LEAD SCORE CASE STUDY

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PROBLEM STATEMENT

An education company named X Education sells online courses to industry professionals. On any given day, many professionals who are interested in the courses land on their website and browse for courses.

The company markets its courses on several websites and search engines like Google. Once these people land on the website, they might browse the courses or fill up a form for the course or watch some videos. When these people fill up a form providing their email address or phone number, they are classified to be a lead. Moreover, the company also gets leads through past referrals. Once these leads are acquired, employees from the sales team start making calls, writing emails, etc. Through this process, some of the leads get converted while most do not. The typical lead conversion rate at X education is around 30%.

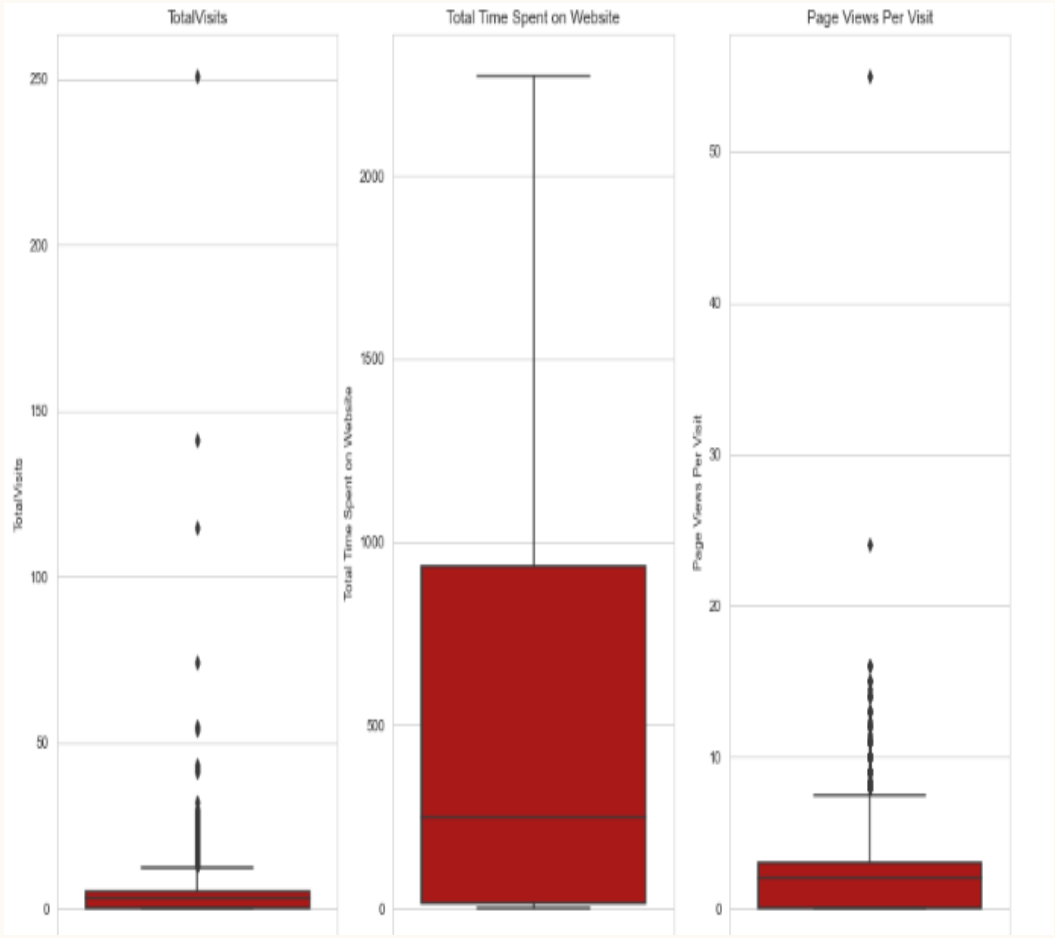
BUSINESS OBJECTIVE

The company requires us to build a model wherein you need to assign a lead score to each of the leads such that the customers with higher lead score have a higher conversion chance and the customers with lower lead score have a lower conversion chance.
The CEO, in particular, has given a ballpark of the target lead conversion rate to be around 80%.

SOLUTION METHODOLOGY

- Data cleaning and data manipulation.
  - ✓ Check and handle duplicate data.
  - ✓ Check and handle NA values and missing values.
  - ✓ Drop columns, if it contains large amount of missing values and not useful for the analysis.
  - ✓ Imputation of the values, if necessary.
  - ✓ Check and handle outliers in data.
- EDA
  - ✓ Univariate data analysis: value count, distribution of variable etc.
  - ✓ Bivariate data analysis: correlation coefficients and pattern between the variables etc.
- Feature Scaling & Dummy Variables and encoding of the data.
- Classification technique: logistic regression used for the model making and prediction.
- Validation of the model.
- Model presentation.
- Conclusions and recommendations.

