INSTAGRAM REACH FORECASTING MODEL

INSTAGRAM REACH FORECASTING

OBJECTIVE OF PROJECT:

Instagram reach forecasting is the process of predicting the number of people that an Instagram post, story, or other content will be reached, based on historical data and various other factors. For content creators and anyone using Instagram professionally, predicting the reach can be valuable for planning and optimizing their social media strategy. By understanding how their content is performing, creators can make informed decisions about when to publish, what types of content to create, and how to engage their audience. It can lead to increased engagement, better performance metrics, and ultimately, greater success on the platform.

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from statsmodels.tsa.arima.model import ARIMA
from sklearn.metrics import mean_squared_error, mean_absolute_error
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
```

```
df = pd.read_csv('Instagram-Reach.csv')
```

```
data = df
```

```
df.head()
```

	Date	Instagram reach
0	2022-04-01T00:00:00	7620
1	2022-04-02T00:00:00	12859
2	2022-04-03T00:00:00	16008
3	2022-04-04T00:00:00	24349
4	2022-04-05T00:00:00	20532

DATA CLEANING

```
df.isnull().sum()
```

```
Date              0
Instagram reach   0
dtype: int64
```

DATA ANALYSIS

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 365 entries, 0 to 364
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   Date             365 non-null    object
 1   Instagram reach  365 non-null    int64 
dtypes: int64(1), object(1)
memory usage: 5.8+ KB
```

```
df.shape
```

```
(365, 2)
```

```
df.describe()
```

	Instagram reach
count	365.000000
mean	50474.712329
std	30051.787552
min	7620.000000
25%	25070.000000
50%	43987.000000
75%	68331.000000
max	161998.000000

```
df.drop_duplicates(inplace=True)
```

```
df.head()
```

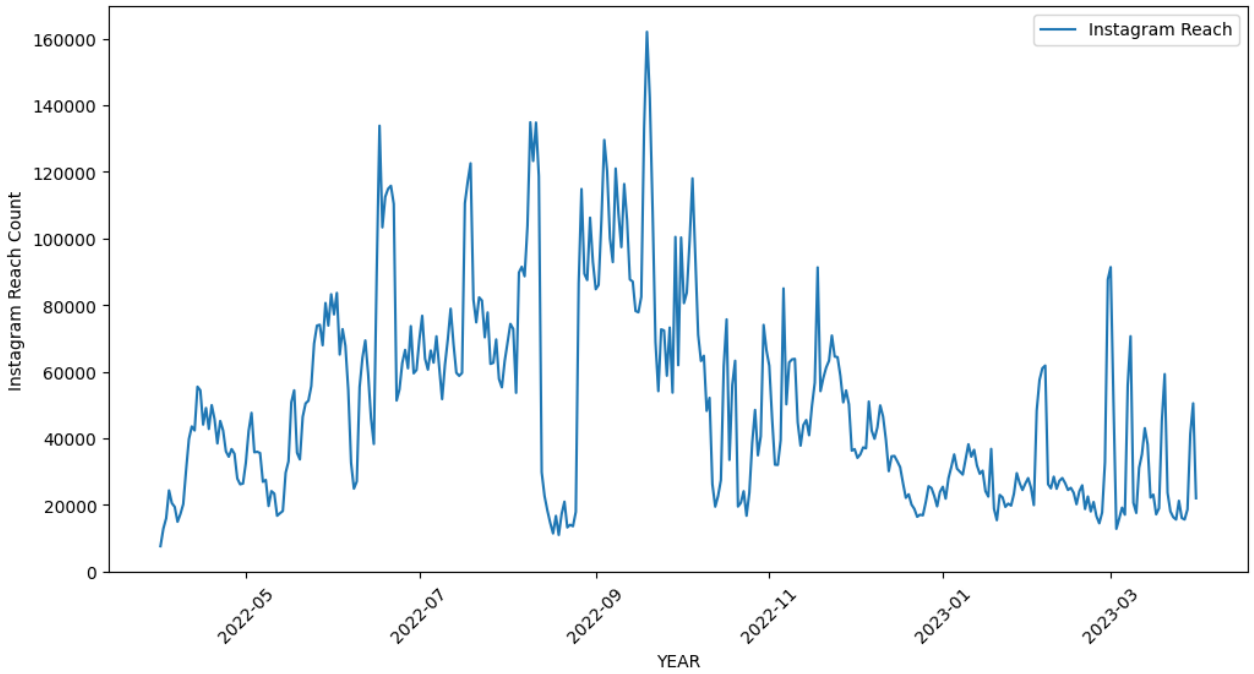
	Date	Instagram reach
0	2022-04-01T00:00:00	7620
1	2022-04-02T00:00:00	12859
2	2022-04-03T00:00:00	16008
3	2022-04-04T00:00:00	24349
4	2022-04-05T00:00:00	20532

```
#converting date into time series
df['Date'] = pd.to_datetime(df['Date'])
```

