HR Analytics and Employee Attrition Prediction

Importing Libraries

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score
from sklearn.preprocessing import StandardScaler
from sklearn.impute import SimpleImputer
```

Loading Data

In [4]:
```
df = pd.read_csv("C:\\Users\\byash\\HR Analytics and  Employee Attrition Prediction
```

In [5]:
```
df
```

Out[5]:

	Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Educat
0	41	Yes	Travel_Rarely	1102	Sales	1	
1	49	No	Travel_Frequently	279	Research & Development	8	
2	37	Yes	Travel_Rarely	1373	Research & Development	2	
3	33	No	Travel_Frequently	1392	Research & Development	3	
4	27	No	Travel_Rarely	591	Research & Development	2	
...	...	...	...	...	...	...	
1465	36	No	Travel_Frequently	884	Research & Development	23	
1466	39	No	Travel_Rarely	613	Research & Development	6	
1467	27	No	Travel_Rarely	155	Research & Development	4	
1468	49	No	Travel_Frequently	1023	Sales	2	
1469	34	No	Travel_Rarely	628	Research & Development	8	

1470 rows × 35 columns

Data Inforamation and Data cleaning

In [6]:
```
df.head()
```

Out[6]:

	Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education
0	41	Yes	Travel_Rarely	1102	Sales	1	2
1	49	No	Travel_Frequently	279	Research & Development	8	1
2	37	Yes	Travel_Rarely	1373	Research & Development	2	2
3	33	No	Travel_Frequently	1392	Research & Development	3	4
4	27	No	Travel_Rarely	591	Research & Development	2	1

5 rows × 35 columns

In [10]:
```
df.columns
```

Out[10]:
```
Index(['Age', 'Attrition', 'BusinessTravel', 'DailyRate', 'Department',
       'DistanceFromHome', 'Education', 'EducationField', 'EmployeeCount',
       'EmployeeNumber', 'EnvironmentSatisfaction', 'Gender', 'HourlyRate',
       'JobInvolvement', 'JobLevel', 'JobRole', 'JobSatisfaction',
       'MaritalStatus', 'MonthlyIncome', 'MonthlyRate', 'NumCompaniesWorked',
       'Over18', 'OverTime', 'PercentSalaryHike', 'PerformanceRating',
       'RelationshipSatisfaction', 'StandardHours', 'StockOptionLevel',
       'TotalWorkingYears', 'TrainingTimesLastYear', 'WorkLifeBalance',
       'YearsAtCompany', 'YearsInCurrentRole', 'YearsSinceLastPromotion',
       'YearsWithCurrManager'],
      dtype='object')
```

In [12]:
```
df.describe()
```

Out[12]:

	Age	DailyRate	DistanceFromHome	Education	EmployeeCount	Employ
count	1470.000000	1470.000000	1470.000000	1470.000000	1470.0	1
mean	36.923810	802.485714	9.192517	2.912925	1.0	1
std	9.135373	403.509100	8.106864	1.024165	0.0	
min	18.000000	102.000000	1.000000	1.000000	1.0	
25%	30.000000	465.000000	2.000000	2.000000	1.0	
50%	36.000000	802.000000	7.000000	3.000000	1.0	1
75%	43.000000	1157.000000	14.000000	4.000000	1.0	1
max	60.000000	1499.000000	29.000000	5.000000	1.0	2

8 rows × 26 columns

In [13]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 35 columns):
 #   Column                    Non-Null Count  Dtype 
---  ------                    --------------  ----- 
 0   Age                       1470 non-null   int64 
 1   Attrition                 1470 non-null   object
 2   BusinessTravel            1470 non-null   object
 3   DailyRate                 1470 non-null   int64 
 4   Department                1470 non-null   object
 5   DistanceFromHome          1470 non-null   int64 
 6   Education                 1470 non-null   int64 
 7   EducationField            1470 non-null   object
 8   EmployeeCount             1470 non-null   int64 
 9   EmployeeNumber            1470 non-null   int64 
 10  EnvironmentSatisfaction   1470 non-null   int64 
 11  Gender                    1470 non-null   object
 12  HourlyRate                1470 non-null   int64 
 13  JobInvolvement            1470 non-null   int64 
 14  JobLevel                  1470 non-null   int64 
 15  JobRole                   1470 non-null   object
 16  JobSatisfaction           1470 non-null   int64 
 17  MaritalStatus             1470 non-null   object
 18  MonthlyIncome             1470 non-null   int64 
 19  MonthlyRate               1470 non-null   int64 
 20  NumCompaniesWorked        1470 non-null   int64 
 21  Over18                    1470 non-null   object
 22  OverTime                  1470 non-null   object
 23  PercentSalaryHike         1470 non-null   int64 
 24  PerformanceRating         1470 non-null   int64 
 25  RelationshipSatisfaction  1470 non-null   int64 
 26  StandardHours             1470 non-null   int64 
 27  StockOptionLevel          1470 non-null   int64 
 28  TotalWorkingYears         1470 non-null   int64 
 29  TrainingTimesLastYear     1470 non-null   int64 
 30  WorkLifeBalance           1470 non-null   int64 
 31  YearsAtCompany            1470 non-null   int64 
 32  YearsInCurrentRole        1470 non-null   int64 
 33  YearsSinceLastPromotion   1470 non-null   int64 
 34  YearsWithCurrManager      1470 non-null   int64 
dtypes: int64(26), object(9)
memory usage: 402.1+ KB
```