OUTLIER ANALYSIS

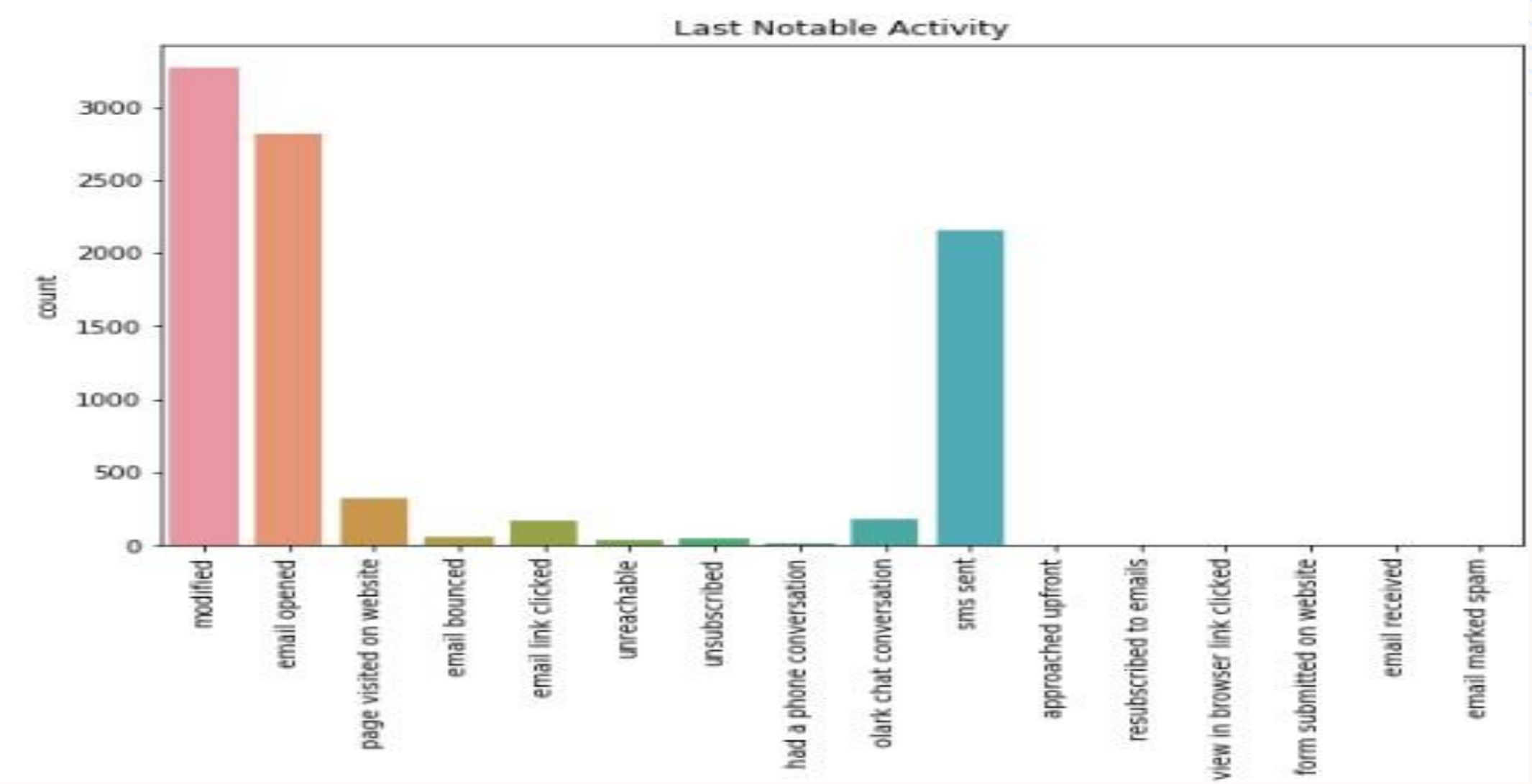


- There are outliers in ' Total Visits' column and 'Page Views Per Visit' column
- To treat them we have to do **0.99-0.1%** analysis to get rid of the outliers.

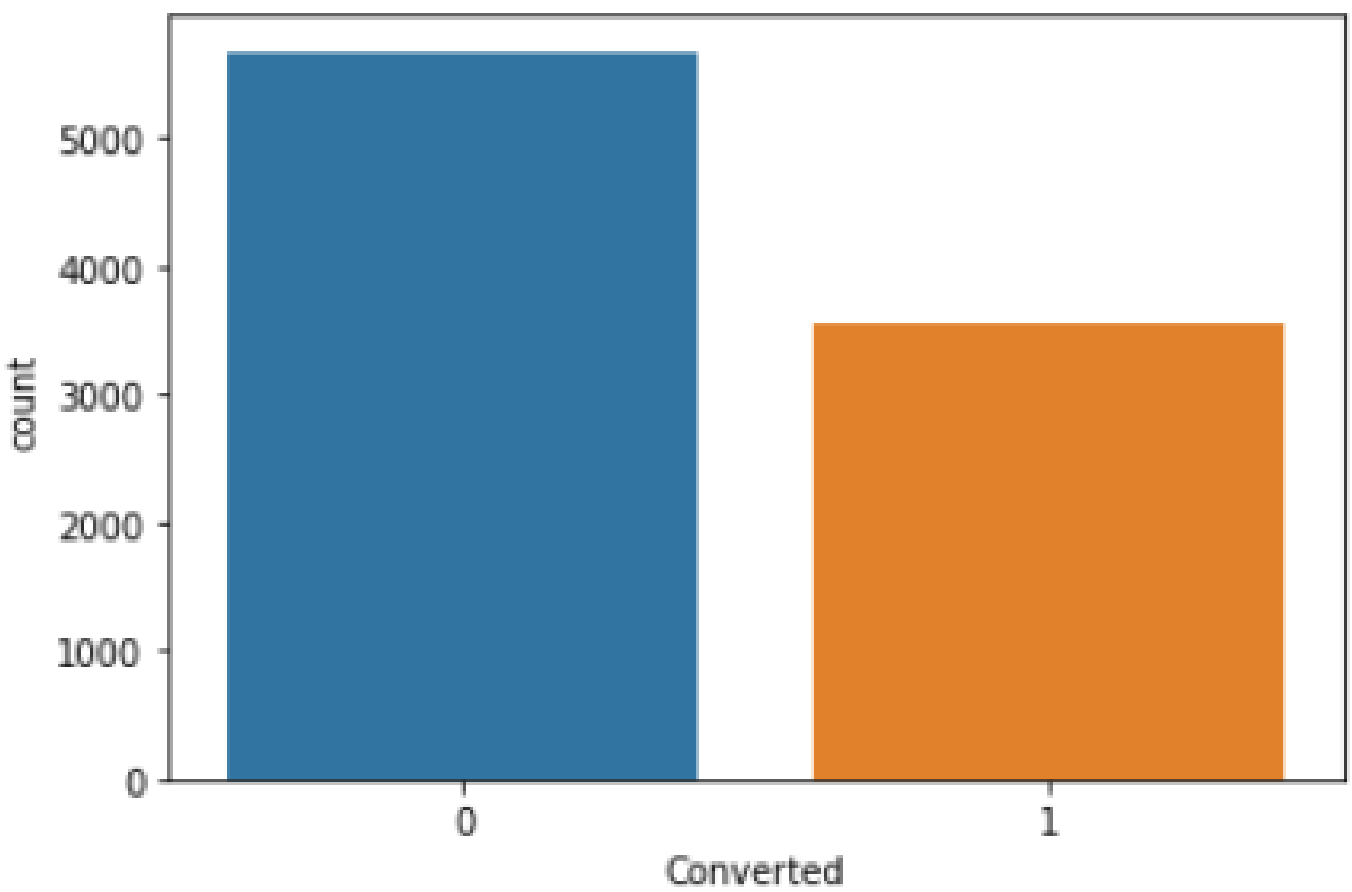
DATA MANIPULATION

- Total Number of Rows =37, Total Number of Columns =9240.
- Single value features like “Magazine”, “Receive More Updates About Our Courses”, “Update me on Supply”
- Chain Content”, “Get updates on DM Content”, “I agree to pay the amount through cheque” etc. have been dropped.
- Removing the “Prospect ID” and “Lead Number” which is not necessary for the analysis.
- After checking for the value counts for some of the object type variables, we find some of the features which has no enough variance, which we have dropped, the features are: “Do Not Call”, “What matters most to you in choosing course”, “Search”, “Newspaper
- Article”, “X Education Forums”, “Newspaper”, “Digital Advertisement” etc.
- Dropping the columns having more than 35% as missing value such as ‘How did you hear about X Education’ and ‘Lead Profile’.