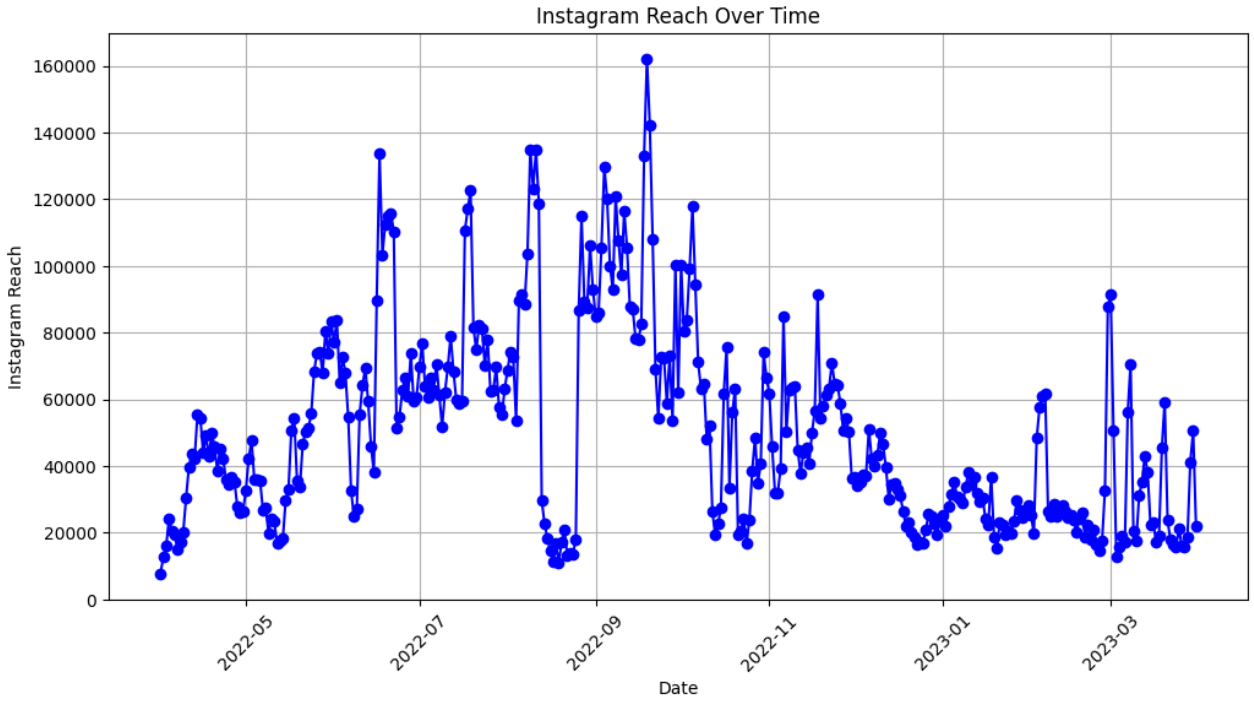
DATA VISUALISATION

```
mean_by_date = df.groupby(df['Date']).mean()
plt.figure(figsize=(12, 6))
plt.plot(mean_by_date.index,mean_by_date['Instagram reach'],label='Instagram Reach')
plt.xlabel('YEAR')
plt.ylabel('Instagram Reach Count')
plt.xticks(rotation=45)
```

```
plt.legend()
plt.show()
```



