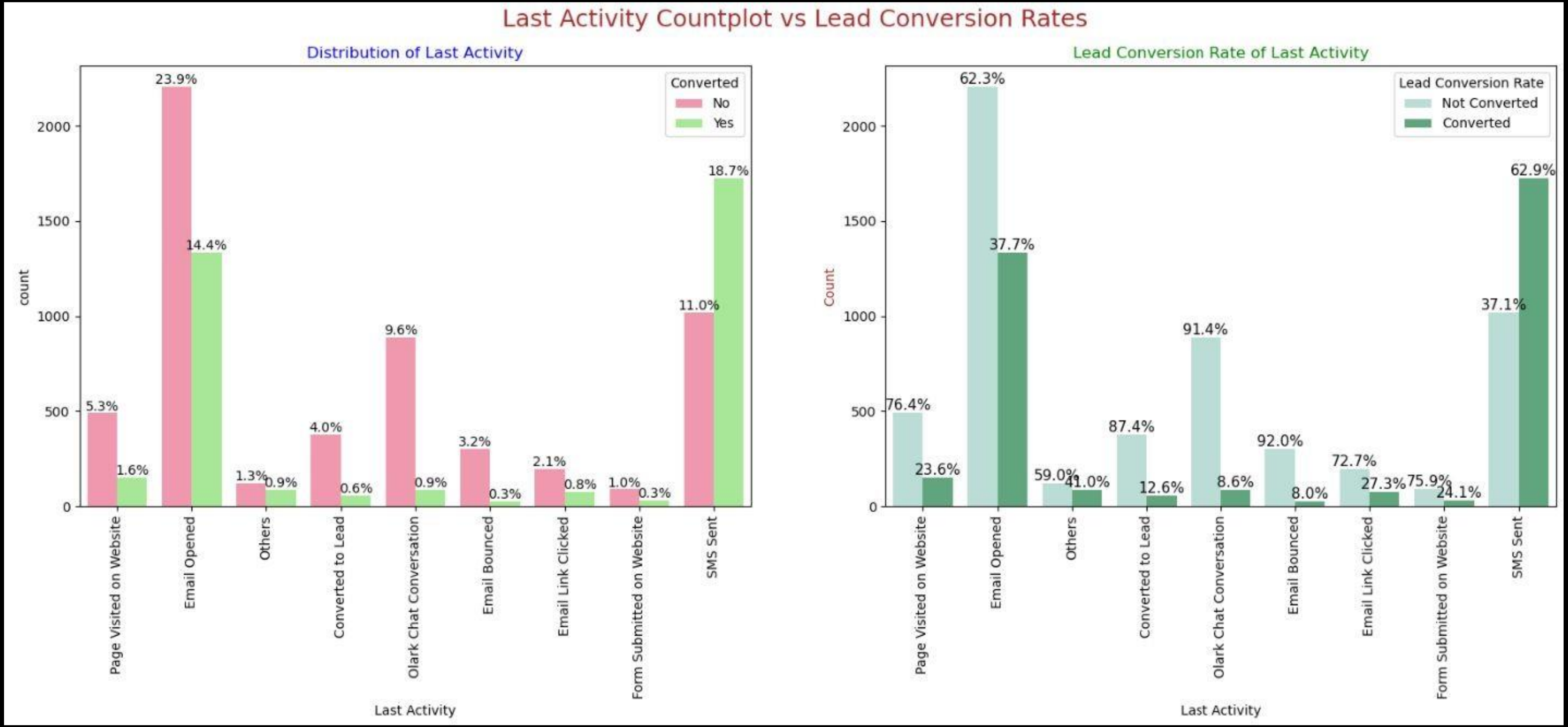
EDA – Bivariate Analysis for Categorical Variables



Lead Source:

- *Google* has **LCR of 40%** out of 31% customers,
- *Direct Traffic* contributes **32% LCR** with 27% customers, which is lower than Google,
- *Organic Search* also gives **37.8% of LCR**, but the contribution is by only 12.5% of customers,
- *Reference* has **LCR of 9fi%**, but there are only around 6% of customers through this Lead Source.