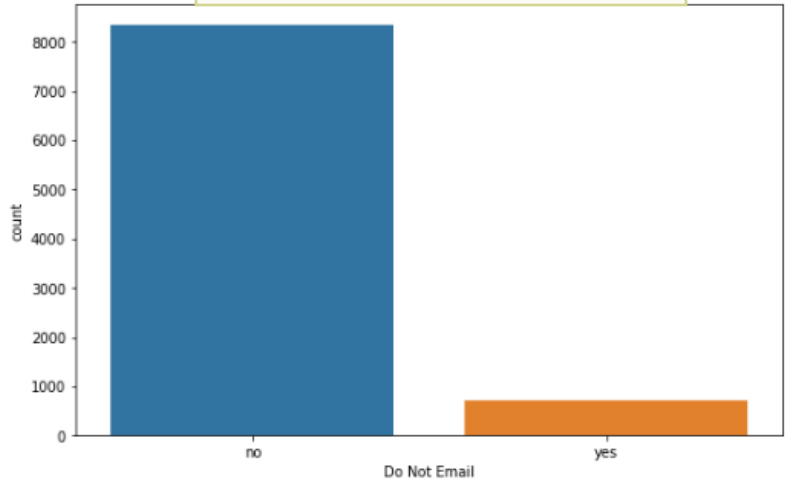
EDA


Last Notable Activity
count
3000
2500
2000
1500
1000
500
0
modified
email opened
page visited on website
email bounced
email link clicked
unreachable
unsubscribed
had a phone conversation
olark chat conversation
sms sent
approached upfront
resubscribed to emails
view in browser link clicked
form submitted on website
email received
email marked spam

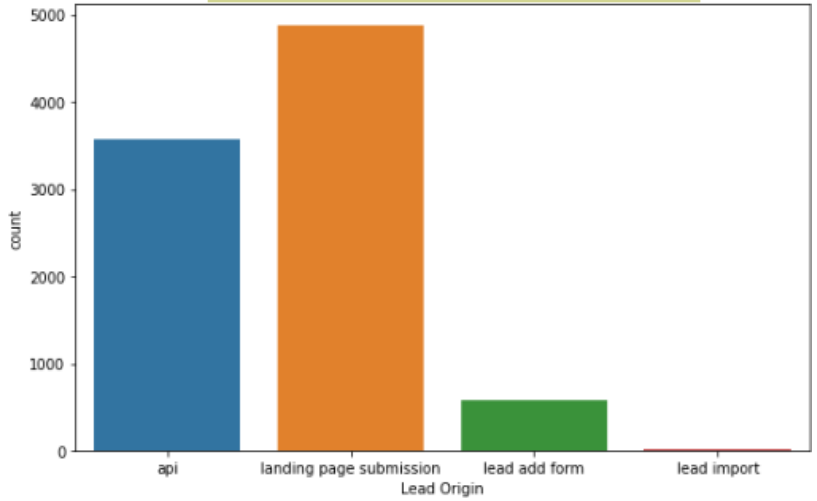
Converted ("Y variable")