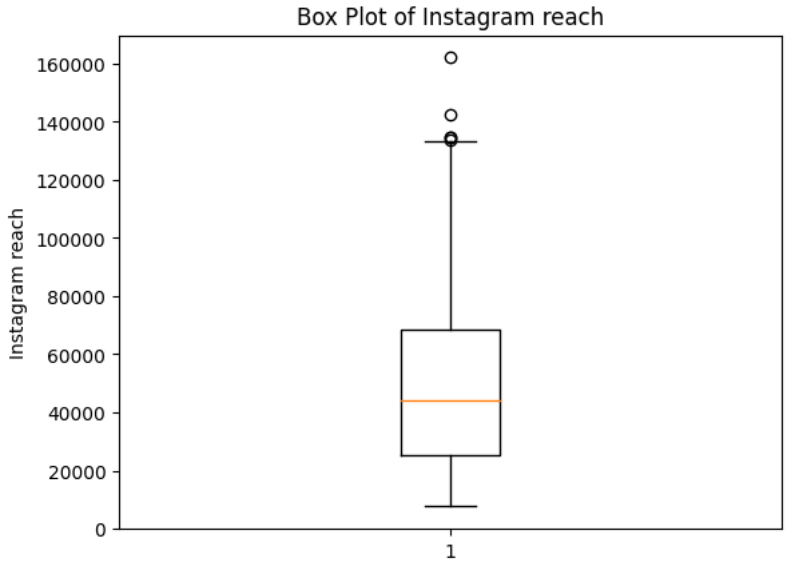

```
plt.figure(figsize=(12, 6))
plt.plot(df['Date'], df['Instagram reach'], marker='o', linestyle='-', color='blue')
plt.xlabel('Date')
plt.ylabel('Instagram Reach')
plt.title('Instagram Reach Over Time')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```



BOX PLOT

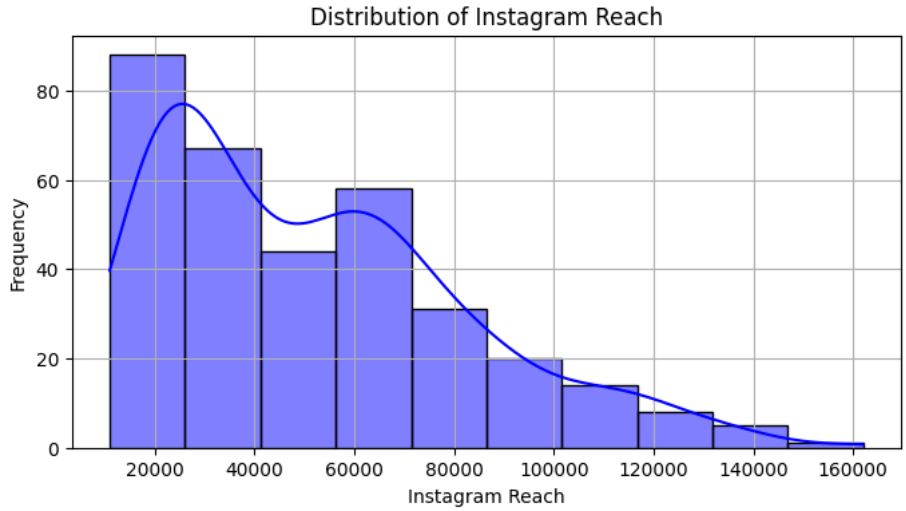
```
plt.boxplot(df['Instagram reach'])
plt.ylabel('Instagram reach')
```

```
plt.title('Box Plot of Instagram reach')
plt.show()
```



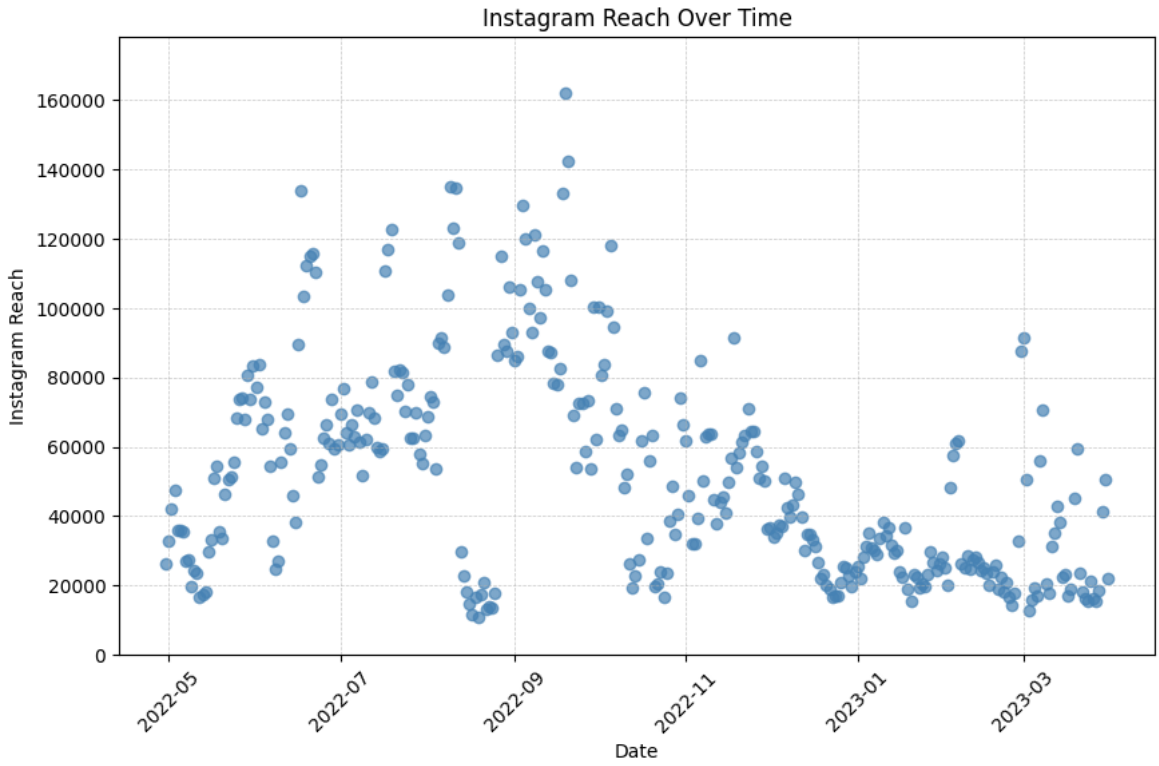
HISTOGRAM PLOT