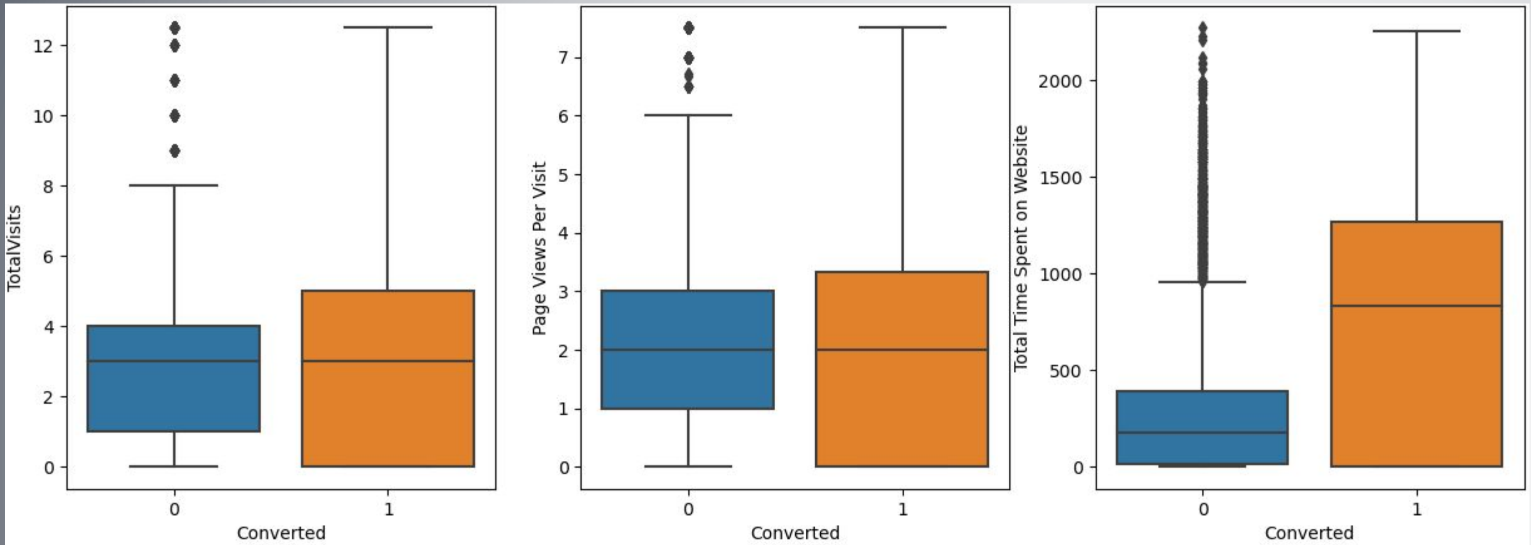
EDA – Bivariate Analysis for Categorical Variables

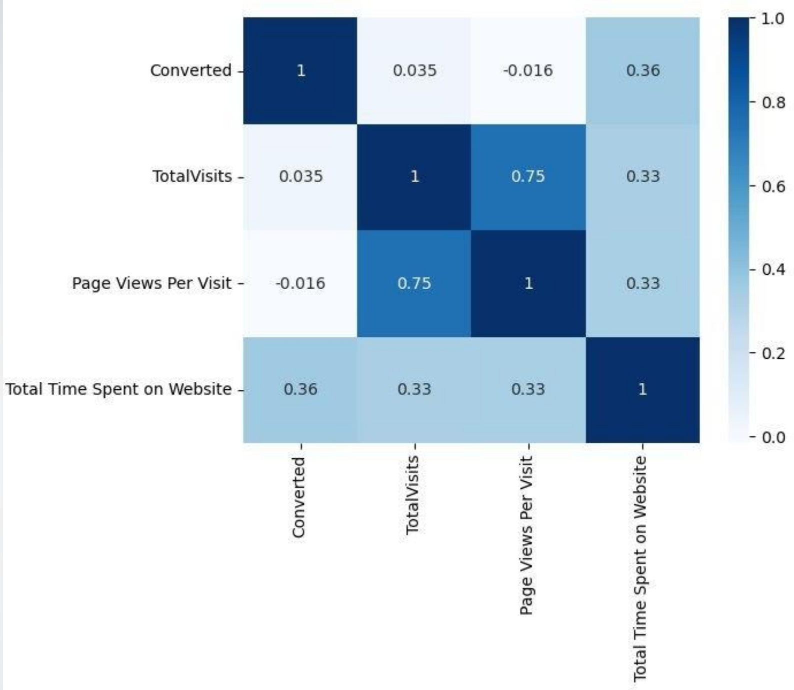


Last Activity:

- *'SMS Sent'* has **high lead conversion rate of 63%** with 30% contribution from last activities,
- *'Email Opened'* activity contributed 38% of last activities performed by the customers, with **37% lead conversion rate.**