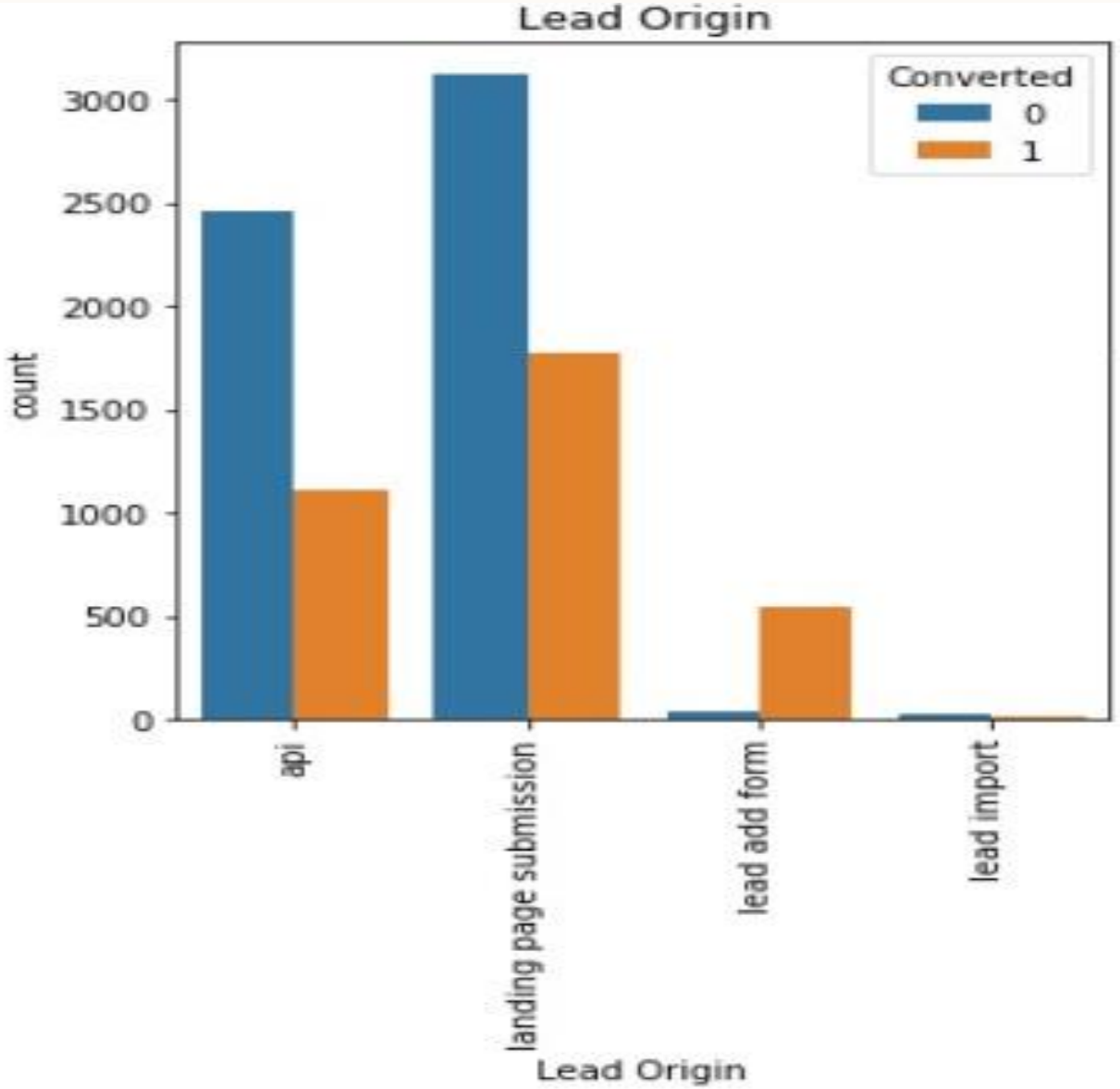
Do not Email

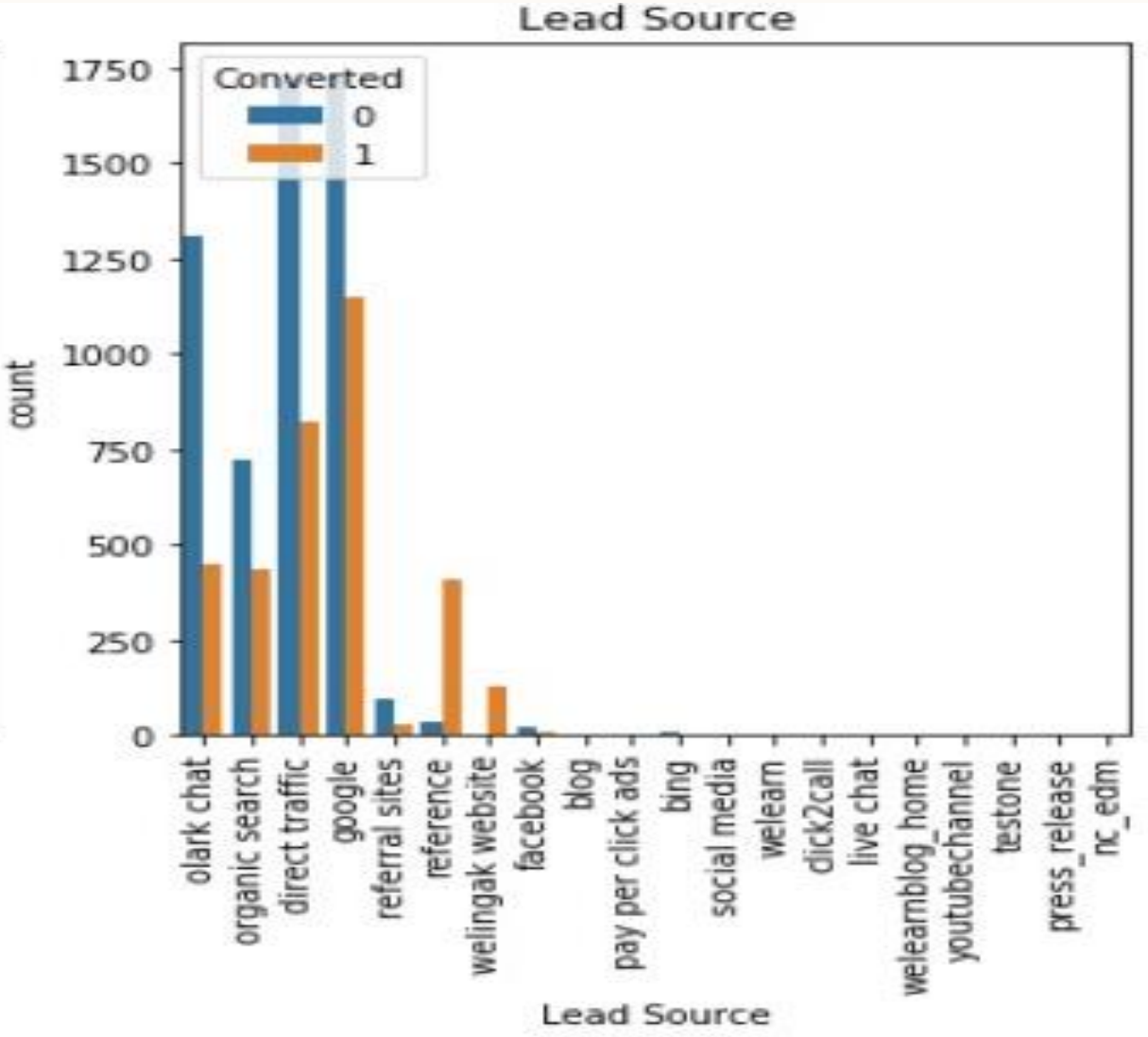


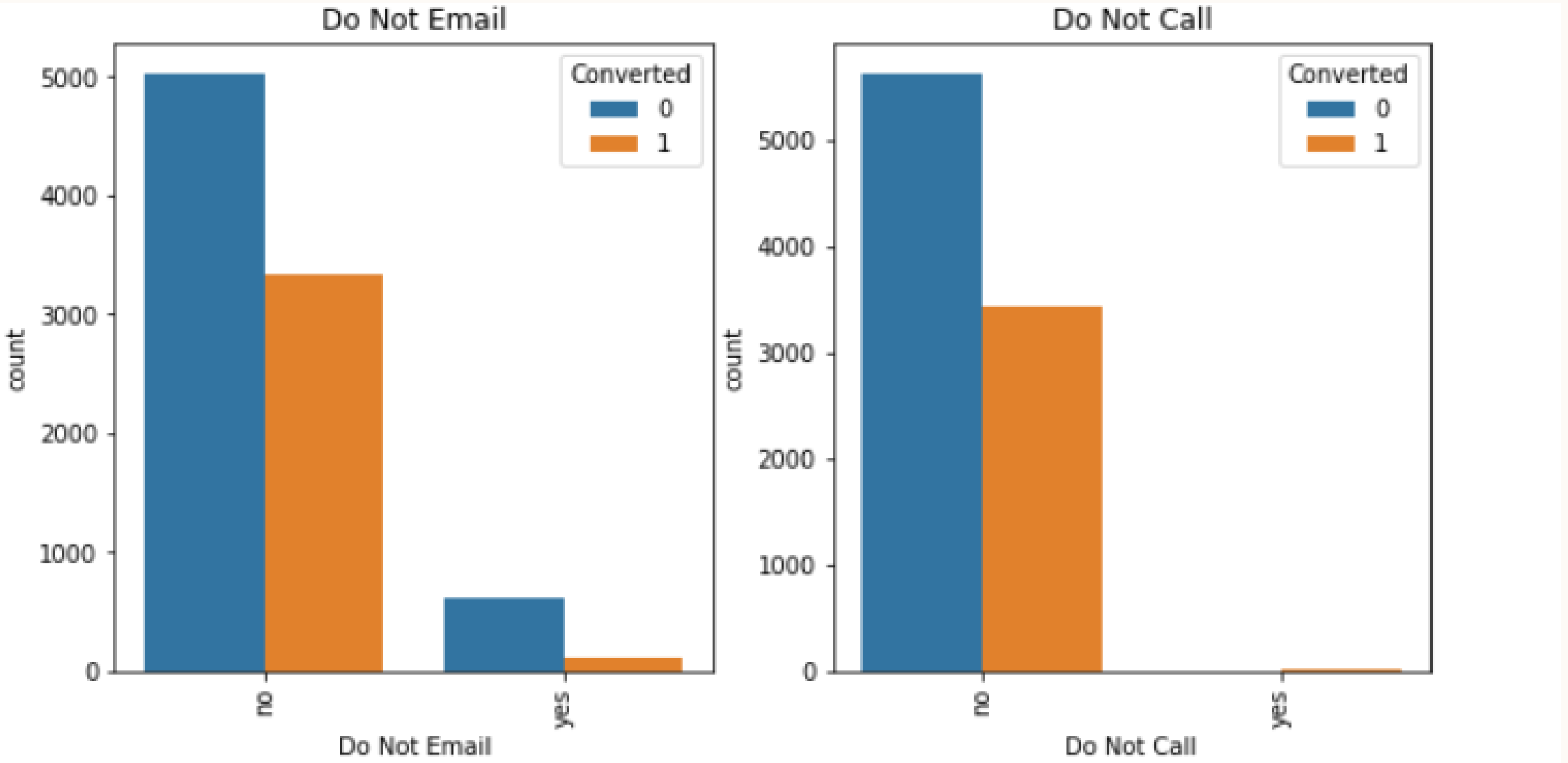
Lead Origin

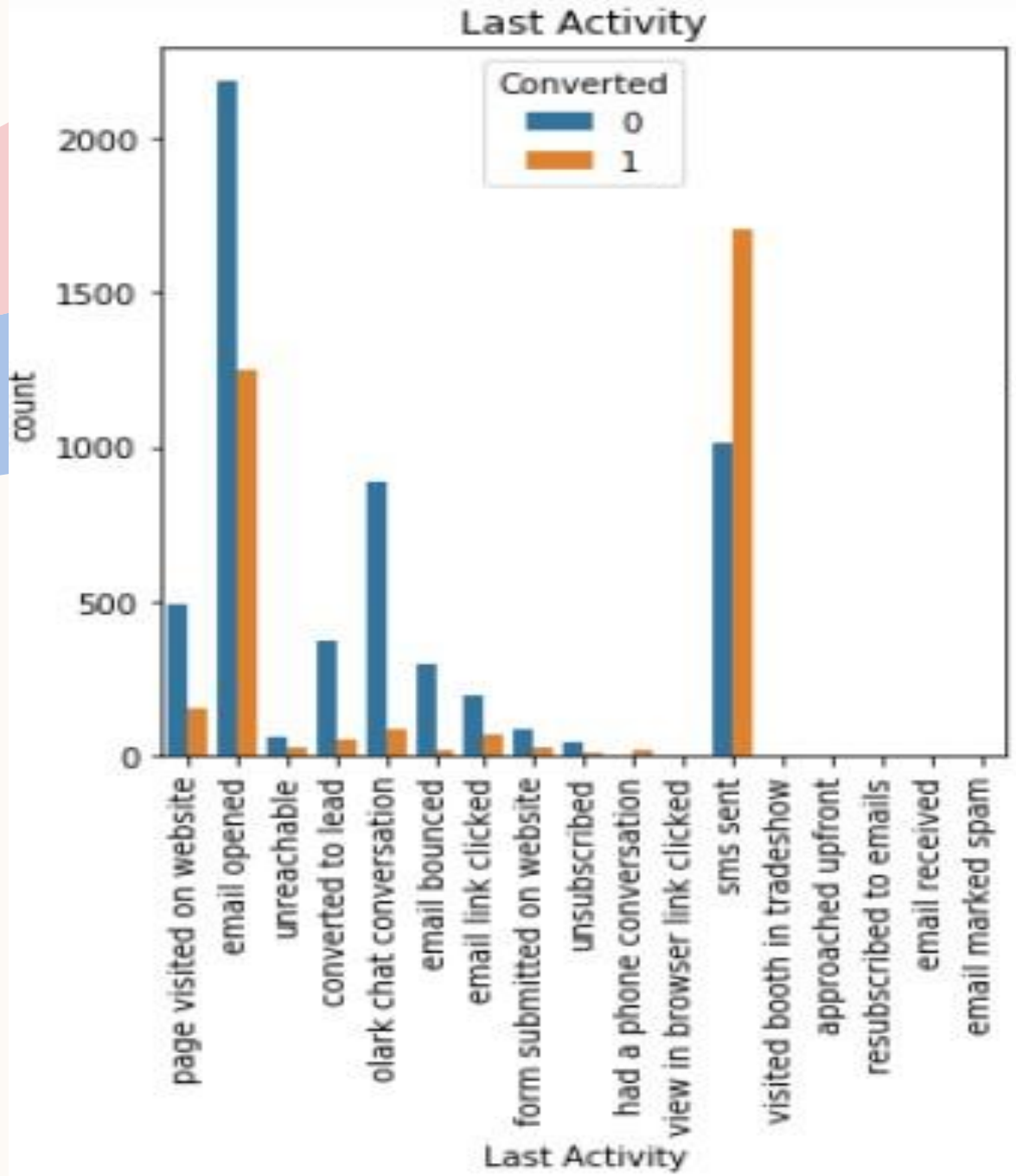


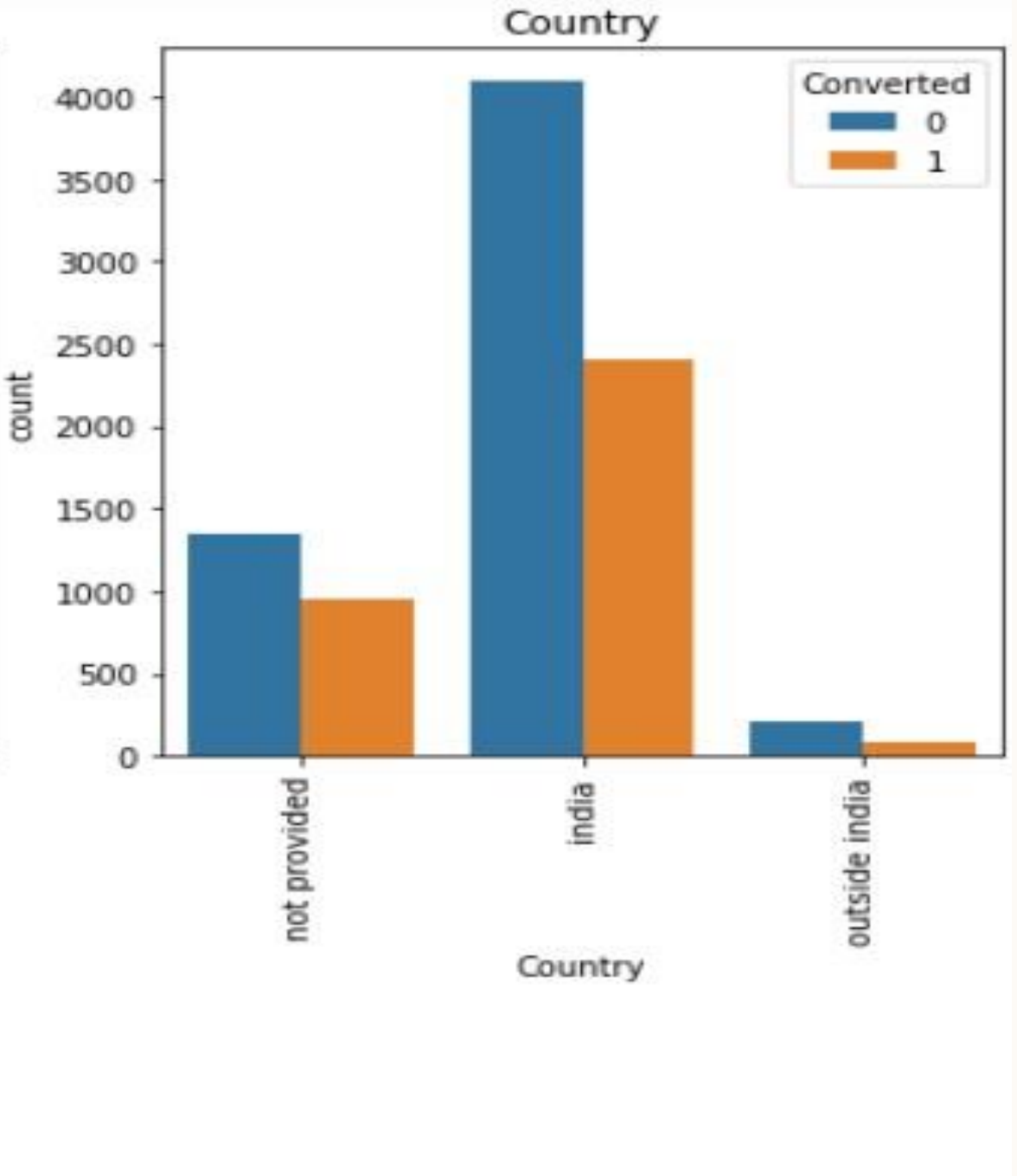
CATEGORIAL VARIABLE RELATION






Do Not Email
Converted
0
1
5000
4000
3000
2000
1000
0
count
no
yes
Do Not Email
Do Not Call
Converted
0
1
5000
4000
3000
2000
1000
0
count
no
yes
Do Not Call


Last Activity
Converted
0
1
count
2000
1500
1000
500
0
page visited on website
email opened
unreachable
converted to lead
olark chat conversation
email bounced
email link clicked
form submitted on website
unsubscribed
had a phone conversation
view in browser link clicked
sms sent
visited booth in tradeshow
approached upfront
