# Impression Analytics for Campaign Cost as per User Behaviour

## Code has been divided into two parts

1. Data Cleaning & Visualisation
2. Data Modelling & Machine Learning

```
from google.colab import drive

drive.mount('/content/gdrive/', force_remount=True)
```

```
Mounted at /content/gdrive/
```

```
%cd gdrive/MyDrive/BDA\ -\ Semester\ Project
```

```
/content/gdrive/MyDrive/BDA - Semester Project
```

### Importing all necessary libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
from sklearn.model_selection import train_test_split
from sklearn.linear_model import PassiveAggressiveRegressor
```

### Read the dataset Using Pandas

```
data = pd.read_csv("Dataset/Instagram data.csv", encoding = 'latin1')
data.head(10)
```

| | Impressions | From Home | From Hashtags | From Explore | From Other | Saves | Comments | Shares | Likes | Profile Visits | Fol |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 3920.0 | 2586.0 | 1028.0 | 619.0 | 56.0 | 98.0 | 9.0 | 5.0 | 162.0 | 35.0 | |
| **1** | 5394.0 | 2727.0 | 1838.0 | 1174.0 | 78.0 | 194.0 | 7.0 | NaN | 224.0 | 48.0 | |
| **2** | 4021.0 | 2085.0 | 1188.0 | 0.0 | 533.0 | 41.0 | 11.0 | 1.0 | 131.0 | 62.0 | |
| **3** | 4528.0 | 2700.0 | 621.0 | 932.0 | NaN | 172.0 | 10.0 | 7.0 | 213.0 | 23.0 | |

## 1 - Data Cleaning and Visualisation

Using data analytics techniques, isNULL to detect null values in dataset

```
data.isnull().sum()
```

```
Impressions       2
From Home         4
From Hashtags     2
From Explore      4
From Other        3
Saves             2
Comments          4
Shares            5
Likes             4
Profile Visits    2
Follows           2
Caption           1
Hashtags          2
dtype: int64
```

## Drop all NULL values

```
data = data.dropna()
```

# Data Information

```
data.info()
```

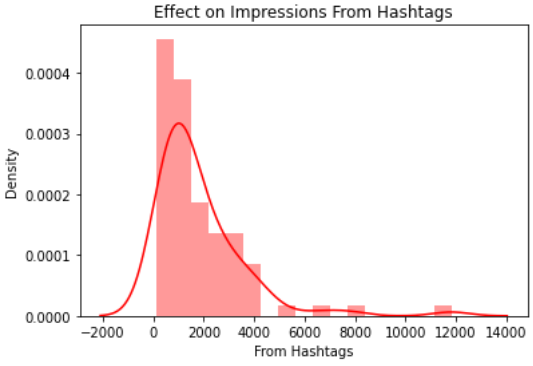
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 86 entries, 0 to 118
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   Impressions     86 non-null     float64
 1   From Home       86 non-null     float64
 2   From Hashtags   86 non-null     float64
 3   From Explore    86 non-null     float64
 4   From Other      86 non-null     float64
 5   Saves           86 non-null     float64
 6   Comments        86 non-null     float64
 7   Shares          86 non-null     float64
 8   Likes           86 non-null     float64
 9   Profile Visits  86 non-null     float64
 10  Follows         86 non-null     float64
 11  Caption         86 non-null     object 
 12  Hashtags        86 non-null     object 
dtypes: float64(11), object(2)
memory usage: 9.4+ KB
```

# Data Visualisation to understand Data Better

* Effect on Instagram Post Impression from Hashtags (A feature in Instagram)

```
plt.figure(figsize=(6, 4))
plt.style.use('default')
plt.title("Effect on Impressions From Hashtags")
sns.distplot(data['From Hashtags'], color = "red")
plt.show()
```