In [14]:
```
df.isnull().sum()
```

Out[14]:
```
Age                         0
Attrition                   0
BusinessTravel              0
DailyRate                   0
Department                  0
DistanceFromHome            0
Education                   0
EducationField              0
EmployeeCount               0
EmployeeNumber              0
EnvironmentSatisfaction     0
Gender                      0
HourlyRate                  0
JobInvolvement              0
JobLevel                    0
JobRole                     0
JobSatisfaction             0
MaritalStatus               0
MonthlyIncome               0
MonthlyRate                 0
NumCompaniesWorked          0
Over18                      0
OverTime                    0
PercentSalaryHike           0
PerformanceRating           0
RelationshipSatisfaction    0
StandardHours               0
StockOptionLevel            0
TotalWorkingYears           0
TrainingTimesLastYear       0
WorkLifeBalance             0
YearsAtCompany              0
YearsInCurrentRole          0
YearsSinceLastPromotion     0
YearsWithCurrManager        0
dtype: int64
```

In [16]:
```
df.duplicated().sum()
```

Out[16]:
```
0
```

EDA(Exploratory data analysis)

Converting columns to appropriate data types and Convert categorical columns to category dtype

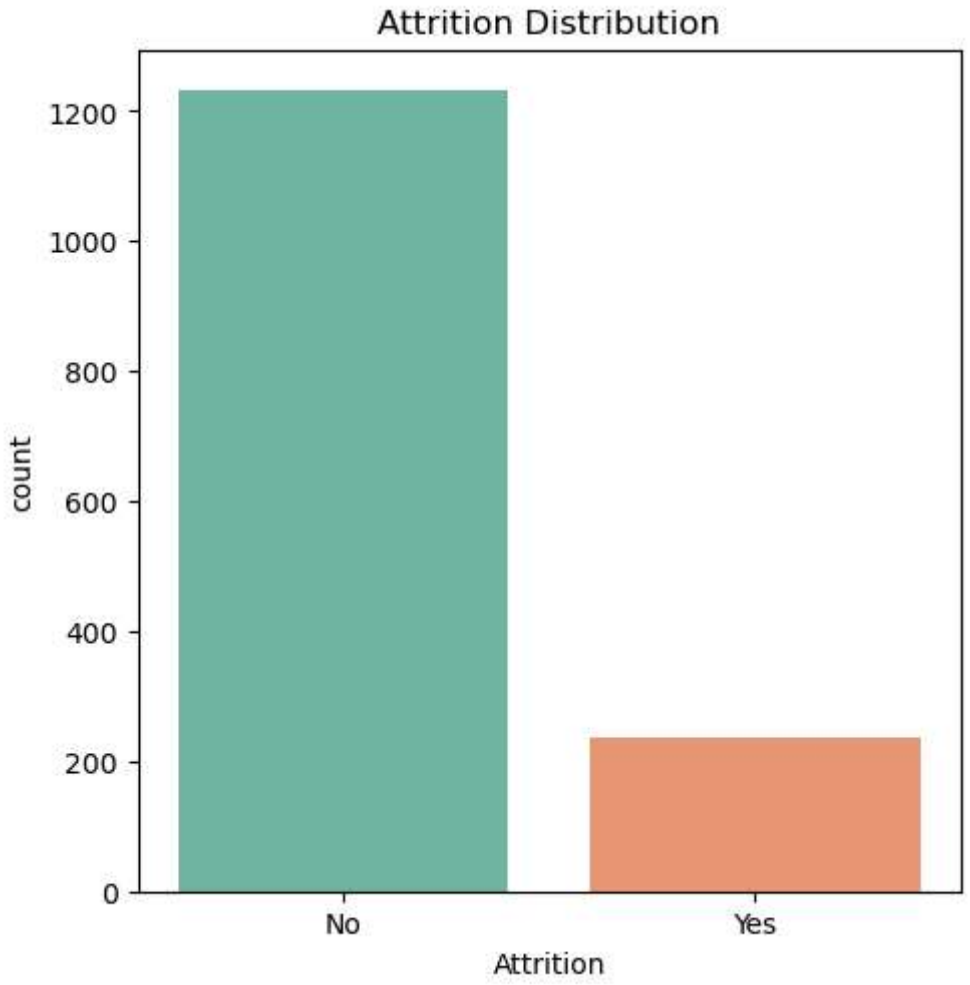
In [38]:
```
for col in df.columns:
    if col not in ['Attrition', 'BusinessTravel', 'Department', 'EducationField', '
        df[col] = pd.to_numeric(df[col], errors='coerce')
categorical_cols = ['Attrition', 'BusinessTravel', 'Department', 'EducationField',
for col in categorical_cols:
    df[col] = df[col].astype('category')
```

1. Attrition Distribution

In [18]:
```
plt.figure(figsize=(18, 12))
plt.subplot(2, 3, 1)
sns.countplot(data=df, x='Attrition', palette='Set2')
plt.title('Attrition Distribution')
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\2424425548.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(data=df, x='Attrition', palette='Set2')
```

Out[18]: Text(0.5, 1.0, 'Attrition Distribution')

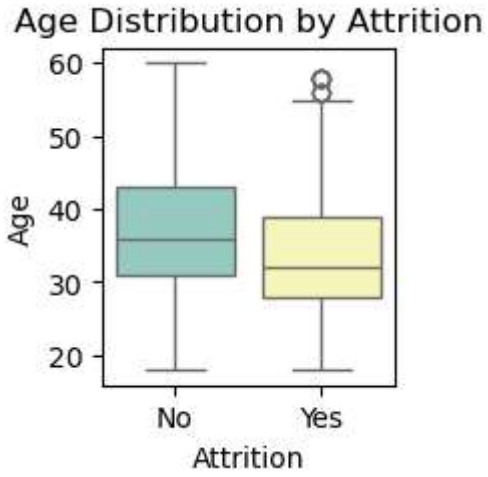


2. Age Distribution by Attrition

In [39]:
```
plt.subplot(2, 3, 2)
sns.boxplot(data=df, x='Attrition', y='Age', palette='Set3')
plt.title('Age Distribution by Attrition')
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\2314402736.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(data=df, x='Attrition', y='Age', palette='Set3')
```

Out[39]: Text(0.5, 1.0, 'Age Distribution by Attrition')