resubscribed to emails
email received
email marked spam
Last Activity


Country
Converted
0
1
count
4000
3500
3000
2500
2000
1500
1000
500
0
not provided
india
outside india
Country

DATA CONVERSION

- Numerical Variables are Normalised.
- Dummy Variables are created for object type variables.
- Total Rows for Analysis: 8792
- Total Columns for Analysis: 43

MODEL BUILDING

1. Splitting the Data into Training and Testing Sets.
2. The first basic step for regression is performing a train-test split, we have chosen 70:30 ratio.
3. Use RFE for Feature Selection.
4. Running RFE with 15 variables as output.
5. Building Model by removing the variable whose p-value is greater than 0.05 and vif values is greater than 5.
6. Predictions on test data set.
7. Overall accuracy 81%.

MODEL BUILDING

With the help of RFE, we can identify the insignificant variables present in our model.

	Features	VIF
2	Lead Origin_Lead Add Form	1.46
13	Last Notable Activity_SMS Sent	1.35
8	Lead Source_Welingak website	1.29
3	Lead Source_Direct traffic	1.25
5	Lead Source_Google	1.24
0	Do Not Email	1.19
11	What is your current occupation_Working Profes...	1.18
1	Total Time Spent on Website	1.15
6	Lead Source_Organic search	1.13
9	Last Activity_Converted to Lead	1.10
10	Last Activity_Olark Chat Conversation	1.08
15	Last Notable Activity_Unsubscribed	1.07
7	Lead Source_Referral sites	1.01
14	Last Notable Activity_Unreachable	1.01
4	Lead Source_Facebook	1.00
12	Last Notable Activity_Had a Phone Conversation	1.00

