Case Study 2:Employee Performance Prediction

Generate Dummy Data

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
np.random.seed(42)
n = 1500
data = {
    'EmployeeID': np.arange(1, n + 1),
    'Age': np.random.randint(22, 61, size=n),
    'YearsOfExperience': np.random.randint(1, 41, size=n),
    'Gender': np.random.choice(['Male', 'Female'], size=n),
    'PerformanceRating': np.random.randint(1, 6, size=n)
}

df = pd.DataFrame(data)
```

Explore and Inspect the Data

```
print("First 15 rows of the dataset:")
print(df.head(15))

print("\nChecking for missing values:")
print(df.isnull().sum())
```

```
First 15 rows of the dataset:
    EmployeeID  Age  YearsOfExperience  Gender  PerformanceRating
0            1   60                 16    Male                  5
1            2   50                 27  Female                  5
2            3   36                  8  Female                  2
3            4   29                 25  Female                  4
4            5   42                 17  Female                  1
5            6   60                 29    Male                  5
6            7   40                  8    Male                  5
7            8   44                 15    Male                  4
8            9   32                 27    Male                  2
9           10   32                  7    Male                  1
10          11   45                  3  Female                  2
11          12   57                 29    Male                  2
12          13   45                 24  Female                  1
13          14   24                  3    Male                  1
14          15   43                 20    Male                  5
```

```
Checking for missing values:
EmployeeID          0
Age                 0
YearsOfExperience   0
Gender              0
PerformanceRating   0
dtype: int64
```

Handling Missing Data

```
df.loc[np.random.randint(0, n, size=30), 'YearsOfExperience'] = np.nan
print("\nMissing values after introducing some:")
print(df.isnull().sum())
df['YearsOfExperience'].fillna(df['YearsOfExperience'].mean(), inplace=True)
print("\nMissing values after filling:")
print(df.isnull().sum())
```

```
Missing values after introducing some:
EmployeeID           0
Age                  0
YearsOfExperience   29
Gender               0
PerformanceRating    0
dtype: int64

Missing values after filling:
EmployeeID          0
Age                 0
YearsOfExperience   0
Gender              0
PerformanceRating   0
dtype: int64
<ipython-input-3-3eb23038fd38>:8: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perfo


  df['YearsOfExperience'].fillna(df['YearsOfExperience'].mean(), inplace=True)
```

Encoding Categorical Data

```
df['Gender'] = df['Gender'].map({'Male': 0, 'Female': 1})
print("\nAfter encoding 'Gender' column:")
print(df.head())
```

```
After encoding 'Gender' column:
   EmployeeID  Age  YearsOfExperience  Gender  PerformanceRating
0           1   60               16.0       0                  5
1           2   50               27.0       1                  5
2           3   36                8.0       1                  2
3           4   29               25.0       1                  4
4           5   42               17.0       1                  1
```

Outlier Detection

```
plt.boxplot(df['YearsOfExperience'], vert=False)
plt.title('Box Plot of Years of Experience')
plt.show()
outliers = df[df['YearsOfExperience'] > 40]
print("\nOutliers in 'YearsOfExperience':")
print(outliers)

df['YearsOfExperience'] = np.where(df['YearsOfExperience'] > 40, 40, df['YearsOfExperience'])
```


```
Outliers in 'YearsOfExperience':
Empty DataFrame
Columns: [EmployeeID, Age, YearsOfExperience, Gender, PerformanceRating]
Index: []
```

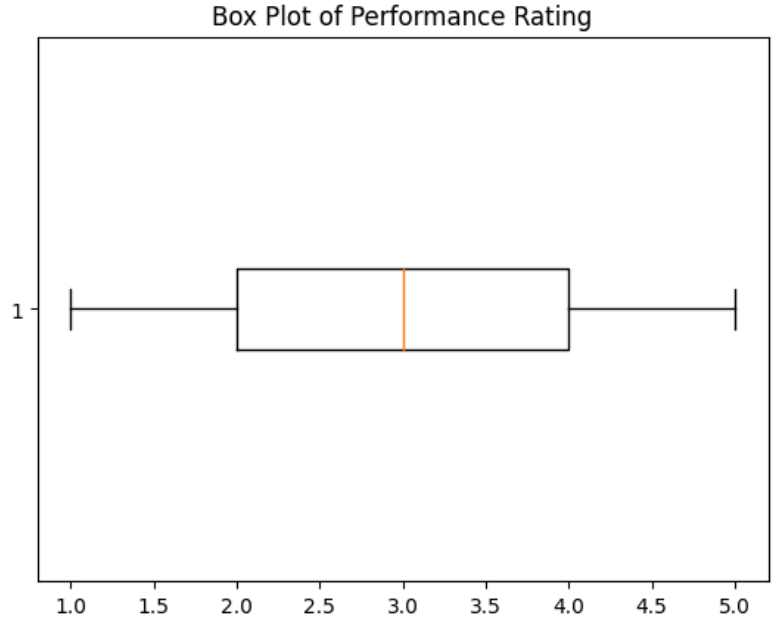
Feature Scaling

```
scaler = StandardScaler()
df[['Age', 'YearsOfExperience']] = scaler.fit_transform(df[['Age', 'YearsOfExperience']])
print("\nAfter feature scaling 'Age' and 'YearsOfExperience':")
print(df.head())
```

```
After feature scaling 'Age' and 'YearsOfExperience':
   EmployeeID       Age  YearsOfExperience  Gender  PerformanceRating
0           1  1.622911          -0.395218       0                  5
1           2  0.743126           0.572405       1                  5
2           3 -0.488574          -1.098943       1                  2
3           4 -1.104424           0.396473       1                  4
4           5  0.039297          -0.307252       1                  1
```

Data Visualization

```
plt.boxplot(df['PerformanceRating'], vert=False)
plt.title('Box Plot of Performance Rating')
plt.show()
plt.scatter(df['YearsOfExperience'], df['PerformanceRating'], alpha=0.5)
plt.title('Years of Experience vs Performance Rating')
plt.xlabel('Years of Experience')
plt.ylabel('Performance Rating')
plt.show()
```



Correlation Analysis

```
print("\nCorrelation Matrix:")
print(df[['Age', 'YearsOfExperience', 'PerformanceRating']].corr())
```

```
Correlation Matrix:
                        Age  YearsOfExperience  PerformanceRating
Age                1.000000          -0.000107           0.009473
YearsOfExperience -0.000107           1.000000          -0.003275
PerformanceRating  0.009473          -0.003275           1.000000
```

Feature Engineering

```
df['ExperiencePerAge'] = df['YearsOfExperience'] / df['Age']
print("\nAfter creating 'ExperiencePerAge':")
print(df.head())
```

```
After creating 'ExperiencePerAge':
   EmployeeID       Age  YearsOfExperience  Gender  PerformanceRating  \
0           1  1.622911          -0.395218       0                  5
1           2  0.743126           0.572405       1                  5
2           3 -0.488574          -1.098943       1                  2
3           4 -1.104424           0.396473       1                  4
4           5  0.039297          -0.307252       1                  1

   ExperiencePerAge
0         -0.243524
1          0.770266
2          2.249285
3         -0.358986
4         -7.818692
```

Prepare Data for Modeling

```
# Step 10: Prepare Data for Modeling
# Dropping irrelevant columns, like 'EmployeeID'
df = df.drop(columns=['EmployeeID'])

# Splitting the data into training and testing sets
X = df.drop('PerformanceRating', axis=1)
y = df['PerformanceRating']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

print("\nShape of training data:", X_train.shape)
print("Shape of testing data:", X_test.shape)
```