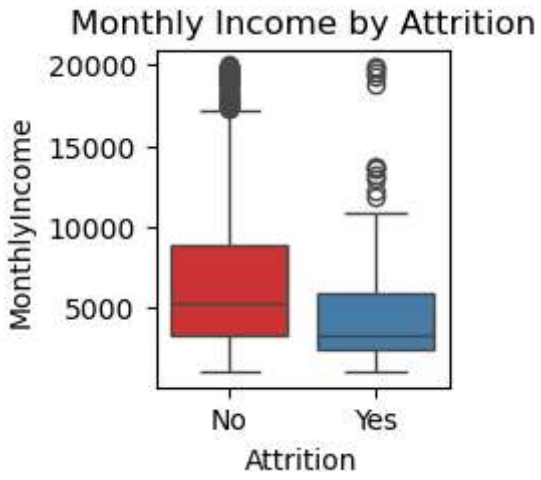


3. Monthly Income by Attrition

In [21]:
```
plt.subplot(2, 3, 3)
sns.boxplot(data=df, x='Attrition', y='MonthlyIncome', palette='Set1')
plt.title('Monthly Income by Attrition')
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\2874951252.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(data=df, x='Attrition', y='MonthlyIncome', palette='Set1')
```

Out[21]: Text(0.5, 1.0, 'Monthly Income by Attrition')



4. Job Satisfaction by Attrition

In [22]:
```
plt.subplot(2, 3, 4)
sns.boxplot(data=df, x='Attrition', y='JobSatisfaction', palette='Set2')
plt.title('Job Satisfaction by Attrition')
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\3358719107.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(data=df, x='Attrition', y='JobSatisfaction', palette='Set2')
```

Out[22]:
```
Text(0.5, 1.0, 'Job Satisfaction by Attrition')
```

5. Distance From Home by Attrition

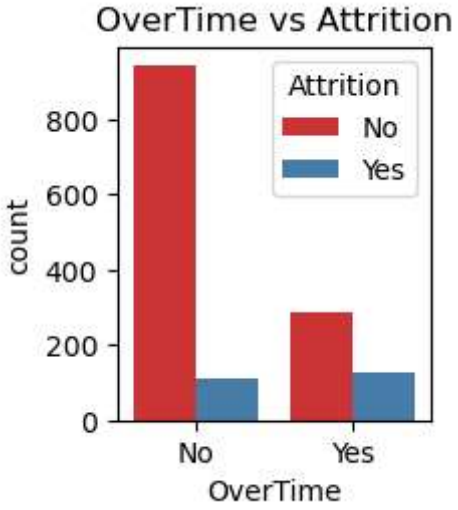
In [41]:
```
plt.subplot(2, 3, 5)
sns.boxplot(data=df, x='Attrition', y='DistanceFromHome', palette='Set3')
plt.title('Distance From Home by Attrition')
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\2363086863.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.boxplot(data=df, x='Attrition', y='DistanceFromHome', palette='Set3')
```

Out[41]:
```
Text(0.5, 1.0, 'Distance From Home by Attrition')
```

6. OverTime vs Attrition

In [42]:
```
plt.subplot(2, 3, 6)
sns.countplot(data=df, x='OverTime', hue='Attrition', palette='Set1')
plt.title('OverTime vs Attrition')

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



Logistic Regression

In [25]:
```
features = ['Age', 'DistanceFromHome', 'Education', 'EnvironmentSatisfaction', 'Job
            'JobLevel', 'JobSatisfaction', 'MonthlyIncome', 'NumCompaniesWorked', '
            'PerformanceRating', 'RelationshipSatisfaction', 'StockOptionLevel', 'T
            'TrainingTimesLastYear', 'WorkLifeBalance', 'YearsAtCompany', 'YearsInC
            'YearsSinceLastPromotion', 'YearsWithCurrManager']

X = df[features]
y = df['Attrition']
```

Imputation

In [28]:
```
imputer = SimpleImputer(strategy='median')
X_imputed = imputer.fit_transform(X)
```

Split data into training and testing sets

X_train, X_test, y_train, y_test = train_test_split(X_imputed, y, test_size=0.3, random_state=42)

Scale features

In [44]:
```
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

Create and train logistic regression model

In [45]:
```
model = LogisticRegression(random_state=42)
model.fit(X_train_scaled, y_train)
```