Generalized Linear Model Regression Results

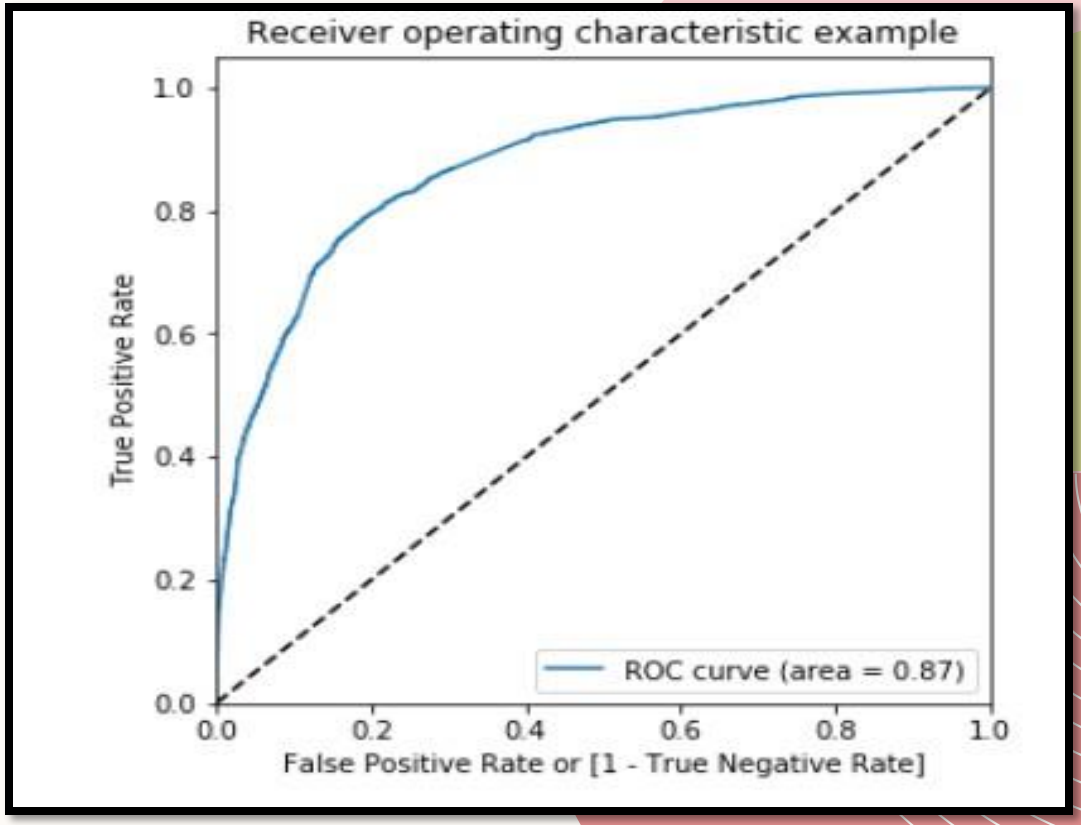
Dep. Variable:	Converted	No. Observations:	6363
Model:	GLM	Df Residuals:	6345
Model Family:	Gaussian	Df Model:	17
Link Function:	identity	Scale:	0.13759
Method:	IRLS	Log-Likelihood:	-2709.2
Date:	Mon, 08 Mar 2021	Deviance:	873.00
Time:	12:27:37	Pearson chi2:	873.
No. Iterations:	3		
Covariance Type:	nonrobust		

	coef	std err	z	P>|z|	[0.025	0.975]
const	0.4041	0.013	30.814	0.000	0.378	0.430
Do Not Email	-0.1824	0.018	-9.966	0.000	-0.218	-0.147
Total Time Spent on Website	0.1806	0.005	34.615	0.000	0.170	0.191
Lead Origin_Lead Add Form	0.3821	0.022	17.002	0.000	0.338	0.426
Lead Source_Direct traffic	-0.1843	0.016	-11.651	0.000	-0.215	-0.153
Lead Source_Facebook	-0.1739	0.062	-2.793	0.005	-0.296	-0.052
Lead Source_Google	-0.1211	0.015	-8.030	0.000	-0.151	-0.092
Lead Source_Organic search	-0.1639	0.019	-8.805	0.000	-0.200	-0.127
Lead Source_Referral sites	-0.1517	0.044	-3.482	0.000	-0.237	-0.066
Lead Source_Welingak website	0.2118	0.041	5.125	0.000	0.131	0.293
Last Activity_Converted to Lead	-0.1343	0.023	-5.894	0.000	-0.179	-0.090
Last Activity_Olark Chat Conversation	-0.1753	0.017	-10.418	0.000	-0.208	-0.142
What is your current occupation_Other	0.2088	0.118	1.777	0.076	-0.021	0.439
What is your current occupation_Working Professional	0.3430	0.018	18.770	0.000	0.307	0.379
Last Notable Activity_Had a Phone Conversation	0.5719	0.131	4.353	0.000	0.314	0.829
Last Notable Activity_SMS Sent	0.2786	0.011	24.272	0.000	0.256	0.301
Last Notable Activity_Unreachable	0.3308	0.081	4.071	0.000	0.172	0.490
Last Notable Activity_Unsubscribed	0.1942	0.068	2.858	0.004	0.061	0.327