EDA – Bivariate Analysis for Numerical Variables





- Past Leads who **spends more time on the Website** have a higher chance of getting successfully converted than those who spends less time as seen in the **box-plot**

Model Building

- **Feature Selection**
- The data set has lots of dimension and large number of features.
- This will reduce model performance and might take high computation time.
- Hence it is important to perform **Recursive Feature Elimination** (RFE) and to select only the important columns.
- Then we can manually fine tune the model.
- RFE outcome
  - Pre RFE – 48 columns & Post RFE – 15 columns

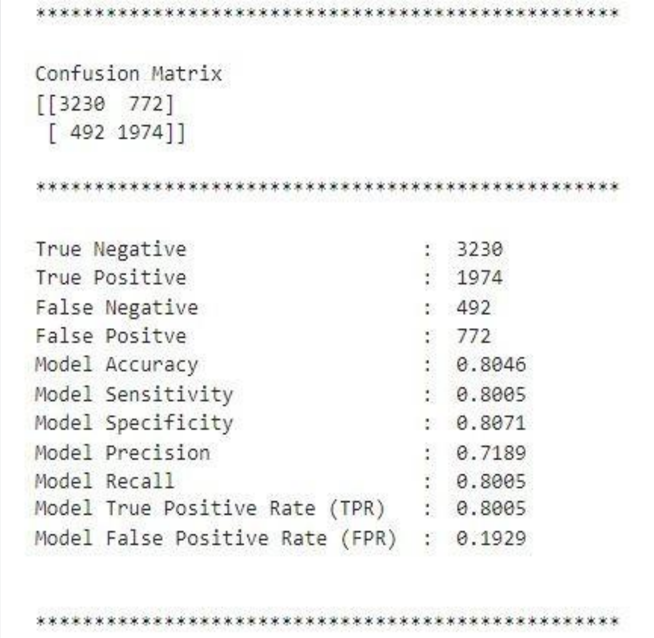
Model Building

- Manual Feature Reduction process was used to build models by dropping variables with p – value greater than 0.05.
- Model 4 looks stable after four iteration with:
  - significant p-values within the threshold (p-values < 0.05) and
  - No sign of multicollinearity with VIFs less than 5
- Hence, **logm4** will be our final model, and we will use it for Model Evaluation which further will be used to make predictions.

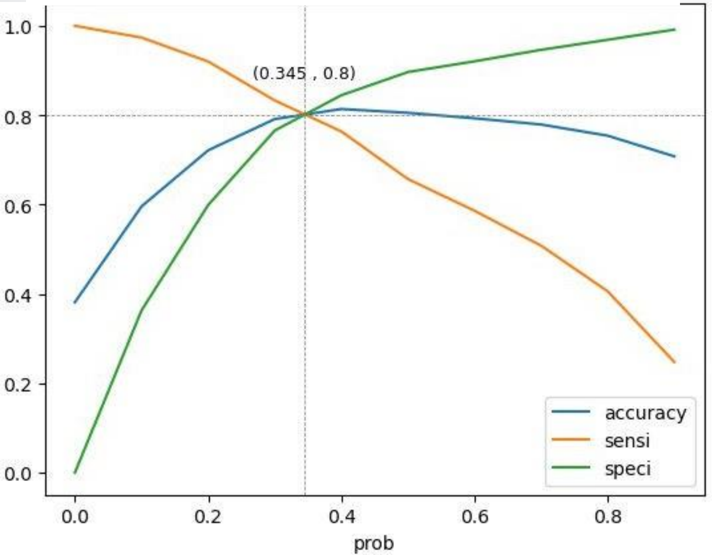
Model Evaluation

Train Data Set

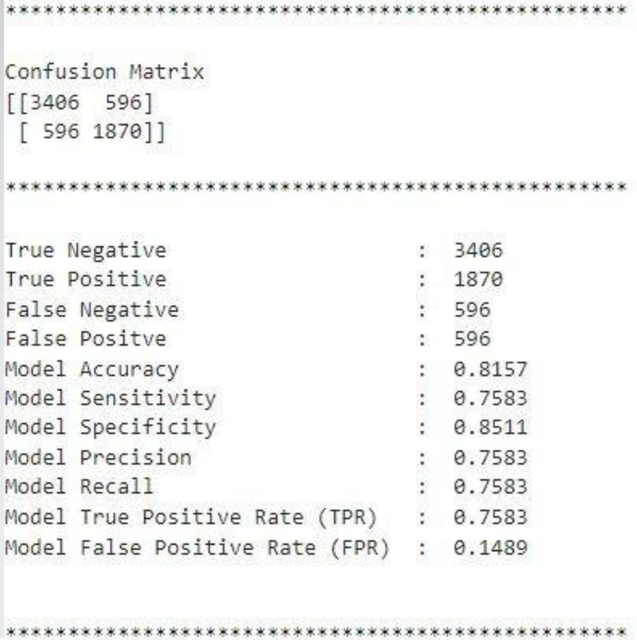
Confusion Matrix & Evaluation Metrics with 0.345 as cutoff