```
plt.figure(figsize=(8, 4))
sns.histplot(df['Instagram reach'], bins=10, kde=True, color='blue')
plt.xlabel('Instagram Reach')
plt.ylabel('Frequency')
plt.title('Distribution of Instagram Reach')
plt.grid(True)
plt.show()
```



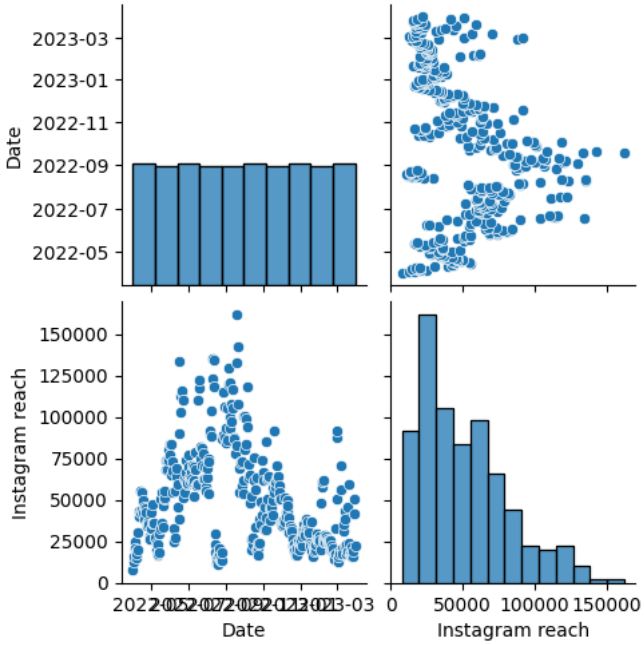
SCATTER PLOT

```
X = df['Date']
y = df['Instagram reach']

plt.figure(figsize=(10, 6))
plt.scatter(X, y, color='steelblue', alpha=0.7)

plt.xlabel('Date')
plt.ylabel('Instagram Reach')
plt.title('Instagram Reach Over Time')
plt.grid(True, linestyle='--', linewidth=0.5, alpha=0.7)
plt.xticks(rotation=45)
plt.ylim(0, max(y) * 1.1)  # Adjusting the y-axis limits for better visibility
plt.show()
```



PAIR PLOT

```
sns.pairplot(df, vars=['Date','Instagram reach'])
plt.show()
```



GETTING THE ROLLING AVERAGE AS PER DIFFERENT TIME AND PERCENT CHANGE

```
df['Day'] = df['Date'].dt.day
df['Month'] = df['Date'].dt.month
df['Year'] = df['Date'].dt.year
df['Weekday'] = df['Date'].dt.weekday
df['Week_of_Year'] = df['Date'].dt.isocalendar().week

df['Rolling_Average_7Days'] = df['Instagram reach'].rolling(window=7).mean()
df['Rolling_Average_30Days'] = df['Instagram reach'].rolling(window=30).mean()

df['Percentage_Change'] = df['Instagram reach'].pct_change() * 100
```

```
df['Reach_Difference'] = df['Instagram reach'].diff()
df['Previous_Day_Reach'] = df['Instagram reach'].shift(1)
df = df.dropna()

print(df)
```

```
          Date  Instagram reach  Day  Month  Year  Weekday  Week_of_Year  \
29  2022-04-30            26410   30      4  2022        5            17
30  2022-05-01            32637    1      5  2022        6            17
31  2022-05-02            42204    2      5  2022        0            18
32  2022-05-03            47632    3      5  2022        1            18
33  2022-05-04            35793    4      5  2022        2            18
..         ...              ...  ...    ...   ...      ...           ...
360 2023-03-27            15622   27      3  2023        0            13
361 2023-03-28            18645   28      3  2023        1            13
362 2023-03-29            41238   29      3  2023        2            13
363 2023-03-30            50490   30      3  2023        3            13
364 2023-03-31            22014   31      3  2023        4            13

