```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

df = pd.read_csv("Employee-Attrition.csv")

df.head()
```

```
   Age Attrition     BusinessTravel  DailyRate              Department
\
0   41       Yes      Travel_Rarely       1102                   Sales

1   49        No  Travel_Frequently        279  Research & Development

2   37       Yes      Travel_Rarely       1373  Research & Development

3   33        No  Travel_Frequently       1392  Research & Development

4   27        No      Travel_Rarely        591  Research & Development


   DistanceFromHome  Education EducationField  EmployeeCount
EmployeeNumber  \
0                 1          2  Life Sciences              1
1
1                 8          1  Life Sciences              1
2
2                 2          2          Other              1
4
3                 3          4  Life Sciences              1
5
4                 2          1        Medical              1
7

   ...  RelationshipSatisfaction StandardHours  StockOptionLevel  \
0  ...                         1            80                 0
1  ...                         4            80                 1
2  ...                         2            80                 0
3  ...                         3            80                 0
4  ...                         4            80                 1

   TotalWorkingYears  TrainingTimesLastYear WorkLifeBalance
YearsAtCompany  \
0                  8                      0               1
6
1                 10                      3               3
10
2                  7                      3               3
0
3                  8                      3               3
```

```
8
4                   6                         3                3
2

  YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager
0                  4                        0                     5
1                  7                        1                     7
2                  0                        0                     0
3                  7                        3                     0
4                  2                        2                     2

[5 rows x 35 columns]
```

```
df.shape
```

```
(1470, 35)
```

```
df.Attrition.value_counts()
```

```
No     1233
Yes     237
Name: Attrition, dtype: int64
```

```
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

df.describe()

                Age    DailyRate  DistanceFromHome    Education
EmployeeCount  \
count  1470.000000  1470.000000       1470.000000  1470.000000
1470.0
mean     36.923810   802.485714          9.192517     2.912925
1.0
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
75%      43.000000  1157.000000         14.000000     4.000000
1.0
max      60.000000  1499.000000         29.000000     5.000000
1.0

       EmployeeNumber  EnvironmentSatisfaction   HourlyRate
JobInvolvement  \
count     1470.000000              1470.000000  1470.000000
1470.000000
mean      1024.865306                 2.721769    65.891156
2.729932
std        602.024335                 1.093082    20.329428
0.711561
min          1.000000                 1.000000    30.000000
1.000000
25%        491.250000                 2.000000    48.000000
2.000000
```

```
50%       1020.500000                    3.000000    66.000000
3.000000
75%       1555.750000                    4.000000    83.750000
3.000000
max       2068.000000                    4.000000   100.000000
4.000000

          JobLevel  ...  RelationshipSatisfaction  StandardHours  \
count  1470.000000  ...               1470.000000         1470.0
mean      2.063946  ...                  2.712245           80.0
std       1.106940  ...                  1.081209            0.0
min       1.000000  ...                  1.000000           80.0
25%       1.000000  ...                  2.000000           80.0
50%       2.000000  ...                  3.000000           80.0
75%       3.000000  ...                  4.000000           80.0
max       5.000000  ...                  4.000000           80.0

       StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
count       1470.000000        1470.000000            1470.000000
mean           0.793878          11.279592               2.799320
std            0.852077           7.780782               1.289271
min            0.000000           0.000000               0.000000
25%            0.000000           6.000000               2.000000
50%            1.000000          10.000000               3.000000
75%            1.000000          15.000000               3.000000
max            3.000000          40.000000               6.000000

       WorkLifeBalance  YearsAtCompany  YearsInCurrentRole  \
count      1470.000000     1470.000000         1470.000000
mean          2.761224        7.008163            4.229252
std           0.706476        6.126525            3.623137
min           1.000000        0.000000            0.000000
25%           2.000000        3.000000            2.000000
50%           3.000000        5.000000            3.000000
75%           3.000000        9.000000            7.000000
max           4.000000       40.000000           18.000000

       YearsSinceLastPromotion  YearsWithCurrManager
count              1470.000000           1470.000000
mean                  2.187755              4.123129
std                   3.222430              3.568136
min                   0.000000              0.000000
25%                   0.000000              2.000000
50%                   1.000000              3.000000
75%                   3.000000              7.000000
max                  15.000000             17.000000

[8 rows x 26 columns]
```

```
df.isnull().any()
```