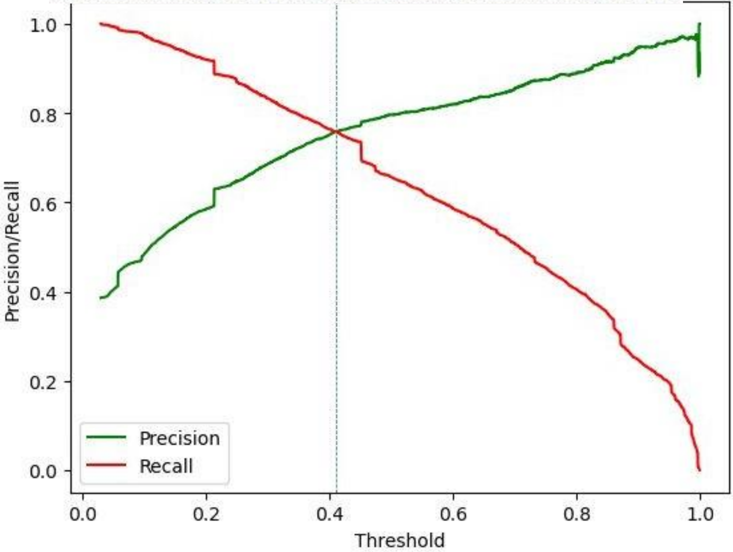
```
**************************************************

Confusion Matrix
[[3230  772]
 [ 492 1974]]

**************************************************

True Negative                    :  3230
True Positive                    :  1974
False Negative                   :  492
False Positve                    :  772
Model Accuracy                   :  0.8046
Model Sensitivity                :  0.8005
Model Specificity                :  0.8071
Model Precision                  :  0.7189
Model Recall                     :  0.8005
Model True Positive Rate (TPR)   :  0.8005
Model False Positive Rate (FPR)  :  0.1929


**************************************************
```



Confusion Matrix & Evaluation Metrics with 0.41 as cutoff



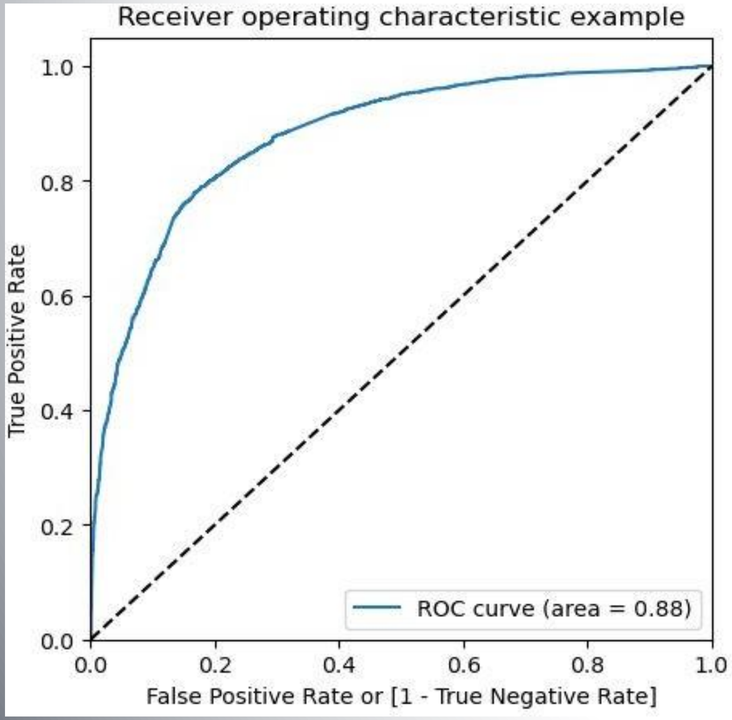
```
**************************************************

Confusion Matrix
[[3406  596]
 [ 596 1870]]

**************************************************

True Negative                    :  3406
True Positive                    :  1870
False Negative                   :  596
False Positve                    :  596
Model Accuracy                   :  0.8157
Model Sensitivity                :  0.7583
Model Specificity                :  0.8511
Model Precision                  :  0.7583
Model Recall                     :  0.7583
Model True Positive Rate (TPR)   :  0.7583
Model False Positive Rate (FPR)  :  0.1489


**************************************************
```