     Rolling_Average_7Days  Rolling_Average_30Days  Percentage_Change  \
29           31883.428571            33336.800000           0.863123
30           31392.142857            34170.700000          23.578190
31           32497.428571            35148.866667          29.313356
32           34048.857143            36203.000000          12.861340
33           34112.285714            36584.466667         -24.855139
..                    ...                     ...                ...
360          18085.571429            32338.066667          -2.848259
361          17368.857143            32368.700000          19.350915
362          20677.857143            32649.200000         121.174578
363          25559.428571            31410.566667          22.435618
364          26474.000000            29098.800000         -56.399287

     Reach_Difference  Previous_Day_Reach
29              226.0             26184.0
30             6227.0             26410.0
31             9567.0             32637.0
32             5428.0             42204.0
33           -11839.0             47632.0
..                ...                 ...
360            -458.0             16080.0
361            3023.0             15622.0
362           22593.0             18645.0
363            9252.0             41238.0
364          -28476.0             50490.0

[336 rows x 12 columns]
```

Rolling Average of Instagram Reach:

```
df['Rolling Average'] = df['Instagram reach'].rolling(window=7, min_periods=1).mean()
```

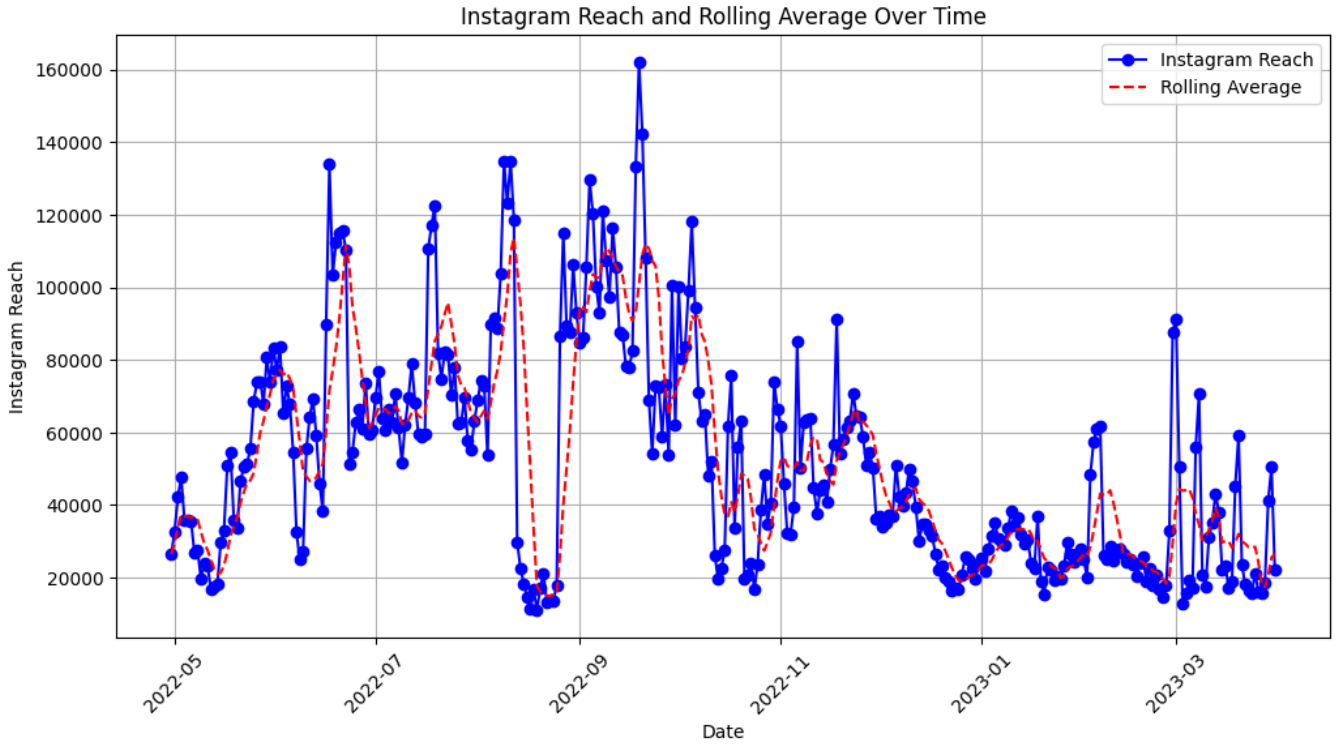
```
<ipython-input-100-597a4959adde>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus
  df['Rolling Average'] = df['Instagram reach'].rolling(window=7, min_periods=1).mean()
```

```
df.head()
```

	Date	Instagram reach	Day	Month	Year	Weekday	Week_of_Year	Rolling_Average_7Days
29	2022-04-30	26410	30	4	2022	5	17	31883.428571
30	2022-05-01	32637	1	5	2022	6	17	31392.142857
31	2022-05-02	42204	2	5	2022	0	18	32497.428571
32	2022-05-03	47632	3	5	2022	1	18	34048.857143
33	2022-05-04	35793	4	5	2022	2	18	34112.285714

Line Plot of Instagram Reach and Rolling Average:

```
plt.figure(figsize=(12,6))
plt.plot(df['Date'], df['Instagram reach'], marker='o', linestyle='-', color='blue', label='Instagram Reach')
plt.plot(df['Date'], df['Rolling Average'], linestyle='--', color='red', label='Rolling Average')
plt.xlabel('Date')
plt.ylabel('Instagram Reach')
plt.title('Instagram Reach and Rolling Average Over Time')
plt.xticks(rotation=45)
plt.legend()
plt.grid(True)
plt.show()
```



ARIMA (AutoRegressive Integrated Moving Average)

```
pip install pmdarima
```

```
Requirement already satisfied: pmdarima in /usr/local/lib/python3.10/dist-packages (2.0.3)
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.3.1)
Requirement already satisfied: Cython!=0.29.18,!=0.29.31,>=0.29 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (0.29.36
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.22.4)
Requirement already satisfied: pandas>=0.19 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.5.3)
Requirement already satisfied: scikit-learn>=0.22 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.2.2)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.10.1)
Requirement already satisfied: statsmodels>=0.13.2 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (0.13.5)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (1.26.16)
Requirement already satisfied: setuptools!=50.0.0,>=38.6.0 in /usr/local/lib/python3.10/dist-packages (from pmdarima) (67.7.2)
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=0.19->pmdarima) (2.8
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=0.19->pmdarima) (2022.7.1)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=0.22->pmdarima)
Requirement already satisfied: patsy>=0.5.2 in /usr/local/lib/python3.10/dist-packages (from statsmodels>=0.13.2->pmdarima) (0.5.3)
Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.10/dist-packages (from statsmodels>=0.13.2->pmdarima) (23.
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from patsy>=0.5.2->statsmodels>=0.13.2->pmdarima) (1
```

```
from pmdarima import auto_arima
stepwise_fit = auto_arima(df['Instagram reach'], trace=True,
suppress_warnings=True)
```

```
Performing stepwise search to minimize aic
 ARIMA(2,1,2)(0,0,0)[0] intercept   : AIC=7439.869, Time=0.34 sec
 ARIMA(0,1,0)(0,0,0)[0] intercept   : AIC=7464.605, Time=0.05 sec
 ARIMA(1,1,0)(0,0,0)[0] intercept   : AIC=7466.566, Time=0.06 sec
 ARIMA(0,1,1)(0,0,0)[0] intercept   : AIC=7466.560, Time=0.07 sec
 ARIMA(0,1,0)(0,0,0)[0]             : AIC=7462.607, Time=0.02 sec
```

```
 ARIMA(1,1,2)(0,0,0)[0] intercept   : AIC=7437.179, Time=0.70 sec
 ARIMA(0,1,2)(0,0,0)[0] intercept   : AIC=7454.999, Time=0.20 sec
 ARIMA(1,1,1)(0,0,0)[0] intercept   : AIC=7442.863, Time=0.48 sec
 ARIMA(1,1,3)(0,0,0)[0] intercept   : AIC=7439.400, Time=0.39 sec
 ARIMA(0,1,3)(0,0,0)[0] intercept   : AIC=7448.128, Time=0.14 sec
 ARIMA(2,1,1)(0,0,0)[0] intercept   : AIC=7439.422, Time=0.26 sec
 ARIMA(2,1,3)(0,0,0)[0] intercept   : AIC=7440.297, Time=1.07 sec
 ARIMA(1,1,2)(0,0,0)[0]             : AIC=7435.216, Time=0.22 sec
 ARIMA(0,1,2)(0,0,0)[0]             : AIC=7452.992, Time=0.12 sec
 ARIMA(1,1,1)(0,0,0)[0]             : AIC=7440.946, Time=0.16 sec
 ARIMA(2,1,2)(0,0,0)[0]             : AIC=7437.153, Time=0.31 sec
 ARIMA(1,1,3)(0,0,0)[0]             : AIC=7437.432, Time=0.33 sec
 ARIMA(0,1,1)(0,0,0)[0]             : AIC=7464.556, Time=0.06 sec
 ARIMA(0,1,3)(0,0,0)[0]             : AIC=7446.128, Time=0.13 sec
 ARIMA(2,1,1)(0,0,0)[0]             : AIC=7436.065, Time=0.21 sec
 ARIMA(2,1,3)(0,0,0)[0]             : AIC=7438.319, Time=0.69 sec

Best model:  ARIMA(1,1,2)(0,0,0)[0]
Total fit time: 6.043 seconds
```

SPLITTING THE DATASET

