```
import pandas as pd

df = pd.read_csv('/kaggle/input/iriscsv/Iris.csv')
df.head()
```

```
   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm
Species
0   1            5.1           3.5            1.4           0.2  Iris-
setosa
1   2            4.9           3.0            1.4           0.2  Iris-
setosa
2   3            4.7           3.2            1.3           0.2  Iris-
setosa
3   4            4.6           3.1            1.5           0.2  Iris-
setosa
4   5            5.0           3.6            1.4           0.2  Iris-
setosa
```

```
df.shape
```

```
(150, 6)
```

Data Cleaning

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Id             150 non-null    int64
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

```
df.describe()
```

```
               Id  SepalLengthCm  SepalWidthCm  PetalLengthCm
PetalWidthCm
count  150.000000     150.000000    150.000000     150.000000
150.000000
mean    75.500000       5.843333      3.054000       3.758667
1.198667
std     43.445368       0.828066      0.433594       1.764420
```

```
0.763161
min      1.000000       4.300000      2.000000       1.000000
0.100000
25%     38.250000       5.100000      2.800000       1.600000
0.300000
50%     75.500000       5.800000      3.000000       4.350000
1.300000
75%    112.750000       6.400000      3.300000       5.100000
1.800000
max    150.000000       7.900000      4.400000       6.900000
2.500000
```