Model Evaluation

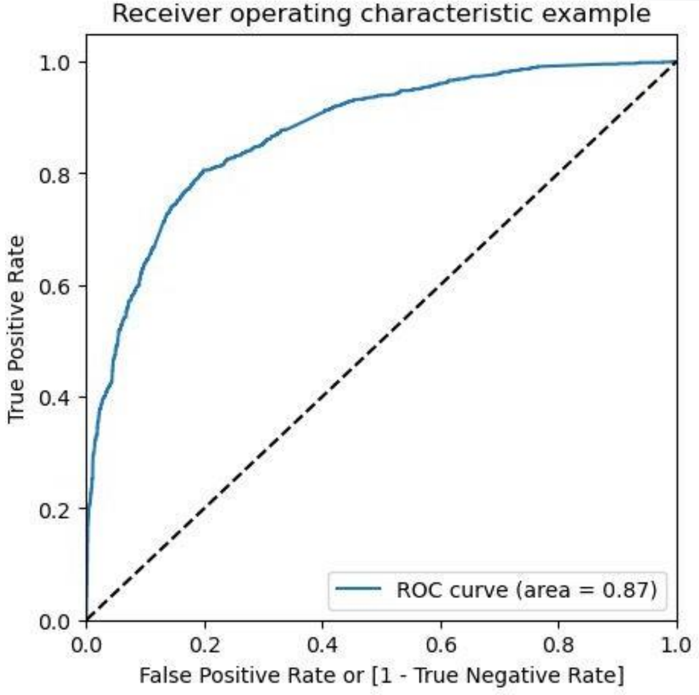
ROC Curve – Train Data Set

- Area under ROC curve is 0.88 out of 1 which indicates a good predictive model.
- The curve is as close to the top left corner of the plot, which represents a model that has a high true positive rate and a low false positive rate at all threshold values.



ROC Curve – Test Data Set

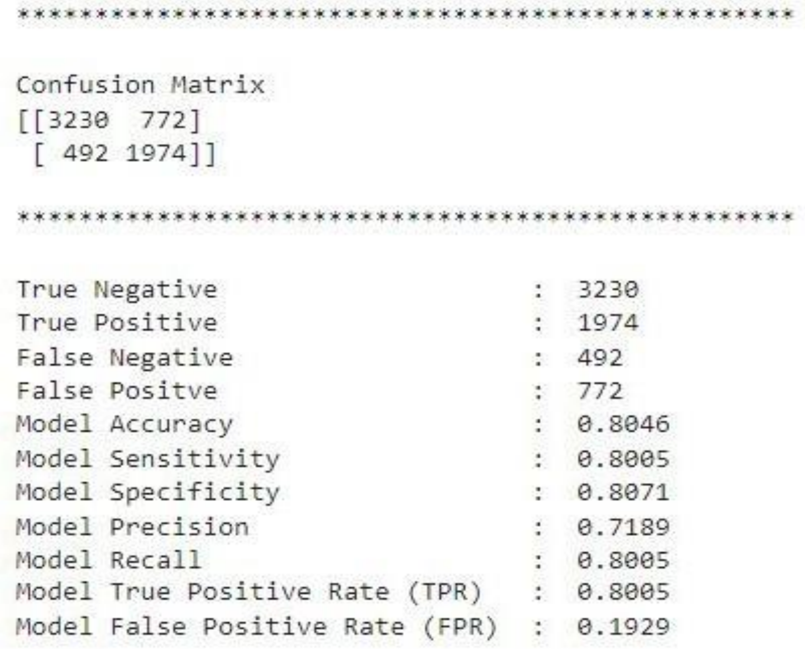
- Area under ROC curve is 0.87 out of 1 which indicates a good predictive model.
- The curve is as close to the top left corner of the plot, which represents a model that has a high true positive rate and a low false positive rate at all threshold values.