```
train_data = df.iloc[:-10] # selecting all rows from the DataFrame
test_data = df.iloc[-10:] # selecting the last 10 rows of the DataFrame
```

TRAINING OUR MODEL

```
from statsmodels.tsa.arima.model import ARIMA

model = ARIMA(train_data['Instagram reach'], order=(1, 1, 2))
model = model.fit()
model.summary()
```

```
/usr/local/lib/python3.10/dist-packages/statsmodels/tsa/base/tsa_model.py:471: ValueWarning: An unsupported index was provided and
  self._init_dates(dates, freq)
/usr/local/lib/python3.10/dist-packages/statsmodels/tsa/base/tsa_model.py:471: ValueWarning: An unsupported index was provided and
  self._init_dates(dates, freq)
/usr/local/lib/python3.10/dist-packages/statsmodels/tsa/base/tsa_model.py:471: ValueWarning: An unsupported index was provided and
  self._init_dates(dates, freq)
```

SARIMAX Results

Dep. Variable:	Instagram reach	**No. Observations:**	326
Model:	ARIMA(1, 1, 2)	**Log Likelihood**	-3605.344
Date:	Mon, 17 Jul 2023	**AIC**	7218.687
Time:	15:18:33	**BIC**	7233.822
Sample:	0	**HQIC**	7224.728
	- 326		
Covariance Type:	opg		

	coef	std err	z	P>|z|	[0.025	0.975]
ar.L1	0.6814	0.069	9.924	0.000	0.547	0.816
ma.L1	-0.7528	0.074	-10.137	0.000	-0.898	-0.607
ma.L2	-0.1859	0.056	-3.344	0.001	-0.295	-0.077
sigma2	2.659e+08	2.15e-10	1.24e+18	0.000	2.66e+08	2.66e+08

Ljung-Box (L1) (Q):	0.00	**Jarque-Bera (JB):**	177.27
Prob(Q):	0.97	**Prob(JB):**	0.00
Heteroskedasticity (H):	0.48	**Skew:**	0.16
Prob(H) (two-sided):	0.00	**Kurtosis:**	6.60

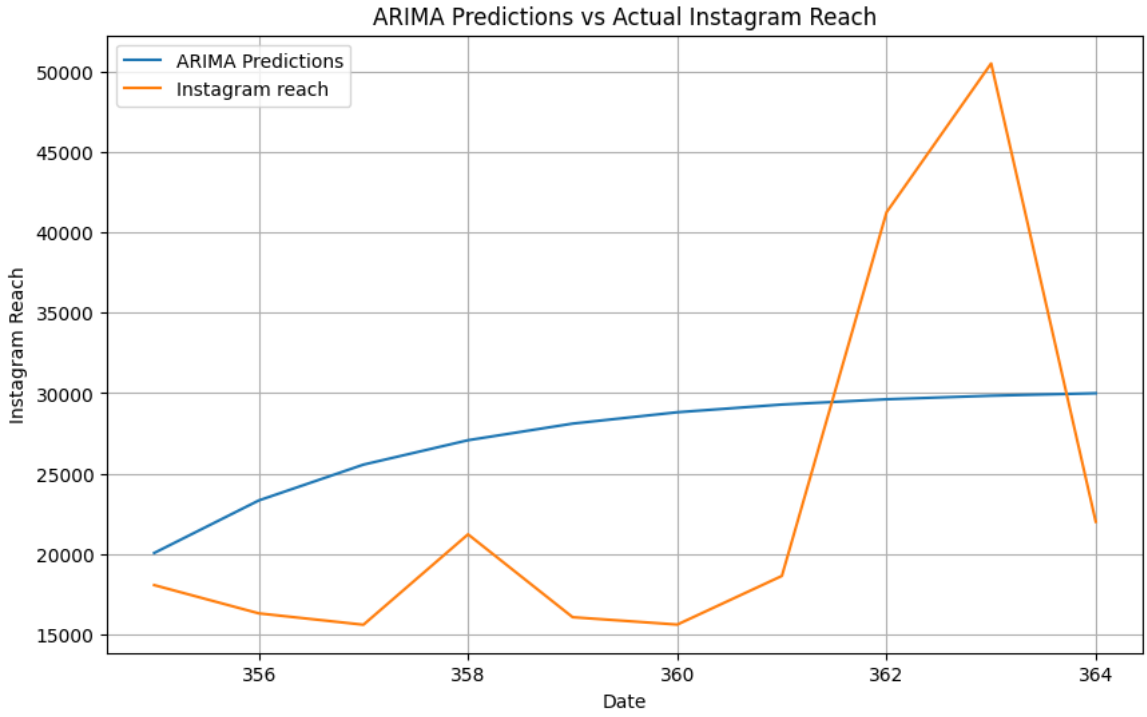
Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-step).
[2] Covariance matrix is singular or near-singular, with condition number 4.89e+33. Standard errors may be unstable.

GRAPH PLOTTING OF ACTUAL VS PREDICTION