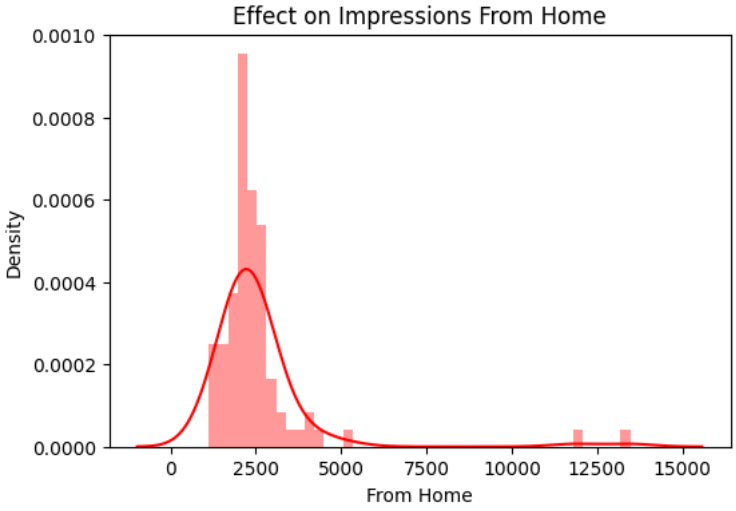
```
/usr/local/lib/python3.8/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distpl
  warnings.warn(msg, FutureWarning)
```




# * Effect on Instagram Post Impression from Home Page (A feature in Instagram)

```
plt.figure(figsize=(6, 4))
# plt.style.use('fivethirtyeight')
plt.style.use('default')
plt.title("Effect on Impressions From Home")
sns.distplot(data['From Home'], color = "red")
plt.show()
```

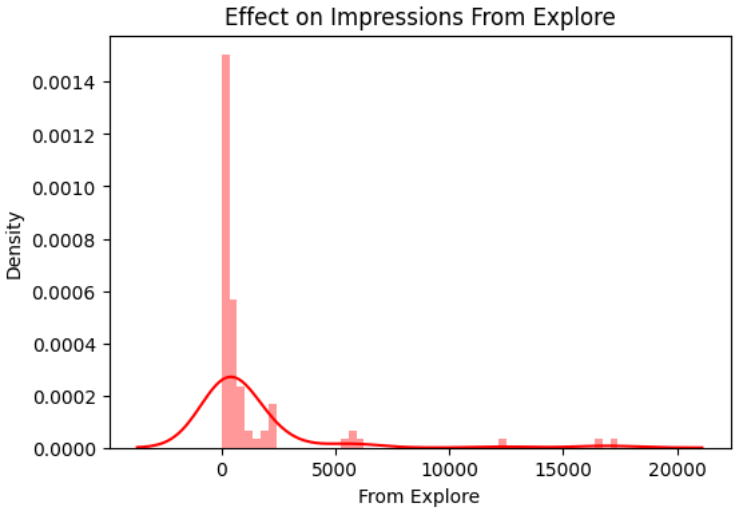
```
/usr/local/lib/python3.8/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distpl
  warnings.warn(msg, FutureWarning)
```




## * Effect on Instagram Post Impression from Explore (A feature in Instagram)

```
plt.figure(figsize=(6, 4))
plt.style.use('default')
plt.rcParams['grid.color'] = 'k'
plt.title("Effect on Impressions From Explore")
sns.distplot(data['From Explore'], color = "red")
plt.show()
```

```
/usr/local/lib/python3.8/dist-packages/seaborn/distributions.py:2619: FutureWarning: `distpl
  warnings.warn(msg, FutureWarning)
```



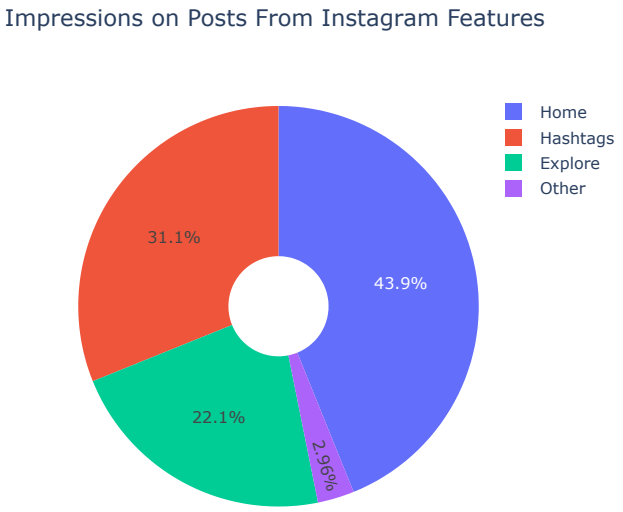

## Complete Data Visualisation to understand division of data on differnet istagram features

```
home = data["From Home"].sum()
hashtags = data["From Hashtags"].sum()
explore = data["From Explore"].sum()
other = data["From Other"].sum()

labels = ['Home','Hashtags','Explore','Other']
values = [home, hashtags, explore, other]

fig = px.pie(data, values=values, names=labels, title='Impressions on Posts From Instagram Features', hole=0.25,width=500, height=500)
```

```
fig.show()
```