Model Evaluation

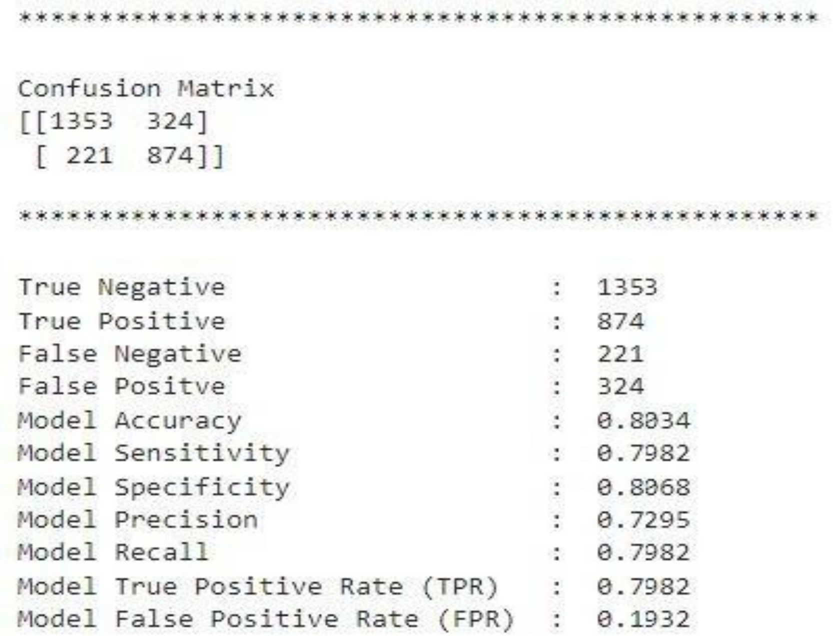
Confusion Matrix & Metrics

Train Data Set



```
**************************************************

Confusion Matrix
[[3230  772]
 [ 492 1974]]

**************************************************

True Negative                    :  3230
True Positive                    :  1974
False Negative                   :  492
False Positve                    :  772
Model Accuracy                   :  0.8046
Model Sensitivity                :  0.8005
Model Specificity                :  0.8071
Model Precision                  :  0.7189
Model Recall                     :  0.8005
Model True Positive Rate (TPR)   :  0.8005
Model False Positive Rate (FPR)  :  0.1929
```

Test Data Set



```
**************************************************

Confusion Matrix
[[1353  324]
 [ 221  874]]

**************************************************

True Negative                    :  1353
True Positive                    :  874
False Negative                   :  221
False Positve                    :  324
Model Accuracy                   :  0.8034
Model Sensitivity                :  0.7982
Model Specificity                :  0.8068
Model Precision                  :  0.7295
Model Recall                     :  0.7982
Model True Positive Rate (TPR)   :  0.7982
Model False Positive Rate (FPR)  :  0.1932
```

- Using a cut-off [illegible] nd **79.82% in the test set**.
- Sensitivity in this ca [illegible] otential leads which are converting
- The CEO of X Education [illegible]
- The model also achieved a [illegible] objectives.

Recommendation based on Final Model

- As per the problem statement, increasing lead conversion is crucial for the growth and success of X Education. To achieve this, we have developed a regression model that can help us identify the most significant factors that impact lead conversion.
- We have determined the following features that have the highest positive coefficients, and these features should be given priority in our marketing and sales efforts to increase lead conversion.
  - Lead Source_Welingak Website: 5.39
  - Lead Source_Reference: 2.93
  - Current_occupation_Working Professional: 2.67
  - Last Activity_SMS Sent: 2.05
  - Last Activity_Others: 1.25
  - Total Time Spent on Website: 1.05
  - Last Activity_Email Opened: 0.94
  - Lead Source_Olark Chat: 0.91

- We have also identified features with negative coefficients that may indicate potential areas for improvement. These include:
  - Specialization in Hospitality Management: -1.09
  - Specialization in Others: -1.20
  - Lead Origin of Landing Page Submission: -1.26

Recommendation based on Final Model

- To increase

- Focus on features with positive coefficients for targeted marketing strategies.
- Develop strategies to attract high-quality leads from top-performing lead sources.
- Optimize communication channels based on lead engagement impact.
- Engage working professionals with tailored messaging.
- More budget/spend can be done on Welingak Website in terms of advertising, etc.
- Incentives/discounts for providing reference that convert to lead, encourage providing more references.
- Working professionals to be aggressively targeted as they have high conversion rate and will have better financial situation to pay higher fees too.

- To identify

- Analyze negative coefficients in specialization offerings.
- Review landing page submission process for areas of improvement.