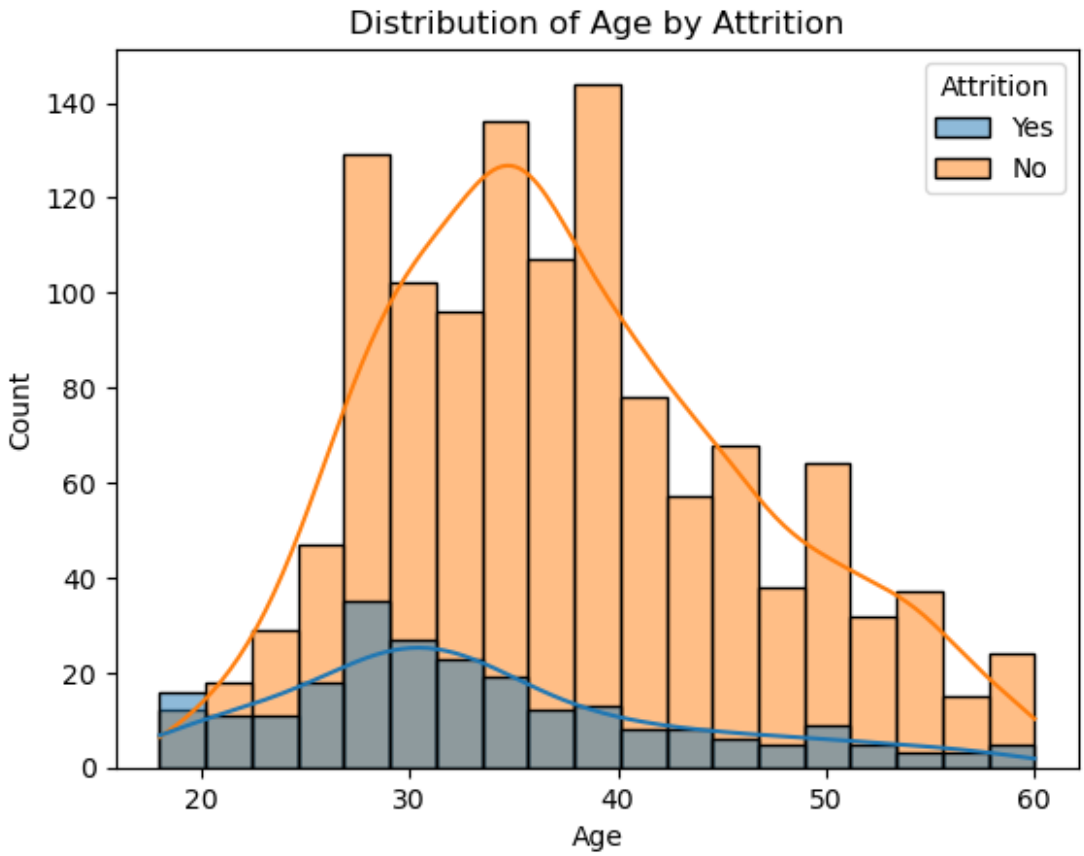
```
Age                         False
Attrition                   False
BusinessTravel              False
DailyRate                   False
Department                  False
DistanceFromHome            False
Education                   False
EducationField              False
EmployeeCount           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

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

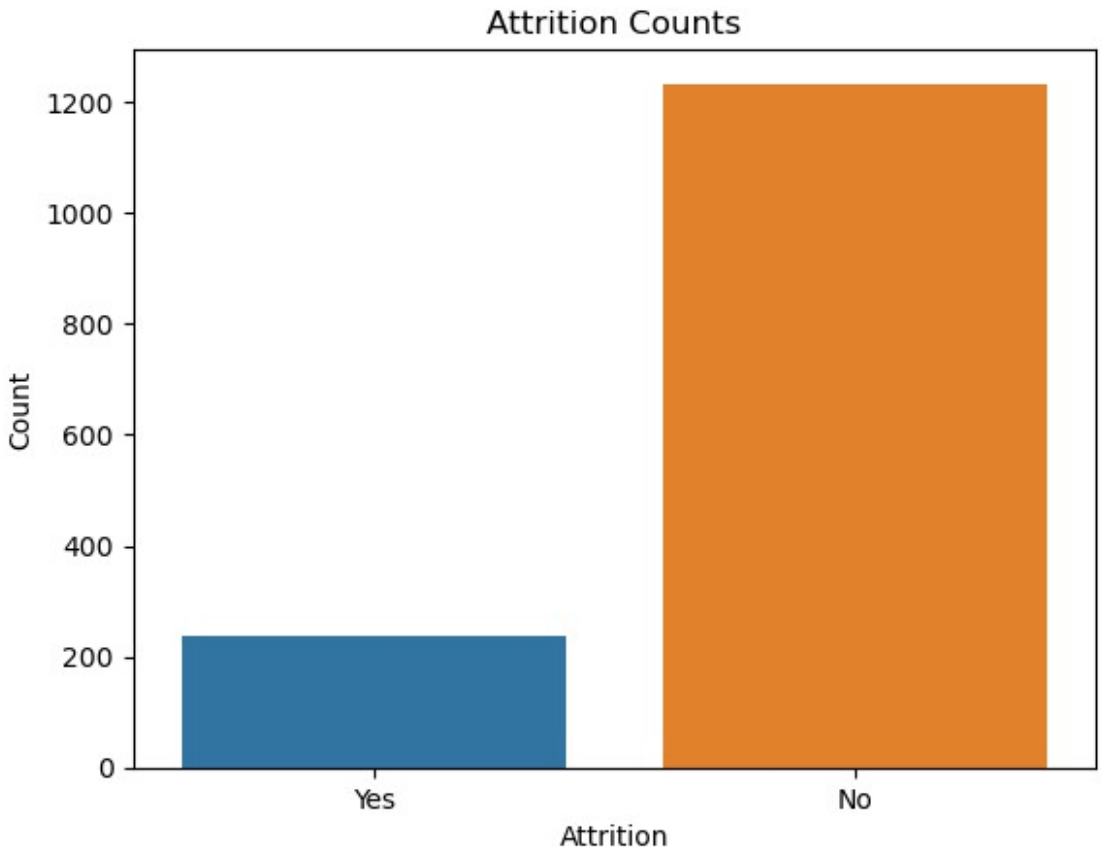
```
Age                         0
Attrition                   0
BusinessTravel              0
DailyRate                   0
Department                  0
DistanceFromHome            0
Education                   0
EducationField              0
EmployeeCount               0
EmployeeNumber              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
```

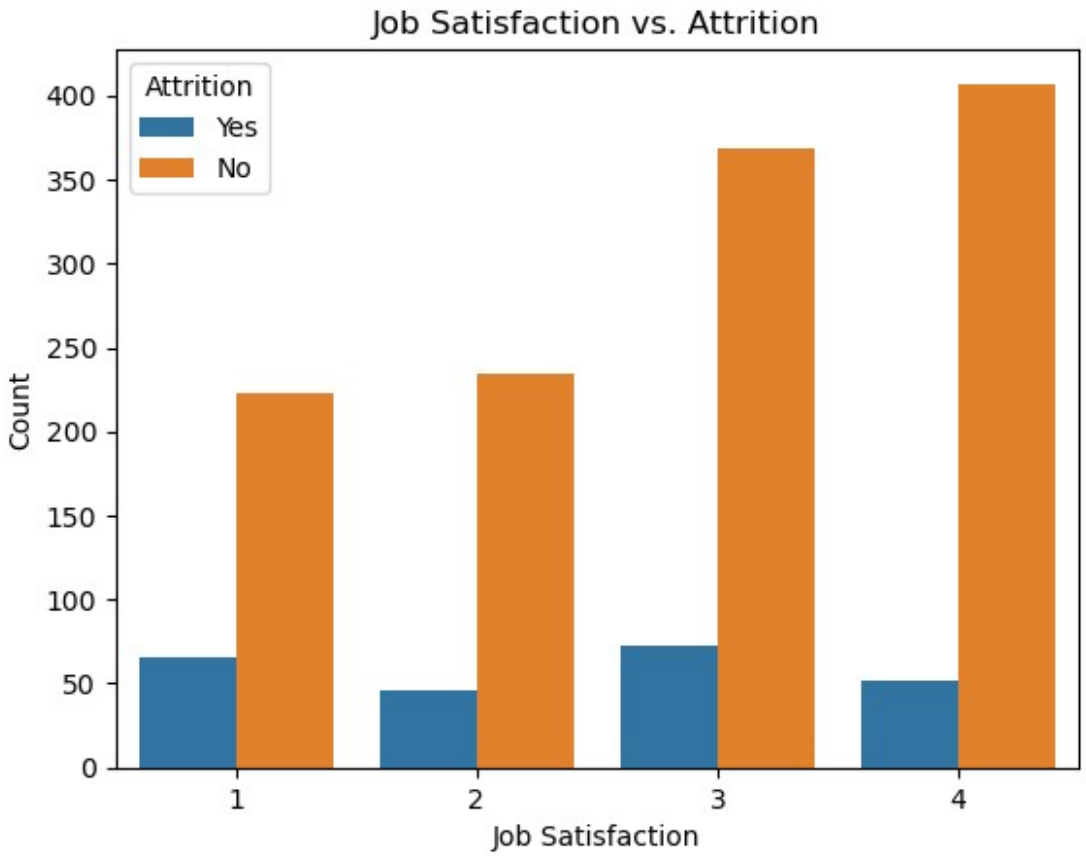
```
sns.histplot(data=df, x='Age', hue='Attrition', kde=True)
plt.title('Distribution of Age by Attrition')
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```



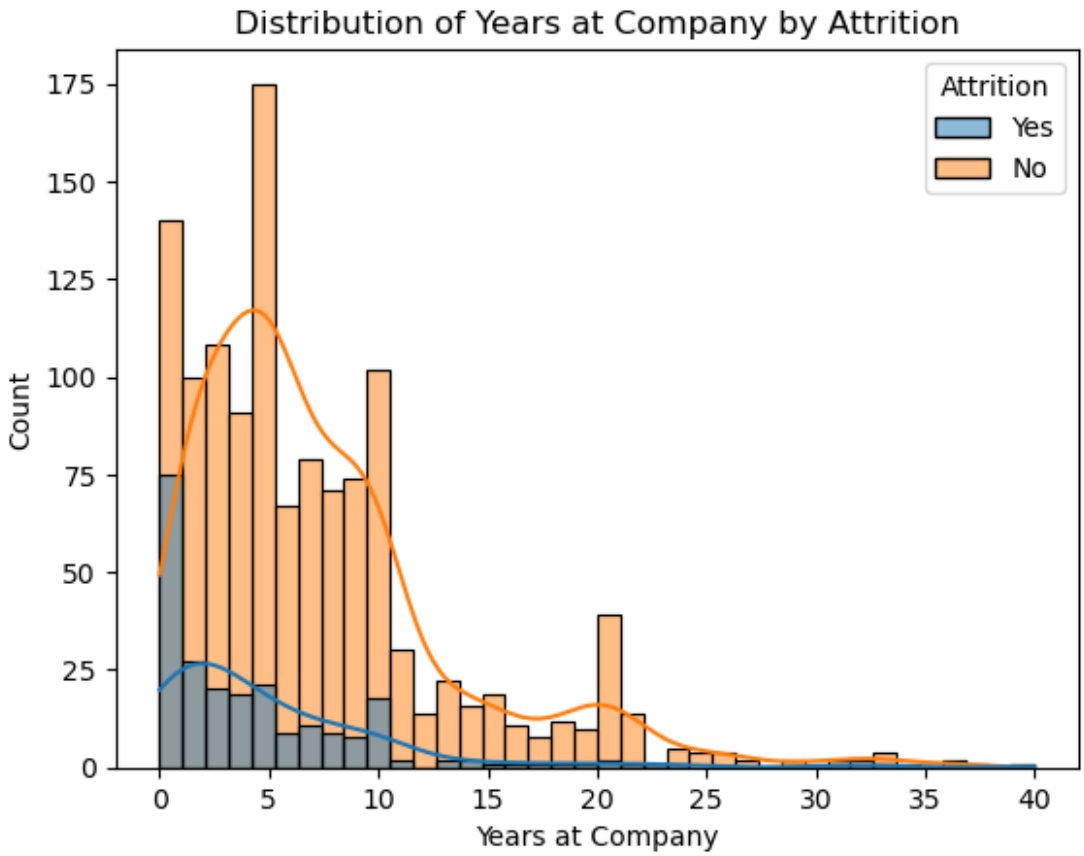

```
sns.countplot(x='Attrition', data=df)
plt.title('Attrition Counts')
plt.xlabel('Attrition')
plt.ylabel('Count')
plt.show()
```



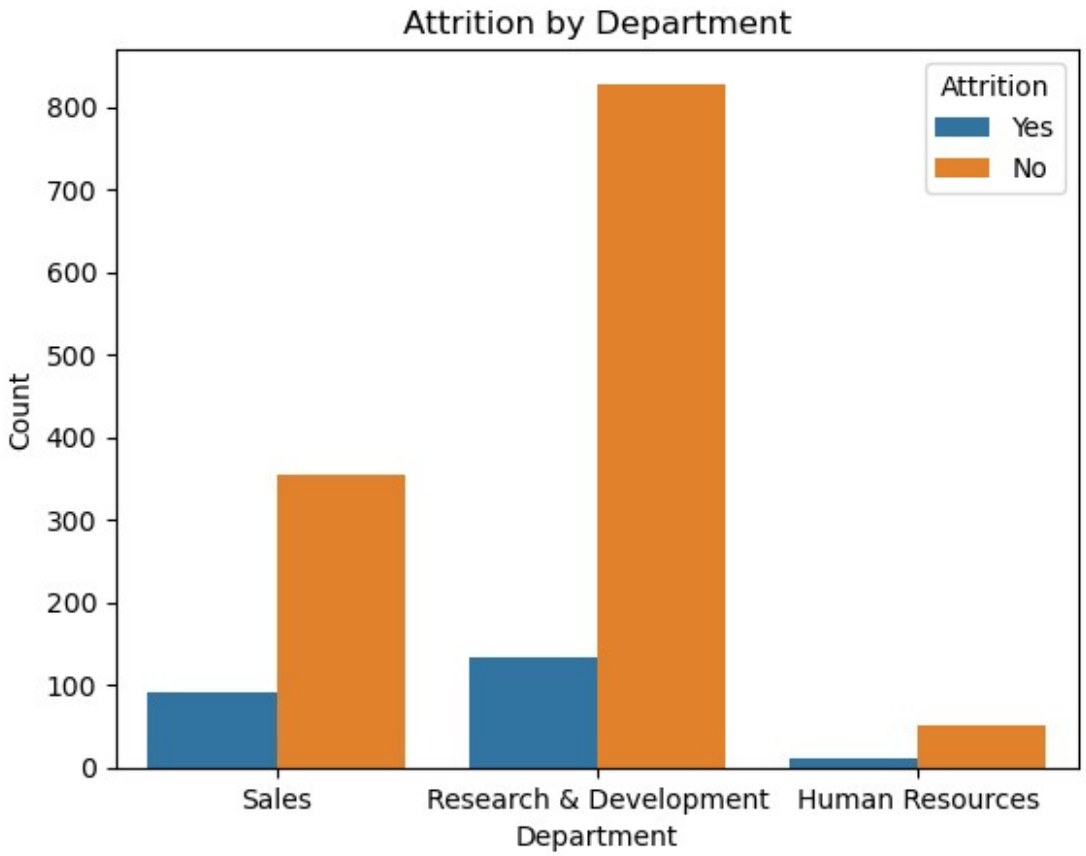

```
sns.countplot(x='JobSatisfaction', hue='Attrition', data=df)
plt.title('Job Satisfaction vs. Attrition')
plt.xlabel('Job Satisfaction')
plt.ylabel('Count')
plt.show()
```



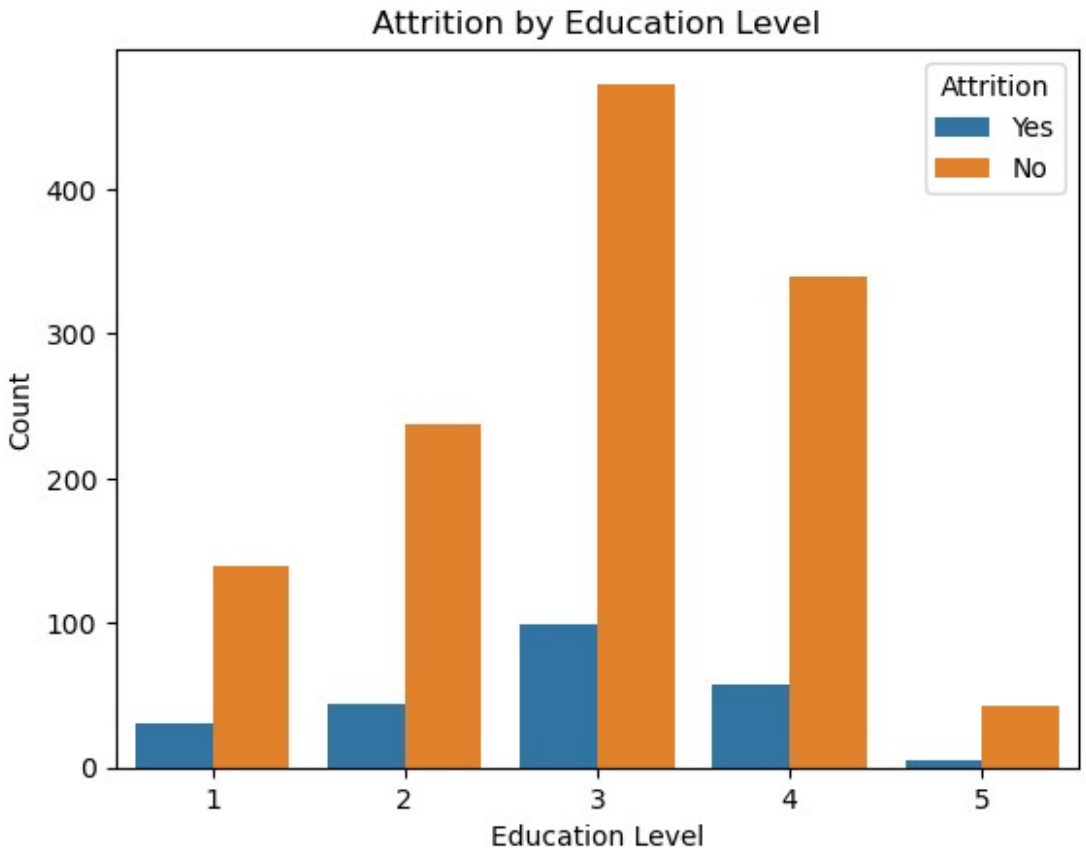

```
sns.histplot(data=df, x='YearsAtCompany', hue='Attrition', kde=True)
plt.title('Distribution of Years at Company by Attrition')
plt.xlabel('Years at Company')
plt.ylabel('Count')
plt.show()
```



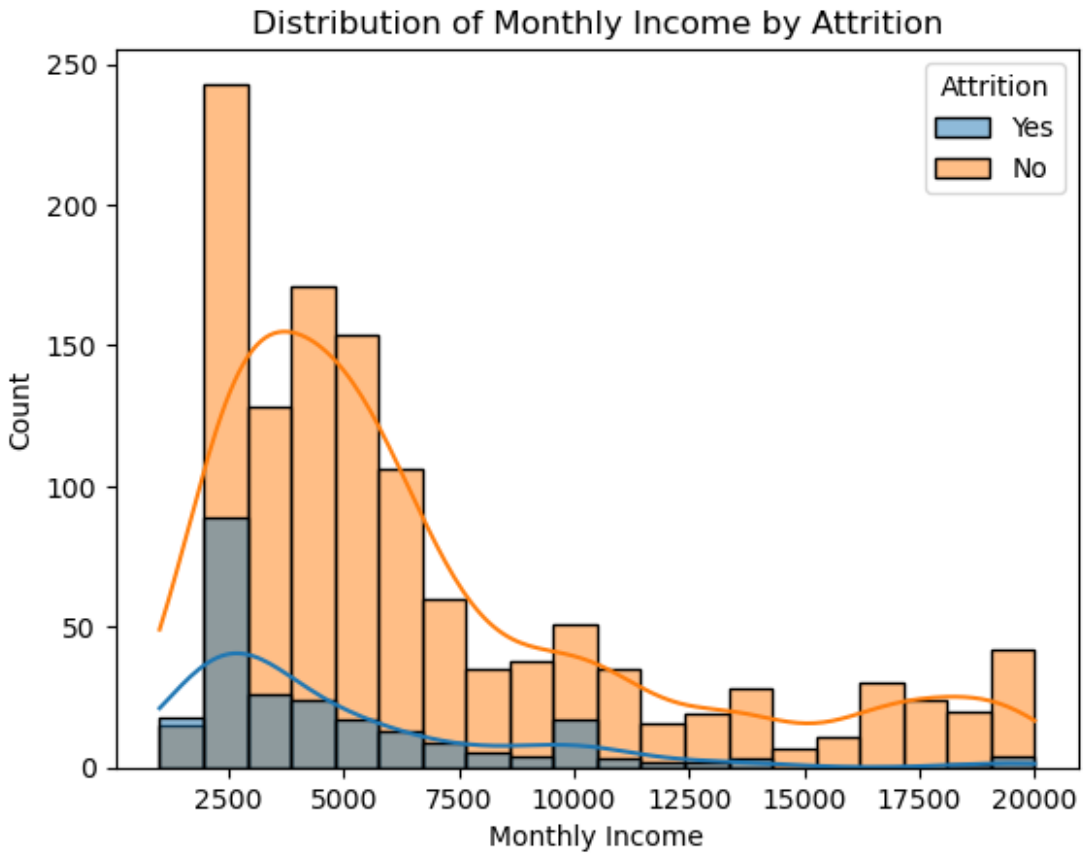

```
sns.countplot(x='Department', hue='Attrition', data=df)
plt.title('Attrition by Department')
plt.xlabel('Department')
plt.ylabel('Count')
plt.show()
```



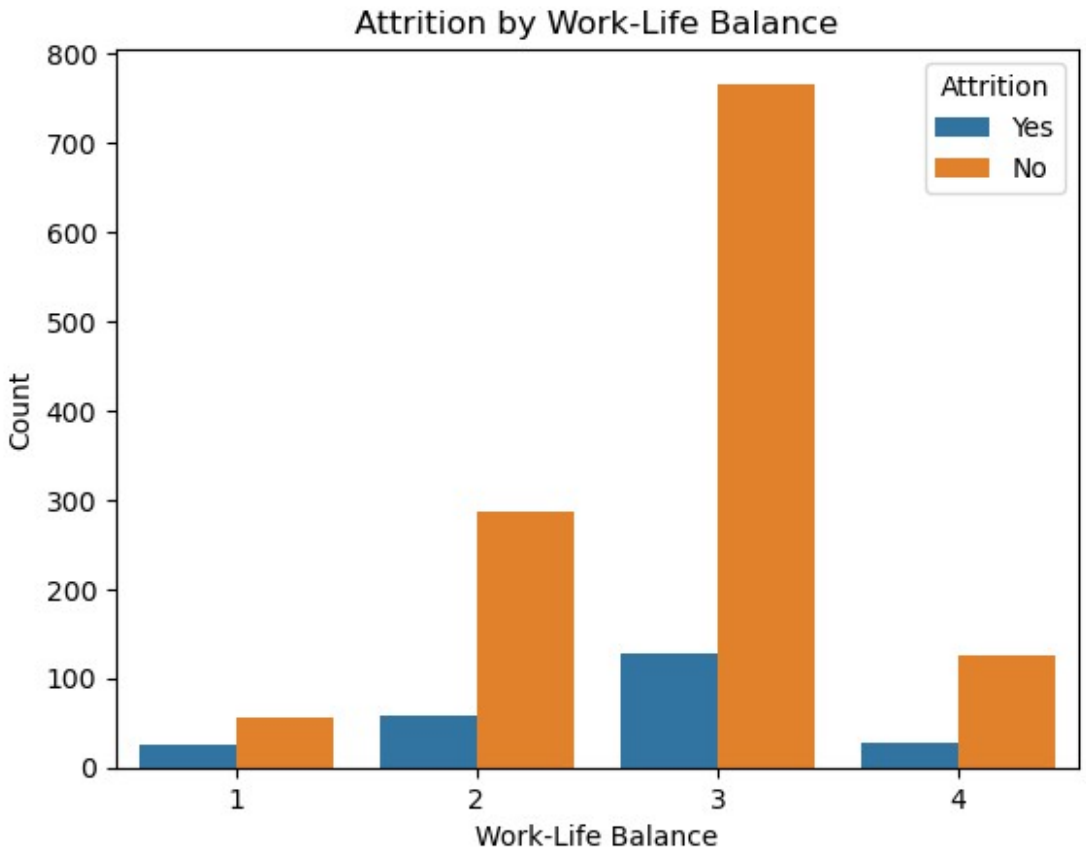

```
sns.countplot(x='Education', hue='Attrition', data=df)
plt.title('Attrition by Education Level')
plt.xlabel('Education Level')
plt.ylabel('Count')
plt.show()
```




```
sns.histplot(data=df, x='MonthlyIncome', hue='Attrition', kde=True)
plt.title('Distribution of Monthly Income by Attrition')
plt.xlabel('Monthly Income')
plt.ylabel('Count')
plt.show()
```

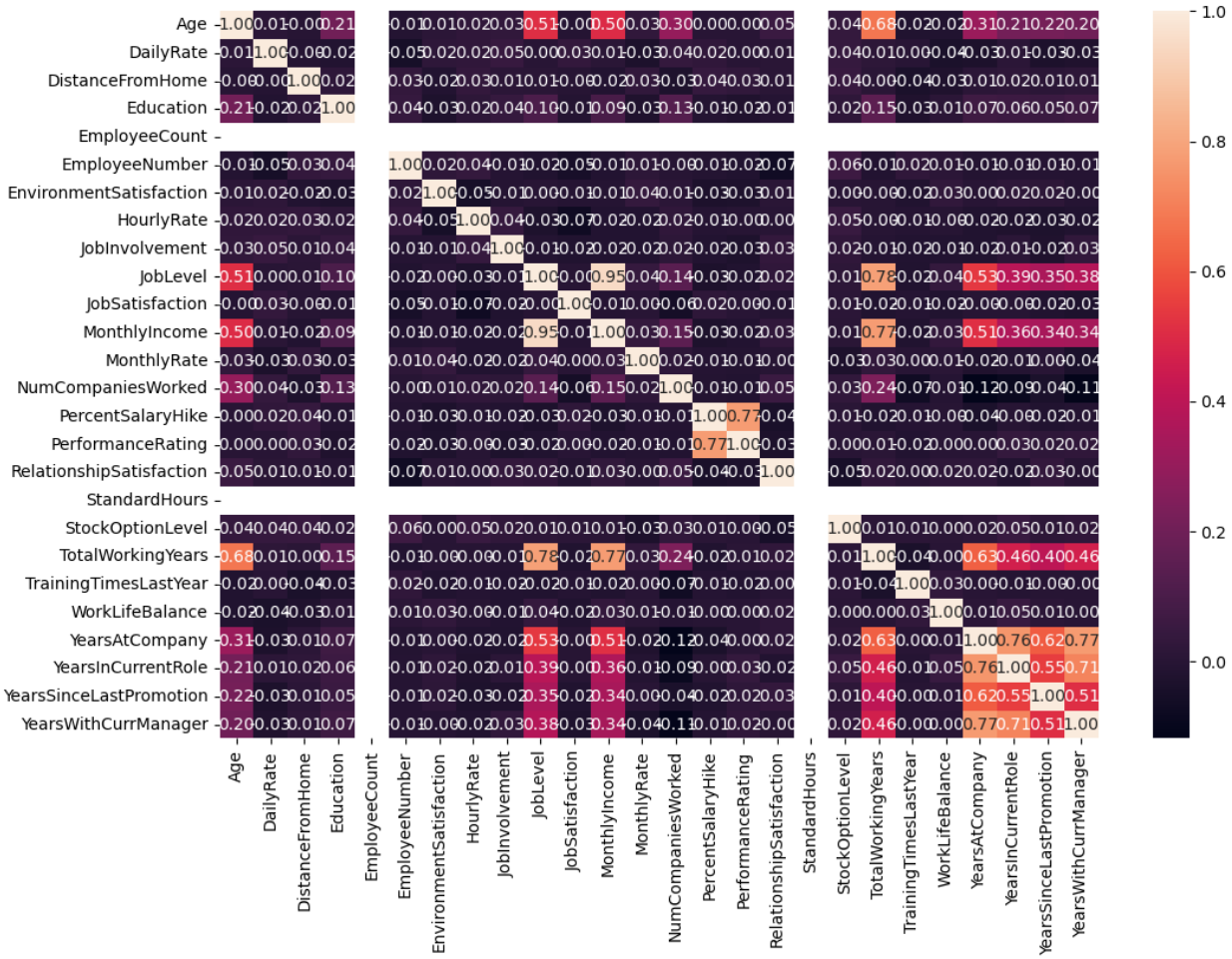



```
sns.countplot(x='WorkLifeBalance', hue='Attrition', data=df)
plt.title('Attrition by Work-Life Balance')
plt.xlabel('Work-Life Balance')
plt.ylabel('Count')
plt.show()
```

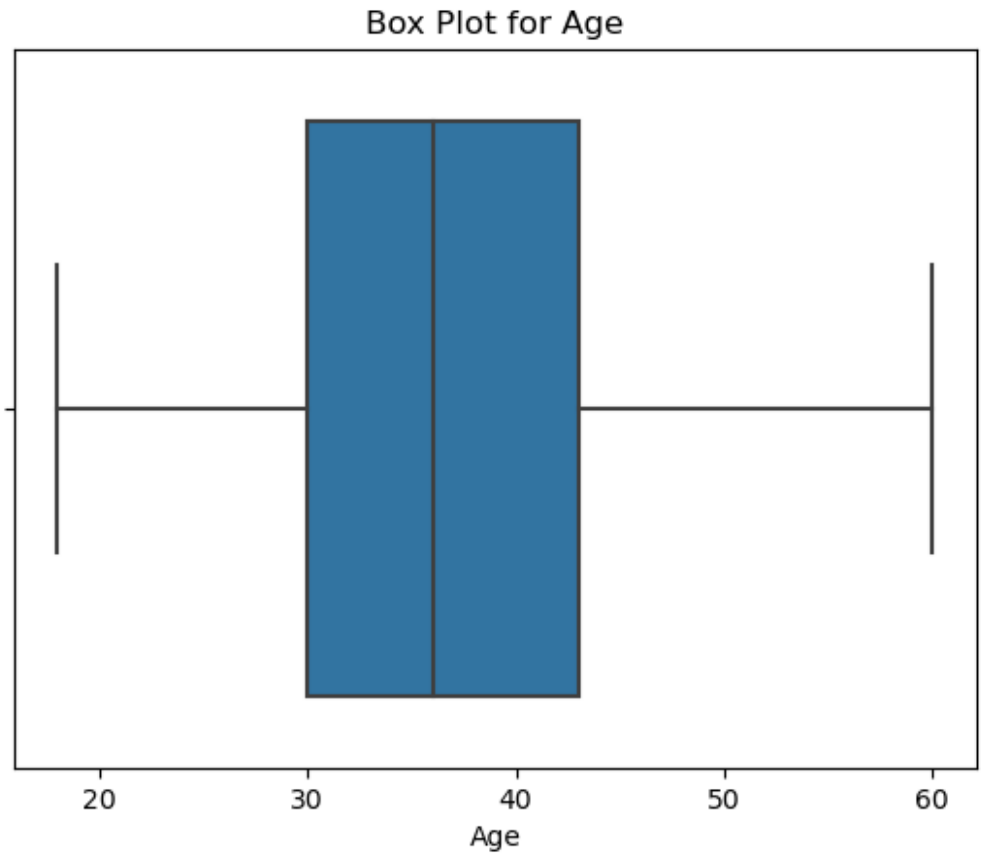



```
correlation_matrix = df.corr(numeric_only=True)
plt.figure(figsize=(12, 8))
sns.heatmap(correlation_matrix, annot=True,fmt=".2f")
```

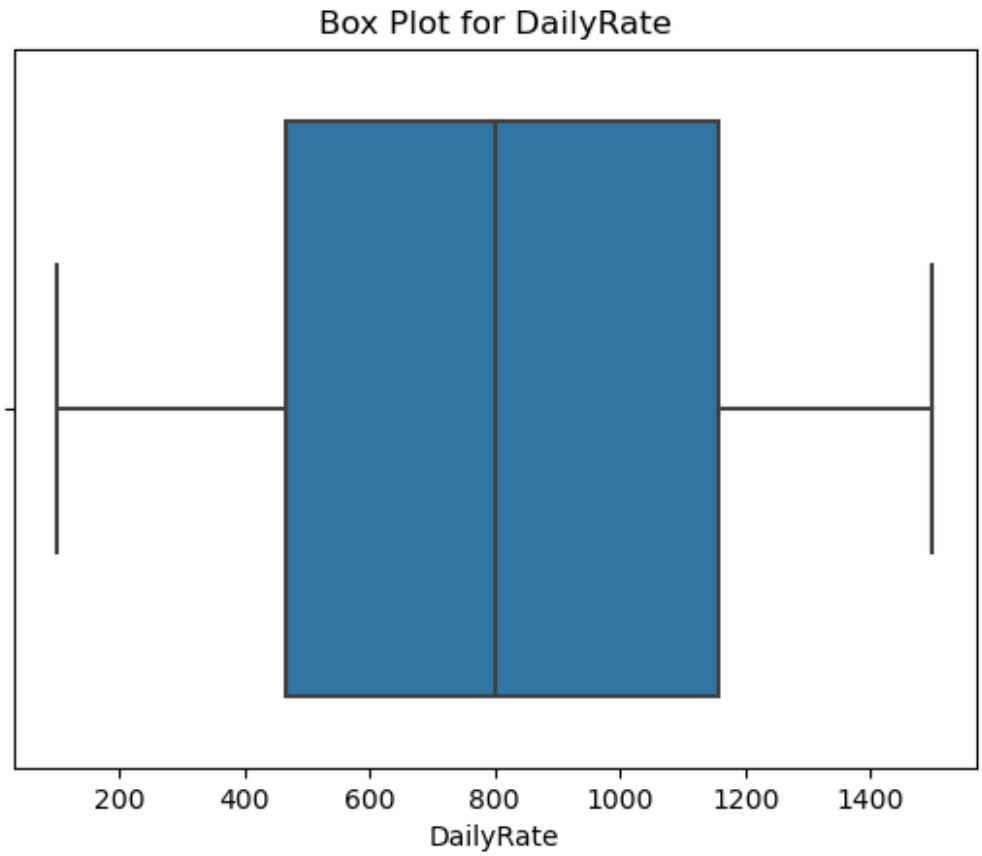
```
<Axes: >
```



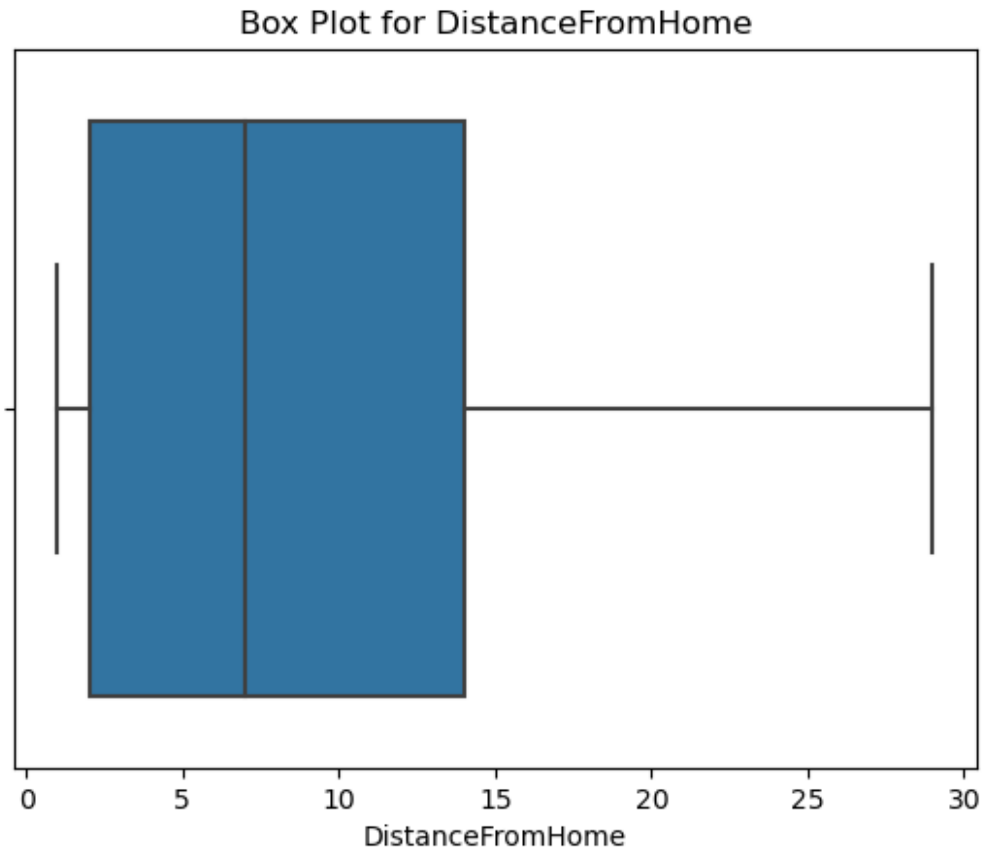

```
sns.boxplot(x='Age', data=df)
plt.title('Box Plot for Age')
plt.show()
```




```
sns.boxplot(x='DailyRate', data=df)
plt.title('Box Plot for DailyRate')
plt.show()
```




```
sns.boxplot(x='DistanceFromHome', data=df)
plt.title('Box Plot for DistanceFromHome')
plt.show()
```




```
y = df['Attrition']
y.head()

0    Yes
1     No
2    Yes
3     No
4     No
Name: Attrition, dtype: object

x = df.drop('Attrition', axis=1)
x.head()

   Age     BusinessTravel  DailyRate              Department  \
0   41      Travel_Rarely       1102                   Sales
1   49  Travel_Frequently        279  Research & Development
2   37      Travel_Rarely       1373  Research & Development
3   33  Travel_Frequently       1392  Research & Development
4   27      Travel_Rarely        591  Research & Development

   DistanceFromHome  Education EducationField  EmployeeCount
EmployeeNumber  \
0                 1          2  Life Sciences              1
1
```

```
1                  8           1  Life Sciences               1
2
2                  2           2          Other               1
4
3                  3           4  Life Sciences               1
5
4                  2           1        Medical               1
7

   EnvironmentSatisfaction  ... RelationshipSatisfaction
StandardHours  \
0                        2  ...                        1
80
1                        3  ...                        4
80
2                        4  ...                        2
80
3                        4  ...                        3
80
4                        1  ...                        4
80

   StockOptionLevel  TotalWorkingYears TrainingTimesLastYear
WorkLifeBalance  \
0                 0                  8                     0
1
1                 1                 10                     3
3
2                 0                  7                     3
3
3                 0                  8                     3
3
4                 1                  6                     3
3

  YearsAtCompany  YearsInCurrentRole  YearsSinceLastPromotion  \
0              6                   4                        0
1             10                   7                        1
2              0                   0                        0
3              8                   7                        3
4              2                   2                        2

   YearsWithCurrManager
0                     5
1                     7
2                     0
3                     0
4                     2

[5 rows x 34 columns]
```

```
x_labelled = pd.get_dummies(x, drop_first=True)
x_labelled
```

```
      Age  DailyRate  DistanceFromHome  Education  EmployeeCount  \
0      41       1102                 1          2              1
1      49        279                 8          1              1
2      37       1373                 2          2              1
3      33       1392                 3          4              1
4      27        591                 2          1              1
...   ...        ...               ...        ...            ...
1465   36        884                23          2              1
1466   39        613                 6          1              1
1467   27        155                 4          3              1
1468   49       1023                 2          3              1
1469   34        628                 8          3              1

      EmployeeNumber  EnvironmentSatisfaction  HourlyRate
JobInvolvement  \
0                  1                        2          94
3
1                  2                        3          61
2
2                  4                        4          92
2
3                  5                        4          56
3
4                  7                        1          40
3
...              ...                      ...         ...
...
1465            2061                        3          41
4
1466            2062                        4          42
2
1467            2064                        2          87
4
1468            2065                        4          63
2
1469            2068                        2          82
4

      JobLevel  ...  JobRole_Laboratory Technician  JobRole_Manager  \
0            2  ...                              0                0
1            2  ...                              0                0
2            1  ...                              1                0
3            1  ...                              0                0
4            1  ...                              1                0
...        ...  ...                            ...              ...
1465         2  ...                              1                0
1466         3  ...                              0                0
```

```
1467         2  ...                                0                0
1468         2  ...                                0                0
1469         2  ...                                1                0

      JobRole_Manufacturing Director  JobRole_Research Director  \
0                                  0                         0
1                                  0                         0
2                                  0                         0
3                                  0                         0
4                                  0                         0
...                              ...                       ...
1465                               0                         0
1466                               0                         0
1467                               1                         0
1468                               0                         0
1469                               0                         0

      JobRole_Research Scientist  JobRole_Sales Executive  \
0                              0                        1
1                              1                        0
2                              0                        0
3                              1                        0
4                              0                        0
...                          ...                      ...
1465                           0                        0
1466                           0                        0
1467                           0                        0
1468                           0                        1
1469                           0                        0

      JobRole_Sales Representative  MaritalStatus_Married  \
0                                0                       0
1                                0                       1
2                                0                       0
3                                0                       1
4                                0                       1
...                            ...                     ...
1465                             0                       1
1466                             0                       1
1467                             0                       1
1468                             0                       1
1469                             0                       1

      MaritalStatus_Single  OverTime_Yes
0                        1             1
1                        0             0
2                        1             1
3                        0             1
4                        0             0
...                    ...           ...
```

```
1465                       0              0
1466                       0              0
1467                       0              1
1468                       0              0
1469                       0              0

[1470 rows x 47 columns]
```

```
from sklearn.preprocessing import MinMaxScaler

ms=MinMaxScaler()

x_scaled = ms.fit_transform(x_labelled)
x_scaled
```

```
array([[0.54761905, 0.71581961, 0.        , ..., 0.        , 1.
,
        1.        ],
       [0.73809524, 0.12670007, 0.25      , ..., 1.        , 0.
,
        0.        ],
       [0.45238095, 0.90980673, 0.03571429, ..., 0.        , 1.
,
        1.        ],
       ...,
       [0.21428571, 0.03793844, 0.10714286, ..., 1.        , 0.
,
        1.        ],
       [0.73809524, 0.65926986, 0.03571429, ..., 1.        , 0.
,
        0.        ],
       [0.38095238, 0.37652112, 0.25      , ..., 1.        , 0.
,
        0.        ]])
```

```
X_scaleddf = pd.DataFrame(x_scaled, columns=x_labelled.columns)
X_scaleddf
```

```
           Age  DailyRate  DistanceFromHome  Education  EmployeeCount
\
0     0.547619   0.715820          0.000000       0.25            0.0

1     0.738095   0.126700          0.250000       0.00            0.0

2     0.452381   0.909807          0.035714       0.25            0.0

3     0.357143   0.923407          0.071429       0.75            0.0

4     0.214286   0.350036          0.035714       0.00            0.0

...        ...        ...               ...        ...             ...
```

```
1465  0.428571   0.559771          0.785714       0.25             0.0

1466  0.500000   0.365784          0.178571       0.00             0.0

1467  0.214286   0.037938          0.107143       0.50             0.0

1468  0.738095   0.659270          0.035714       0.50             0.0

1469  0.380952   0.376521          0.250000       0.50             0.0


      EmployeeNumber  EnvironmentSatisfaction  HourlyRate
JobInvolvement  \
0           0.000000                 0.333333    0.914286
0.666667
1           0.000484                 0.666667    0.442857
0.333333
2           0.001451                 1.000000    0.885714
0.333333
3           0.001935                 1.000000    0.371429
0.666667
4           0.002903                 0.000000    0.142857
0.666667
...              ...                      ...         ...
...
1465        0.996613                 0.666667    0.157143
1.000000
1466        0.997097                 1.000000    0.171429
0.333333
1467        0.998065                 0.333333    0.814286
1.000000
1468        0.998549                 1.000000    0.471429
0.333333
1469        1.000000                 0.333333    0.742857
1.000000

      JobLevel  ...  JobRole_Laboratory Technician  JobRole_Manager  \
0         0.25  ...                            0.0              0.0
1         0.25  ...                            0.0              0.0
2         0.00  ...                            1.0              0.0
3         0.00  ...                            0.0              0.0
4         0.00  ...                            1.0              0.0
...        ...  ...                            ...              ...
1465      0.25  ...                            1.0              0.0
1466      0.50  ...                            0.0              0.0
1467      0.25  ...                            0.0              0.0
1468      0.25  ...                            0.0              0.0
1469      0.25  ...                            1.0              0.0
```

```
      JobRole_Manufacturing Director  JobRole_Research Director  \
0                                  0.0                        0.0
1                                  0.0                        0.0
2                                  0.0                        0.0
3                                  0.0                        0.0
4                                  0.0                        0.0
...                                ...                        ...
1465                               0.0                        0.0
1466                               0.0                        0.0
1467                               1.0                        0.0
1468                               0.0                        0.0
1469                               0.0                        0.0

      JobRole_Research Scientist  JobRole_Sales Executive  \
0                            0.0                      1.0
1                            1.0                      0.0
2                            0.0                      0.0
3                            1.0                      0.0
4                            0.0                      0.0
...                          ...                      ...
1465                         0.0                      0.0
1466                         0.0                      0.0
1467                         0.0                      0.0
1468                         0.0                      1.0
1469                         0.0                      0.0

      JobRole_Sales Representative  MaritalStatus_Married  \
0                              0.0                    0.0
1                              0.0                    1.0
2                              0.0                    0.0
3                              0.0                    1.0
4                              0.0                    1.0
...                            ...                    ...
1465                           0.0                    1.0
1466                           0.0                    1.0
1467                           0.0                    1.0
1468                           0.0                    1.0
1469                           0.0                    1.0

      MaritalStatus_Single  OverTime_Yes
0                      1.0           1.0
1                      0.0           0.0
2                      1.0           1.0
3                      0.0           1.0
4                      0.0           0.0
...                    ...           ...
1465                   0.0           0.0
1466                   0.0           0.0
1467                   0.0           1.0
1468                   0.0           0.0
```

```
1469                    0.0           0.0

[1470 rows x 47 columns]
```

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x_scaled, y,
test_size=0.2, random_state=42)

from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report

lo = LogisticRegression(random_state=42)
de = DecisionTreeClassifier(random_state=42)
ra = RandomForestClassifier(random_state=42)

lo.fit(X_train, y_train)
lo_prediction = lo.predict(X_test)

de.fit(X_train, y_train)
de_predictions = de.predict(X_test)

ra.fit(X_train, y_train)
rapredictions = ra.predict(X_test)

logistic_accuracy = accuracy_score(y_test, lo_prediction)
logistic_report = classification_report(y_test, lo_prediction)
logistic_accuracy
```

```
0.891156462585034
```

```
print(logistic_report)
```

```
              precision    recall  f1-score   support

          No       0.91      0.97      0.94       255
         Yes       0.67      0.36      0.47        39

    accuracy                           0.89       294
   macro avg       0.79      0.67      0.70       294
weighted avg       0.88      0.89      0.88       294
```

```
decision_tree_accuracy = accuracy_score(y_test, de_predictions)
decision_tree_report = classification_report(y_test, de_predictions)
decision_tree_accuracy
```

```
0.7721088435374149
```

```
print(decision_tree_report)
```

```
              precision    recall  f1-score   support

          No       0.87      0.86      0.87       255
         Yes       0.17      0.18      0.17        39

    accuracy                           0.77       294
   macro avg       0.52      0.52      0.52       294
weighted avg       0.78      0.77      0.78       294
```

```
random_forest_accuracy = accuracy_score(y_test, rapredictions)
random_forest_report = classification_report(y_test, rapredictions)

random_forest_accuracy
```

```
0.8775510204081632
```

```
print(random_forest_report)
```

```
              precision    recall  f1-score   support

          No       0.88      1.00      0.93       255
         Yes       0.80      0.10      0.18        39

    accuracy                           0.88       294
   macro avg       0.84      0.55      0.56       294
weighted avg       0.87      0.88      0.83       294
```