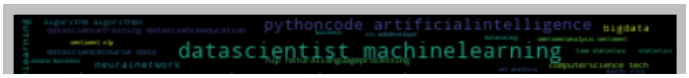



## Stopwords, most common used in Posts Captions

```
text = " ".join(i for i in data.Caption)
stopwords = set(STOPWORDS)
wordcloud = WordCloud(stopwords=stopwords, background_color="black").generate(text)
plt.style.use('classic')
plt.figure( figsize=(8,6))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```


## Stopwords, most common used in Posts Hashtags

```
text = " ".join(i for i in data.Hashtags)
stopwords = set(STOPWORDS)
wordcloud = WordCloud(stopwords=stopwords, background_color="black").generate(text)
plt.figure( figsize=(8,6))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```

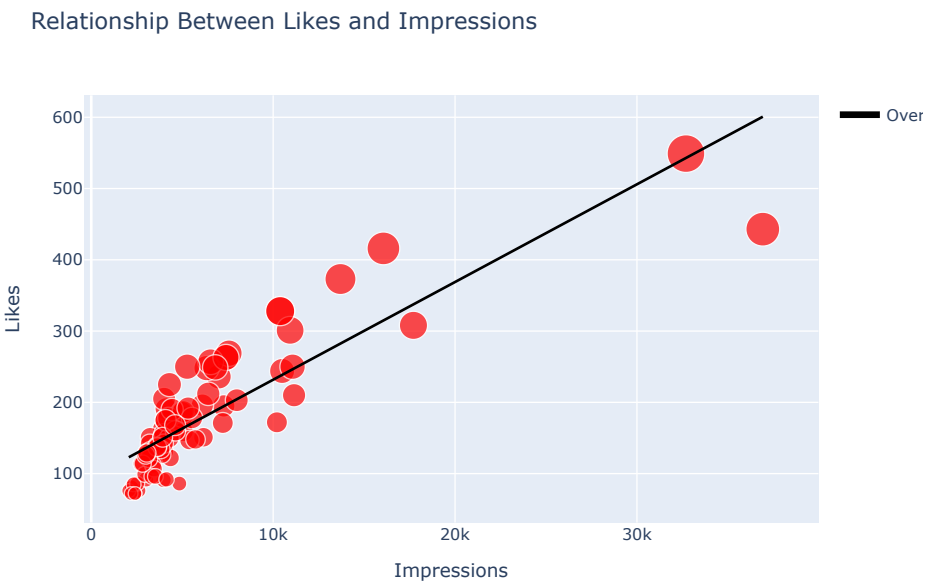



Impressions on Posts are most important thing for any campaign.

## Data Visualisation of Relationships of Different Attributes with Impressions

### * Relationship Between Likes and Impressions

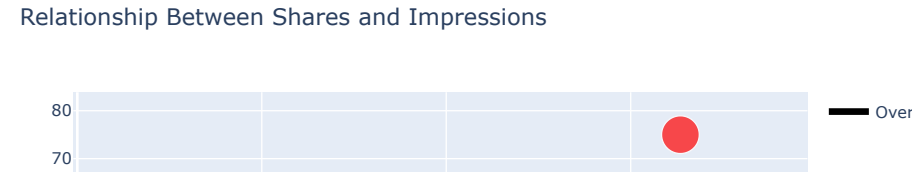
```
plt.figure(figsize=(10, 8))
figure = px.scatter(data_frame = data, x="Impressions",
                    y="Likes", size="Likes", trendline="ols",  trendline_scope="overall",  trendline_color_override="black", color_discre
                    title = "Relationship Between Likes and Impressions",
                    width=800,
                    height=500)
figure.show()
```




```
<Figure size 800x640 with 0 Axes>
```