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

```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

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

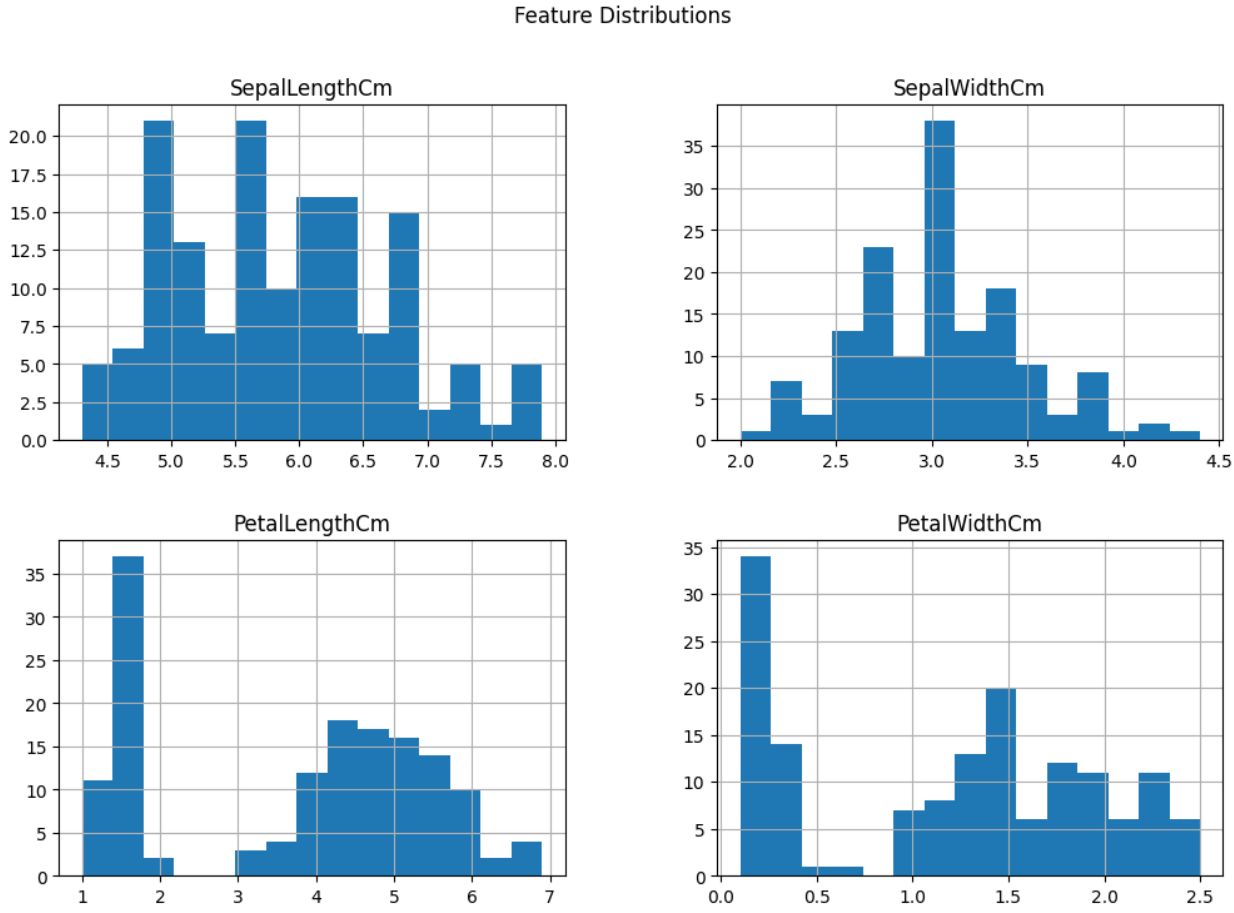
```
df.drop('Id', axis=1, inplace=True)
```

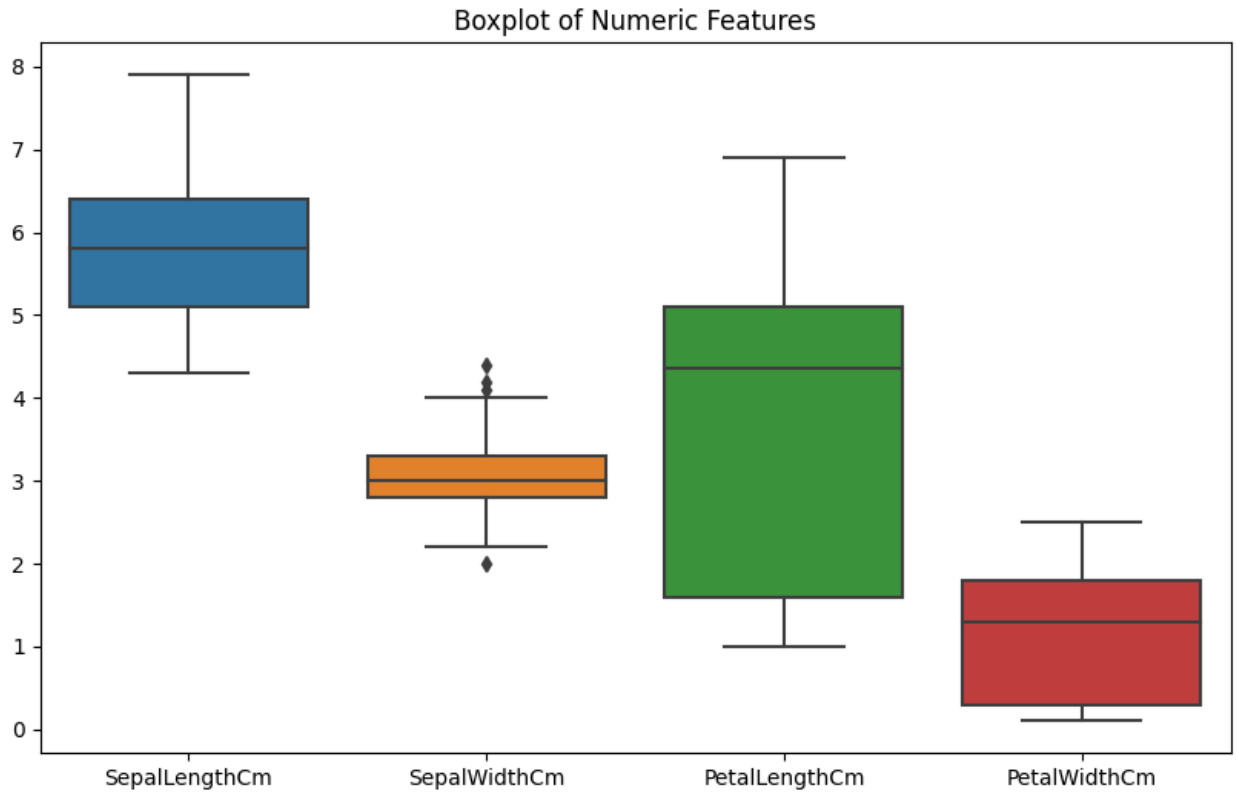
Univariate Analysis

```
import matplotlib.pyplot as plt
import seaborn as sns

# Histograms
df.hist(figsize=(12, 8), bins=15)
plt.suptitle("Feature Distributions")
plt.show()

# Boxplots
plt.figure(figsize=(10, 6))
sns.boxplot(data=df.drop('Species', axis=1))
plt.title('Boxplot of Numeric Features')
plt.show()
```


Feature Distributions
SepalLengthCm
SepalWidthCm
PetalLengthCm
PetalWidthCm



basic statistics