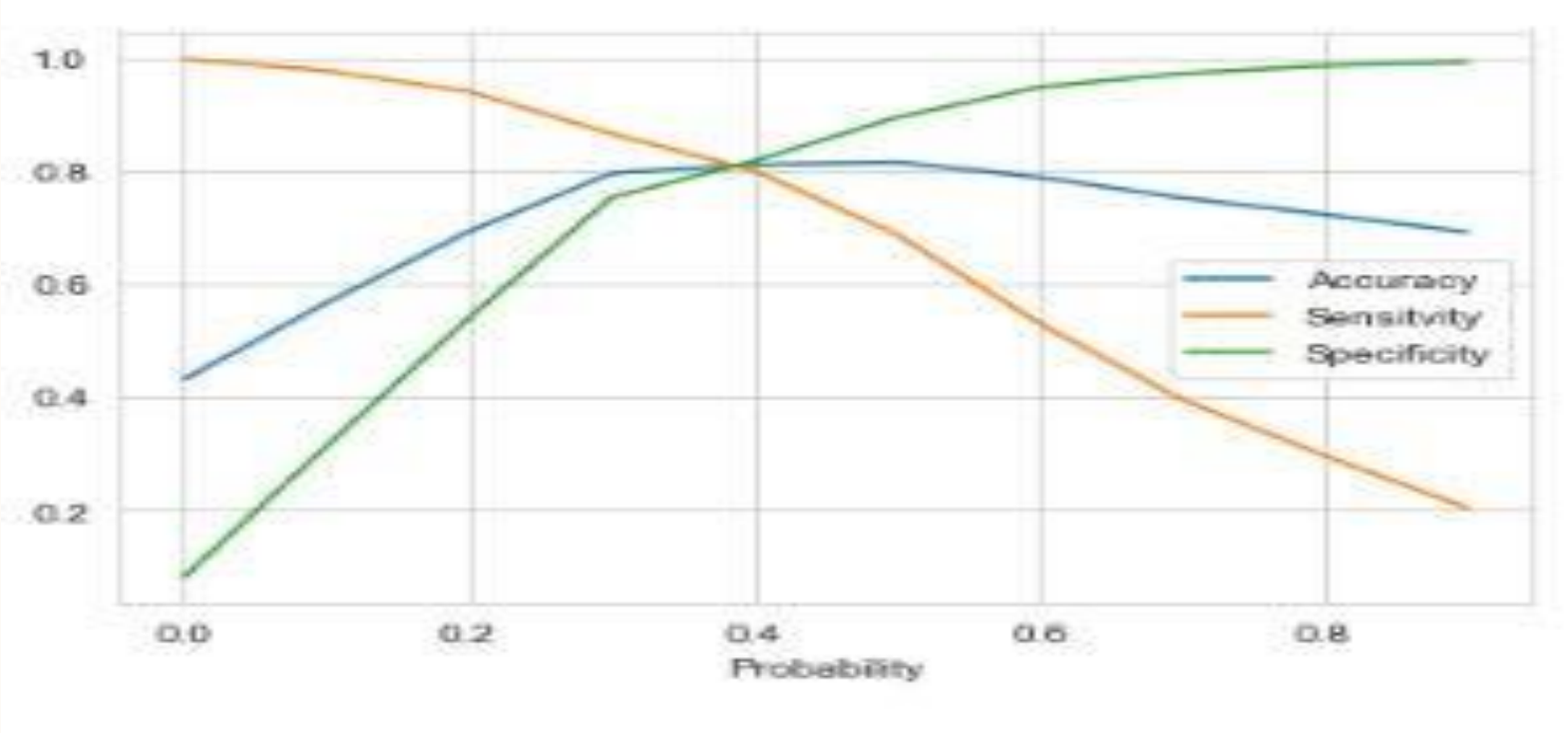
EVALUATING THE MODEL

- ✓ After building the final model making prediction on it(on train set), we created ROC curve to find the model stability with AUC score(area under the curve) As we can see from the graph plotted on the right side, the area score is 0.88 which is a great score.

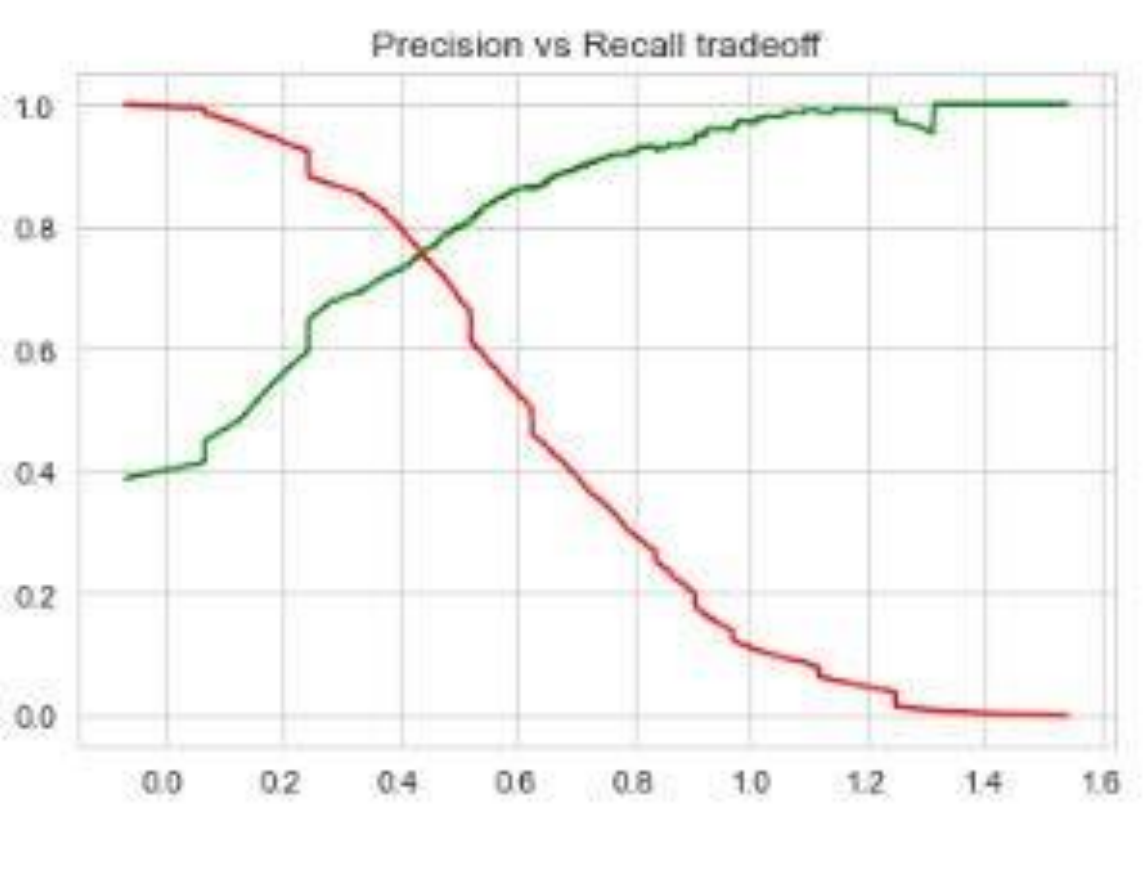
- ✓ And our graph is leaned towards the left side of the border which means we have good accuracy.



FINDING THE OPTIMAL CUT OFF POINT



We found that on 0.4 point all the score of accuracy, sensitivity and specificity are in a close range which is the ideal point to select and hence it was selected.



PRECISION AND RECALL TRADE OFF POINT

1. We created a graph which will show us the trade off between Precision and recall.
2. We found that there is a trade off between Precision and Recall and the meeting point is approximately at 0.5.

CONCLUSION

- ✓ The Accuracy, Precision and Recall score we got from the test data are in the acceptable region.
- ✓ In business terms, this model has an ability to adjust with the company's requirements in coming future.
- ✓ Important features responsible for good conversion rate or the ones' which contributes more towards the probability of a lead getting converted are:

1. **Last Notable Activity_Had a Phone Conversation**
2. **Lead Origin_Lead Add Form**
3. **What is your current occupation_Working Professional.**