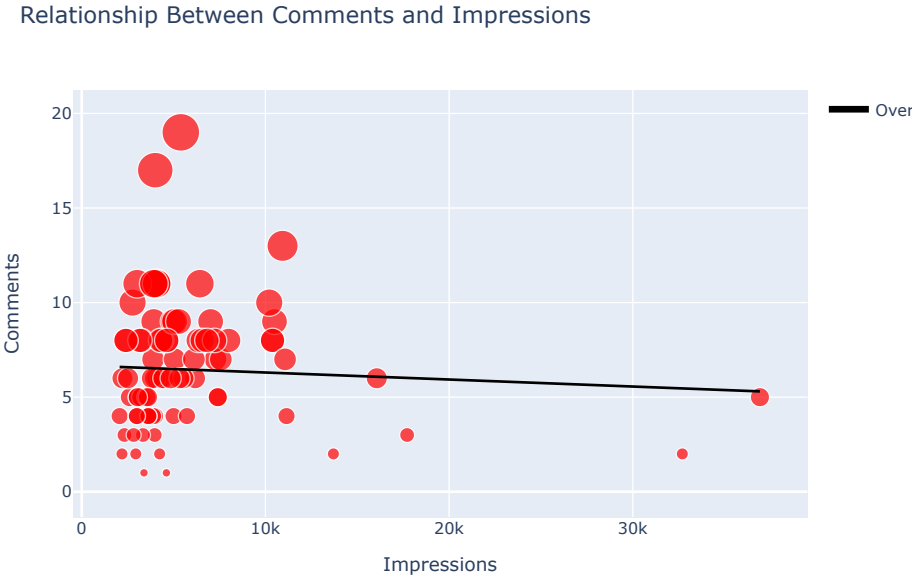
### * Relationship Between Share and Impressions

```
figure = px.scatter(data_frame = data, x="Impressions",
                    y="Shares", size="Shares", trendline="ols",  trendline_scope="overall",  trendline_color_override="black", color_disc
                    title = "Relationship Between Shares and Impressions",
                    width=800,
                    height=500)
figure.show()
```




## * Relationship Between Comments and Impressions

```
figure = px.scatter(data_frame = data, x="Impressions",
                    y="Comments", size="Comments", trendline="ols", trendline_scope="overall",  trendline_color_override="black", color_c
                    title = "Relationship Between Comments and Impressions",
                    width=800,
                    height=500)
figure.show()
```




## * Relationship Between Saved Posts and Impressions

```
figure = px.scatter(data_frame = data, x="Impressions",
                    y="Saves", size="Saves", trendline="ols",  trendline_scope="overall",  trendline_color_override="black", color_discre
                    title = "Relationship Between Saved Posts and Impressions",
                    width=800,
                    height=500)
figure.show()
```

Relationship Between Saved Posts and Impressions

## Correlation of Impressions on a post with other attributes

```
correlation = data.corr()
print(correlation["Impressions"].sort_values(ascending=False))
```

```
Impressions       1.000000
Follows           0.941202
From Explore      0.908189
From Home         0.892918
Likes             0.856155
Saves             0.801936
Profile Visits    0.768840
Shares            0.673775
From Other        0.640388
From Hashtags     0.514576
Comments         -0.059999
Name: Impressions, dtype: float64
```

## Conversion Rate

* Rate of "User Followed the profile / Total Profile visits"

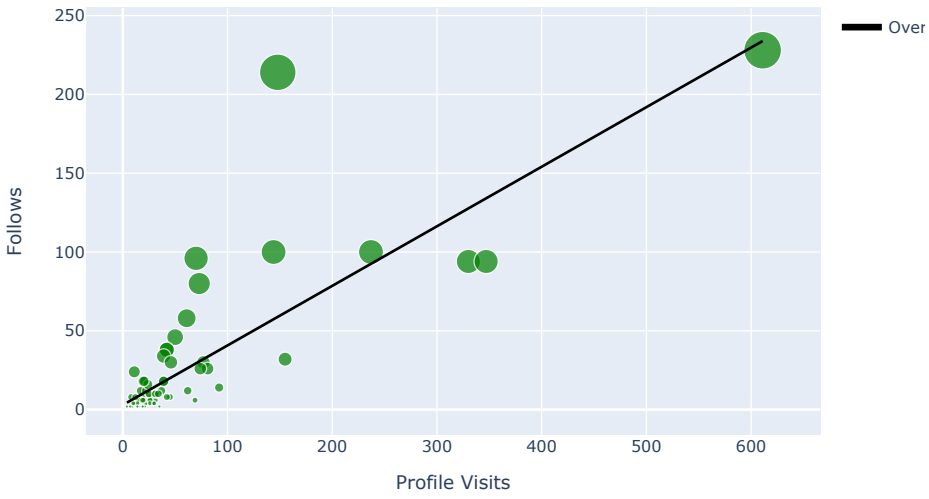
```
conversion_rate = (data["Follows"].sum() / data["Profile Visits"].sum()) * 100
print(conversion_rate)
```

```
43.85669632123106
```