Out[45]:
```
LogisticRegression
LogisticRegression(random_state=42)
```

Make predictions

In [32]:
```
y_pred = model.predict(X_test_scaled)
y_pred
```

Out[32]:
```
array(['No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'Yes', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'Yes', 'No', 'Yes', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'Yes', 'No', 'No', 'Yes',
       'Yes', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'Yes',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'Yes', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'Yes', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'Yes', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'Yes', 'No', 'No',
       'No', 'No', 'Yes', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'Yes', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'Yes', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'Yes', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No',
       'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'No', 'Yes',
       'No', 'No'], dtype=object)
```

Feature importance

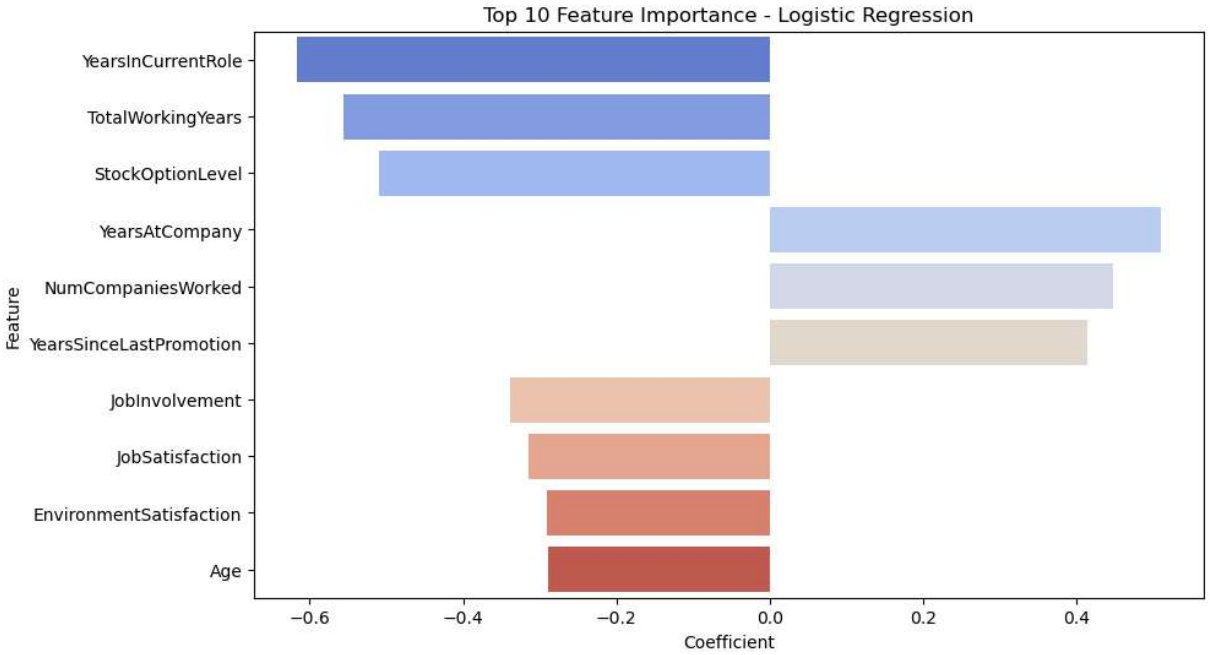
In [48]:
```
coefficients = model.coef_[0]
feature_importance = pd.DataFrame({'Feature': features, 'Coefficient': coefficients
feature_importance['Absolute'] = feature_importance['Coefficient'].abs()
feature_importance = feature_importance.sort_values(by='Absolute', ascending=False)
```

Plot feature importance

In [47]:
```
plt.figure(figsize=(10, 6))
sns.barplot(x='Coefficient', y='Feature', data=feature_importance.head(10), palette
```

```
plt.title('Top 10 Feature Importance - Logistic Regression')
plt.show()
```

```
C:\Users\byash\AppData\Local\Temp\ipykernel_20496\3376853221.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `y` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x='Coefficient', y='Feature', data=feature_importance.head(10), palett
e='coolwarm')
```



In [ ]: