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Practical: Data Science Lab

Dataset: Salary dataset

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error,
r2_score

data = pd.read_csv(r"C:\Users\sit.lab4\Downloads\Salary_Data[1].csv")

print("Dataset Preview:")
print(data.head())
```

```
Dataset Preview:
   Years of Experience    Salary
0                  5.0   90000.0
1                  3.0   65000.0
2                 15.0  150000.0
3                  7.0   60000.0
4                 20.0  200000.0
```

```
print("\nDataset Summary:")
print(data.info())
```

```
Dataset Summary:
<class 'pandas.core.frame.DataFrame'>
Index: 6699 entries, 0 to 6703
Data columns (total 2 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   Years of Experience  6699 non-null   float64
 1   Salary               6699 non-null   float64
dtypes: float64(2)
memory usage: 157.0 KB
None
```

```
data.shape
```

```
(6704, 6)
```

```
data.describe()
```

```
                Age  Years of Experience         Salary
count  6702.000000          6701.000000    6699.000000
mean     33.620859             8.094687  115326.964771
std       7.614633             6.059003   52786.183911
min      21.000000             0.000000     350.000000
25%      28.000000             3.000000   70000.000000
50%      32.000000             7.000000  115000.000000
75%      38.000000            12.000000  160000.000000
max      62.000000            34.000000  250000.000000
```

```
print("\nMissing Values:")
print(data.isnull().sum())
```

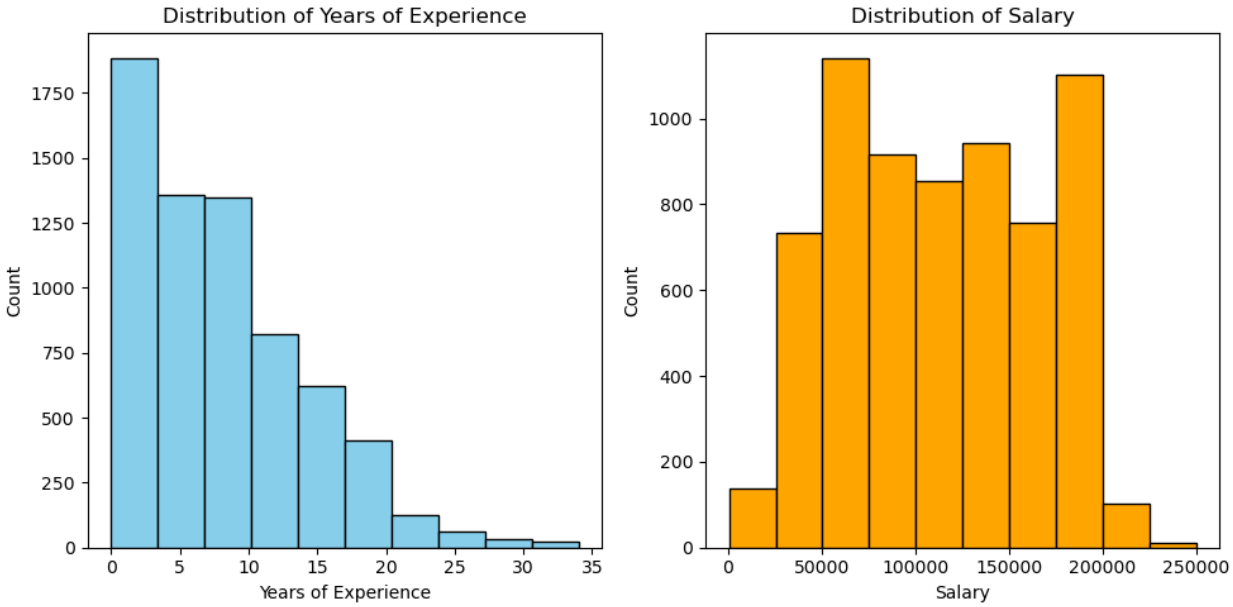
```
Missing Values:
Years of Experience    0
Salary                 0
dtype: int64
```

```
data = data[['Years of Experience', 'Salary']].dropna()
```

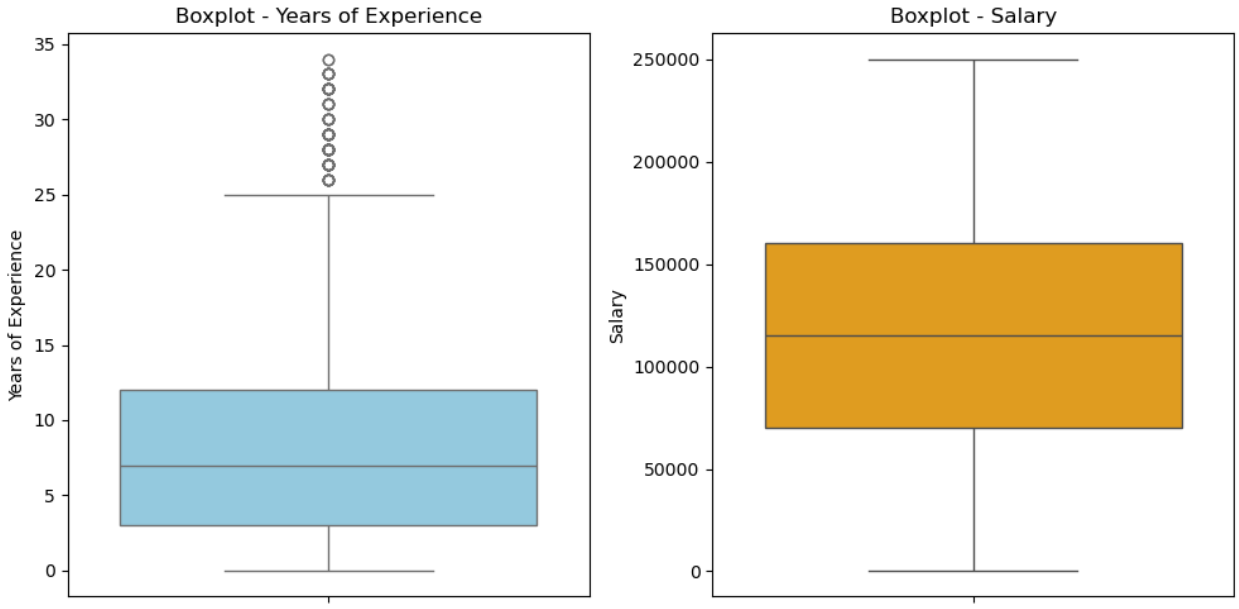
```
# UNIVARIATE ANALYSIS


# Summary statistics
print("\nStatistical Summary:")
print(data.describe())
# Histogram
plt.figure(figsize=(10,5))
plt.subplot(1,2,1)
plt.hist(data['Years of Experience'], bins=10, color='skyblue',
edgecolor='black')
plt.title("Distribution of Years of Experience")
plt.xlabel("Years of Experience")
plt.ylabel("Count")

plt.subplot(1,2,2)
plt.hist(data['Salary'], bins=10, color='orange', edgecolor='black')
plt.title("Distribution of Salary")
plt.xlabel("Salary")
plt.ylabel("Count")
plt.tight_layout()
plt.show()
```

```
===== UNIVARIATE ANALYSIS =====

Statistical Summary:
       Years of Experience         Salary
count          6699.000000    6699.000000
mean              8.095014  115326.964771
```

```
std              6.059853   52786.183911
min              0.000000     350.000000
25%              3.000000   70000.000000
50%              7.000000  115000.000000
75%             12.000000  160000.000000
max             34.000000  250000.000000
```

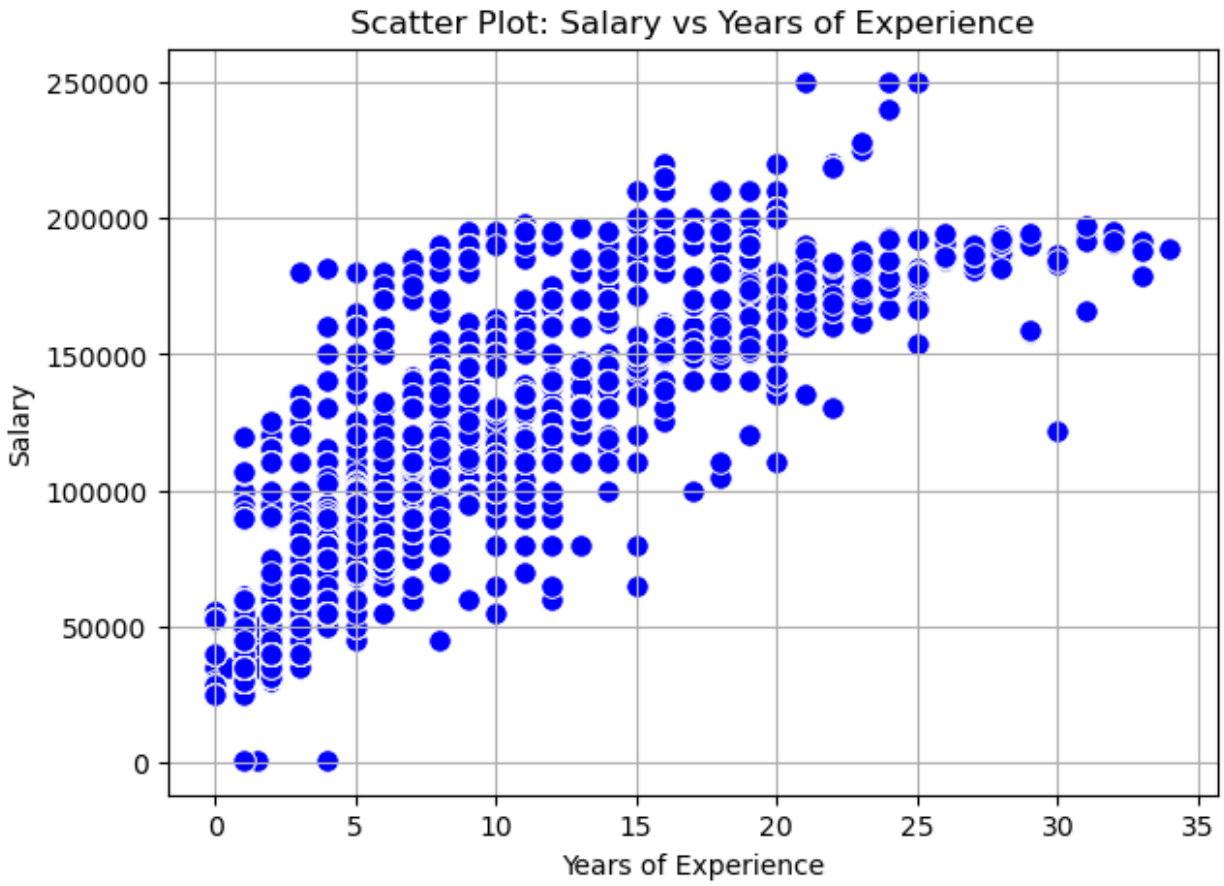



```
# Boxplots for outlier detection
import seaborn as sns
plt.figure(figsize=(10,5))
plt.subplot(1,2,1)
sns.boxplot(y=data['Years of Experience'], color='skyblue')
plt.title("Boxplot - Years of Experience")

plt.subplot(1,2,2)
sns.boxplot(y=data['Salary'], color='orange')
plt.title("Boxplot - Salary")
plt.tight_layout()
plt.show()
```

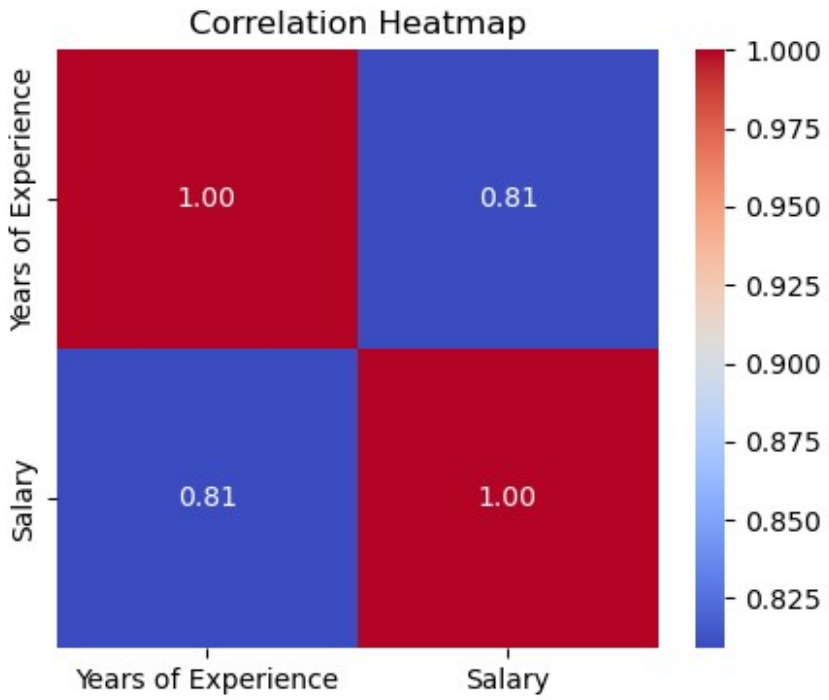



```
# BIVARIATE ANALYSIS

print("\n===== BIVARIATE ANALYSIS =====")

# Scatter plot
plt.figure(figsize=(7,5))
sns.scatterplot(x='Years of Experience', y='Salary', data=data,
color='blue', s=70)
plt.title("Scatter Plot: Salary vs Years of Experience")
plt.xlabel("Years of Experience")
plt.ylabel("Salary")
plt.grid(True)
plt.show()
```

```
===== BIVARIATE ANALYSIS =====
```




```
# Correlation heatmap
plt.figure(figsize=(5,4))
sns.heatmap(data.corr(), annot=True, cmap='coolwarm', fmt=".2f")
plt.title("Correlation Heatmap")
plt.show()
```




```
# Step 6: Split data into training and test sets
X = data[['Years of Experience']]
y = data['Salary']
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

# Step 7: Train the Linear Regression model
model = LinearRegression()
model.fit(X_train, y_train)
```

```
LinearRegression()
```

```
# Step 8: Model coefficients
print("\nIntercept (b0):", model.intercept_)
print("Slope (b1):", model.coef_[0])
```

```
Intercept (b0): 58398.09344836343
Slope (b1): 7042.700439786712
```

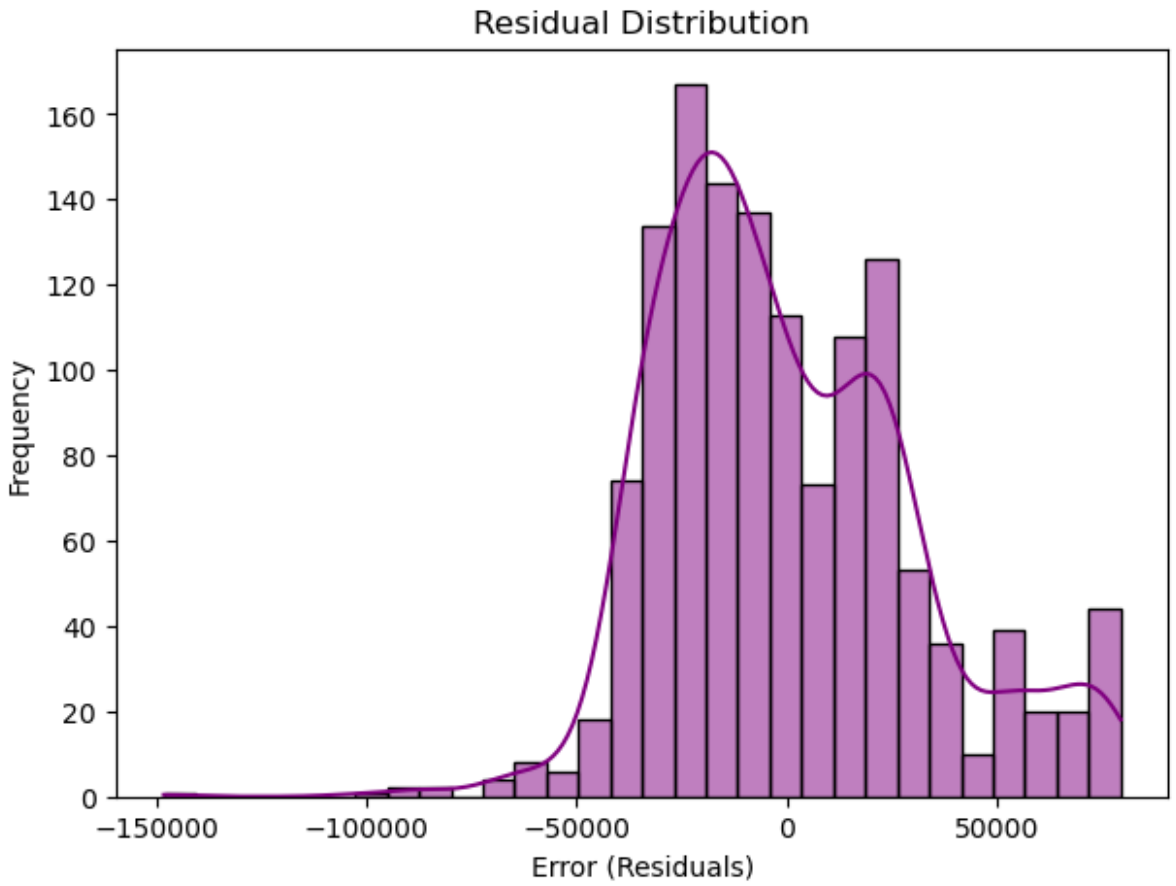
```
# Step 9: Make predictions
y_pred = model.predict(X_test)

# Step 10: Evaluate performance
mae = mean_absolute_error(y_test, y_pred)
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
r2 = r2_score(y_test, y_pred)
```

```
print("\nModel Performance:")
print("Mean Absolute Error (MAE):", mae)
print("Root Mean Squared Error (RMSE):", rmse)
print("R² Score:", r2)
```

```
Model Performance:
Mean Absolute Error (MAE): 24722.101443221924
Root Mean Squared Error (RMSE): 30770.654489455297
R² Score: 0.6669549610495003
```

```
# Step 11: Visualize Regression Line
plt.figure(figsize=(8,6))
plt.scatter(X_train, y_train, color='blue', label='Training Data')
plt.scatter(X_test, y_test, color='green', label='Testing Data')
plt.plot(X_test, y_pred, color='red', linewidth=2, label='Regression
Line')
plt.title("Simple Linear Regression: Salary vs Years of Experience")
plt.xlabel("Years of Experience")
plt.ylabel("Salary")
plt.legend()
plt.grid(True)
plt.show()
```


```
# Residual Plot
residuals = y_test - y_pred
plt.figure(figsize=(7,5))
sns.histplot(residuals, kde=True, color='purple')
plt.title("Residual Distribution")
plt.xlabel("Error (Residuals)")
plt.ylabel("Frequency")
plt.show()
```




```
# Step 12: Predict new value (optional)
exp = float(input("\nEnter Years of Experience to predict Salary: "))
pred_salary = model.predict([[exp]])
print(f"Predicted Salary for {exp} years of experience:
{pred_salary[0]:.2f}")


Enter Years of Experience to predict Salary:  7

Predicted Salary for 7.0 years of experience: 107697.00

C:\ProgramData\anaconda3\Lib\site-packages\sklearn\base.py:493:
UserWarning: X does not have valid feature names, but LinearRegression
was fitted with feature names
  warnings.warn(
```