```
start = len(train_data)
end = len(train_data) + len(test_data) - 1
pred = model.predict(start=start, end=end, typ='levels').rename('ARIMA Predictions')
pred.index = test_data.index  # Aligning the index of predicted values with test_data
pred.plot(legend=True,figsize=(10, 6))
test_data['Instagram reach'].plot(legend=True)
plt.xlabel('Date')
```

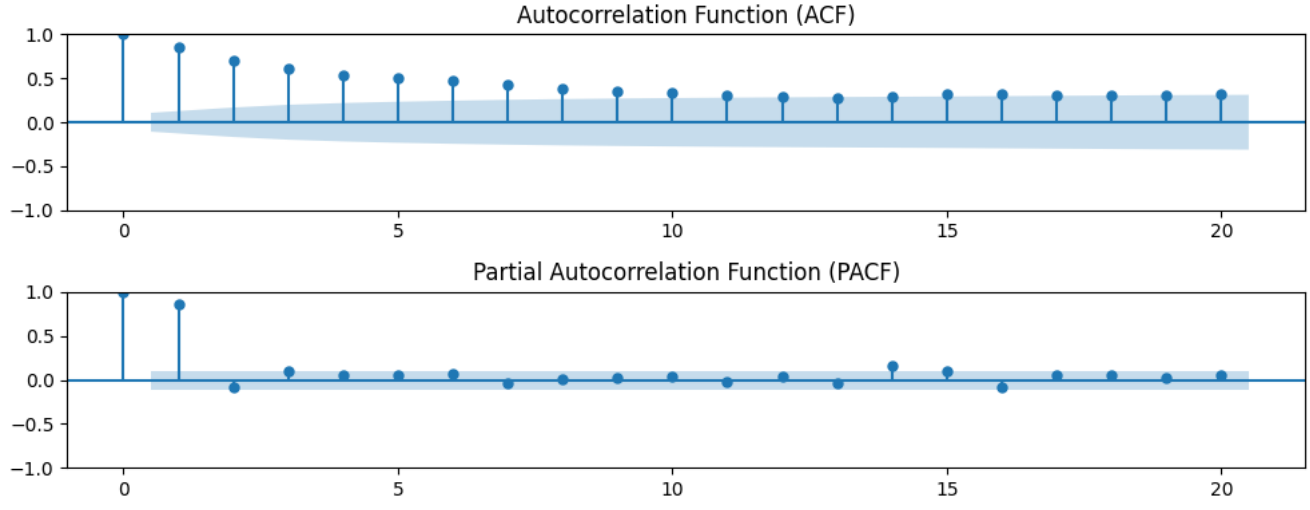
```
plt.ylabel('Instagram Reach')
plt.title('ARIMA Predictions vs Actual Instagram Reach')
plt.grid(True)
```

```
/usr/local/lib/python3.10/dist-packages/statsmodels/tsa/base/tsa_model.py:834: ValueWarning: No supported index is available. Predi
  return get_prediction_index(
```




```
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf

data = df['Instagram reach']

fig, axes = plt.subplots(2, 1, figsize=(10, 4))

# ACF plot
plot_acf(data, lags=20, ax=axes[0])
axes[0].set_title('Autocorrelation Function (ACF)')

# PACF plot
plot_pacf(data, lags=20, ax=axes[1])
axes[1].set_title('Partial Autocorrelation Function (PACF)')

plt.tight_layout()
plt.show()
```

```
/usr/local/lib/python3.10/dist-packages/statsmodels/graphics/tsaplots.py:348: FutureWarning: The default method 'yw' can produce PA
  warnings.warn(
```




```
predictions = model.predict(start=test_data.index[0], end=test_data.index[-1])

mse = mean_squared_error(test_data['Instagram reach'], predictions)
```

```
mae = mean_absolute_error(test_data['Instagram reach'], predictions)
print(mse)
print(mae)
```

```
179512869.0885865
13005.44191363524
/usr/local/lib/python3.10/dist-packages/statsmodels/tsa/base/tsa_model.py:834: ValueWarning: No supported index is available. Predi
  return get_prediction_index(
```

Plot the actual vs. predicted Instagram reach

```
plt.figure(figsize=(12, 6))

# Plotting the actual Instagram reach
plt.plot(test_data.index, test_data['Instagram reach'], color='blue', label='Actual')

# Plotting the predicted Instagram reach
plt.plot(predictions.index, predictions, color='red', label='Predicted')
plt.xlabel('Date')
plt.ylabel('Instagram Reach')
plt.title('Actual vs. Predicted Instagram Reach')
plt.legend()
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```