## * Relationship Between Profile Visits and Followers Gained - Conversion Rate

```
figure = px.scatter(data_frame = data, x="Profile Visits",
                    y="Follows", size="Follows", trendline="ols",  trendline_scope="overall",  trendline_color_override="black", color_di
                    title = "Relationship Between Profile Visits and Followers Gained",
                    width=800,
                    height=500)
figure.show()
```

Relationship Between Profile Visits and Followers Gained




# 2 - Data Modelling & Machine Learning

## Division of Data Into Arrays for train

```
x = np.array(data[['Likes', 'Saves', 'Comments', 'Shares',
                   'Profile Visits', 'Follows']])
y = np.array(data["Impressions"])
```

## Data Splitting into Training and Testing Data

```
xtrain, xtest, ytrain, ytest = train_test_split(x, y,
                                                test_size=0.3,
                                                random_state=0)
```

## Testing 3 Different Models

1 - Passive Aggressive Regression

2 - Linear Regression

3 - Polynomial Regression with Degree 2 (Quadratic)

## 1 - Passive Aggressive Regression

```
model = PassiveAggressiveRegressor()
model.fit(xtrain, ytrain)
model.score(xtest, ytest)
```

```
0.7902092672006692
```

## 2 - Linear Regression

```
#Fitting the Linear Regression to the dataset
p
```

```
0.8432451783075576
```

## 3 - Polynomial Regression for Degree 2 (Quadratic)

```
#Fitting the Linear Regression to the dataset
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.preprocessing import PolynomialFeatures

polynomial_features= PolynomialFeatures(degree=2)
x_poly = polynomial_features.fit_transform(xtrain)

quad_model = LinearRegression()
quad_model.fit(x_poly, ytrain)
y_poly_pred = quad_model.predict(x_poly)

rmse = np.sqrt(mean_squared_error(ytrain,y_poly_pred))
r2 = r2_score(ytrain,y_poly_pred)
print('Root Mean Square Error: ', rmse)
print('R2 Score: ',r2)
```

```
Root Mean Square Error:  455.4196351382433
R2 Score:  0.9907455682805598
```

## Predicting Number of Impressions on Posts Using Trained Models

```
# Features = [['Likes','Saves', 'Comments', 'Shares', 'Profile Visits', 'Follows']]
poly_reg = PolynomialFeatures(degree=2)
likes = input('Likes: ')
saves = input('Saves: ')
comments = input('Comments: ')
shares = input('Shares: ')
profile_visits = input('Profile Visits: ')
follows = input('Followers Gained: ')
```

```
features = np.array([[likes,saves,comments,shares,profile_visits,follows]])
# print(f'Expected number of impressions are: ',{int(quad_model.predict(features)[0])})
print(f'Expected number of impressions by Passive Aggressive Regressor are: {int(model.predict(features)[0])}')
print(f'Expected number of impressions by Linear Regression are: {int(lin_regs.predict(features)[0])}')
print(f'Expected number of impressions by Quadratic Regression are: {int(quad_model.predict(poly_reg.fit_transform(features)))}')
```

```
Likes: 5000
Saves: 600
Comments: 385
Shares: 350
Profile Visits: 900
Followers Gained: 60
Expected number of impressions by Passive Aggressive Regressor are: 133528
Expected number of impressions by Linear Regression are: 103740
Expected number of impressions by Quadratic Regression are: 1914696
/usr/local/lib/python3.8/dist-packages/sklearn/base.py:566: FutureWarning:

Arrays of bytes/strings is being converted to decimal numbers if dtype='numeric'. This behavior is deprecated in 0.24 and will be r

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```