```
df.describe().T[['mean', '50%', 'std', 'min', 'max']]
```

```
                    mean   50%       std  min  max
SepalLengthCm  5.843333  5.80  0.828066  4.3  7.9
SepalWidthCm   3.054000  3.00  0.433594  2.0  4.4
PetalLengthCm  3.758667  4.35  1.764420  1.0  6.9
PetalWidthCm   1.198667  1.30  0.763161  0.1  2.5
```

Bivariate/Multivariate Analysis

```
sns.pairplot(df, hue='Species')
plt.suptitle('Feature Relationships by Species', y=1.02)
plt.show()
```

```
/usr/local/lib/python3.11/dist-packages/seaborn/_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed
in a future version. Convert inf values to NaN before operating
instead.
  with pd.option_context('mode.use_inf_as_na', True):
/usr/local/lib/python3.11/dist-packages/seaborn/_oldcore.py:1075:
```

```
FutureWarning: When grouping with a length-1 list-like, you will need
to pass a length-1 tuple to get_group in a future version of pandas.
Pass `(name,)` instead of `name` to silence this warning.
  data_subset = grouped_data.get_group(pd_key)
/usr/local/lib/python3.11/dist-packages/seaborn/_oldcore.py:1075:
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```

```
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Pass `(name,)` instead of `name` to silence this warning.
  data_subset = grouped_data.get_group(pd_key)
/usr/local/lib/python3.11/dist-packages/seaborn/axisgrid.py:118:
UserWarning: The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```
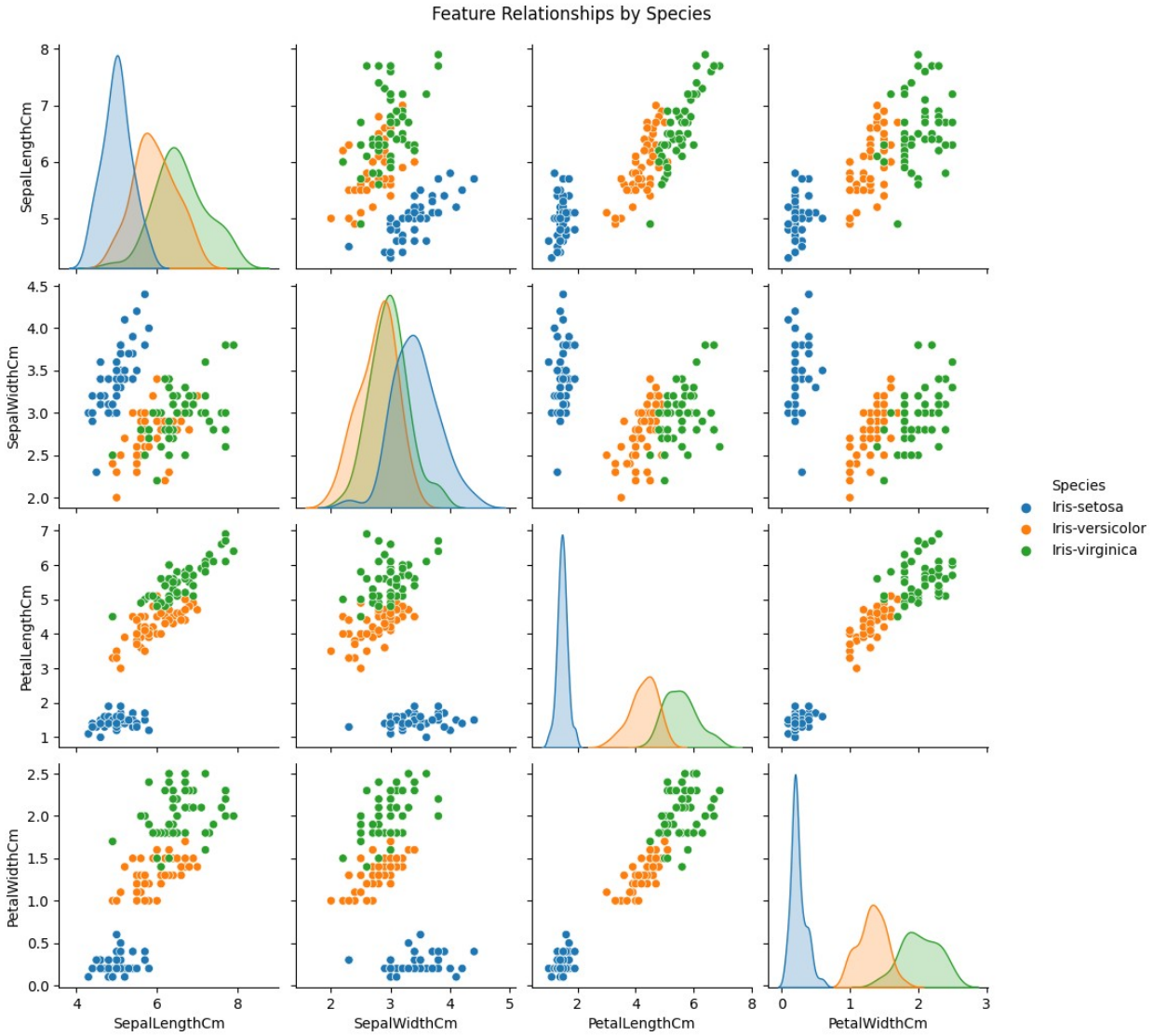
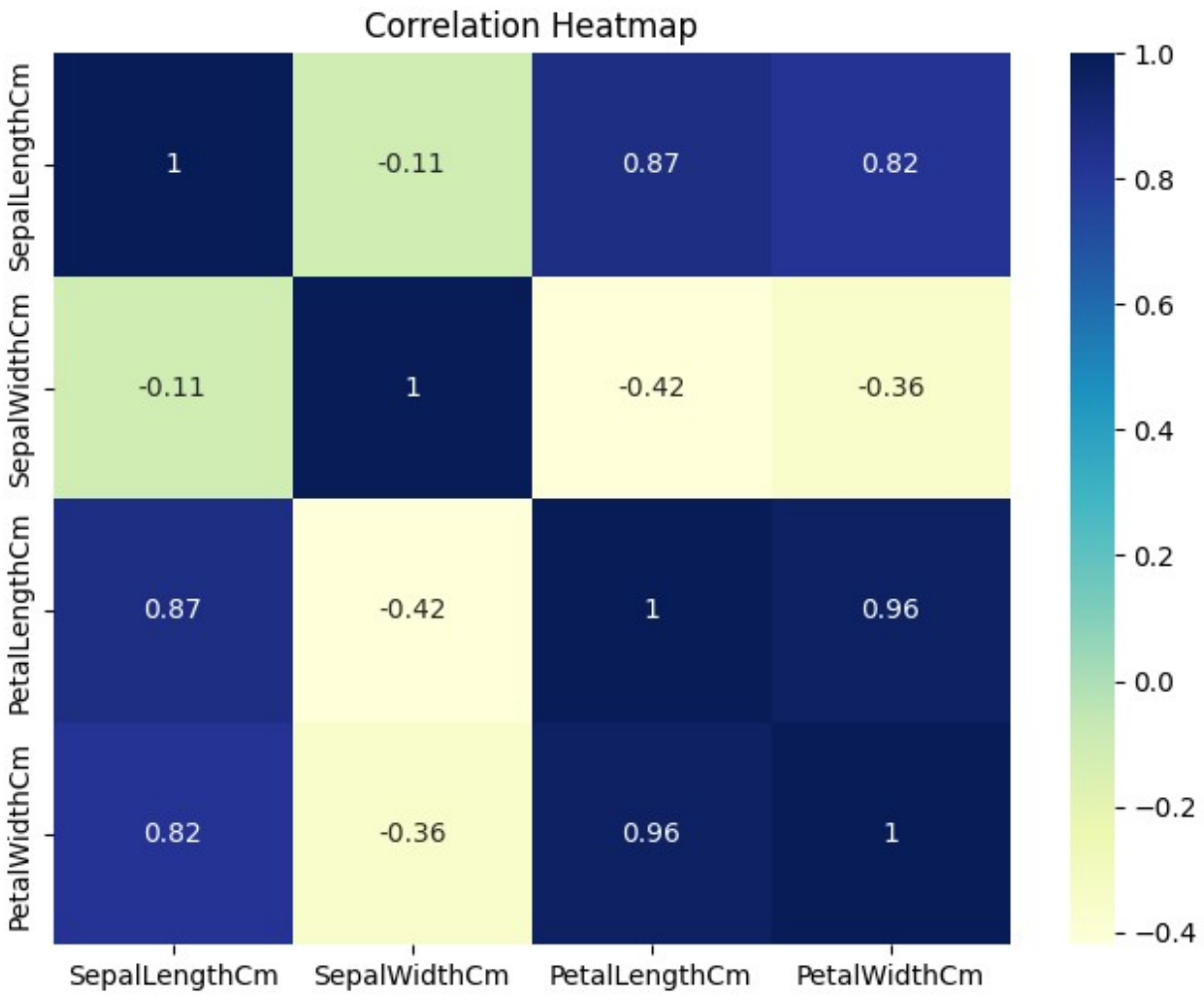
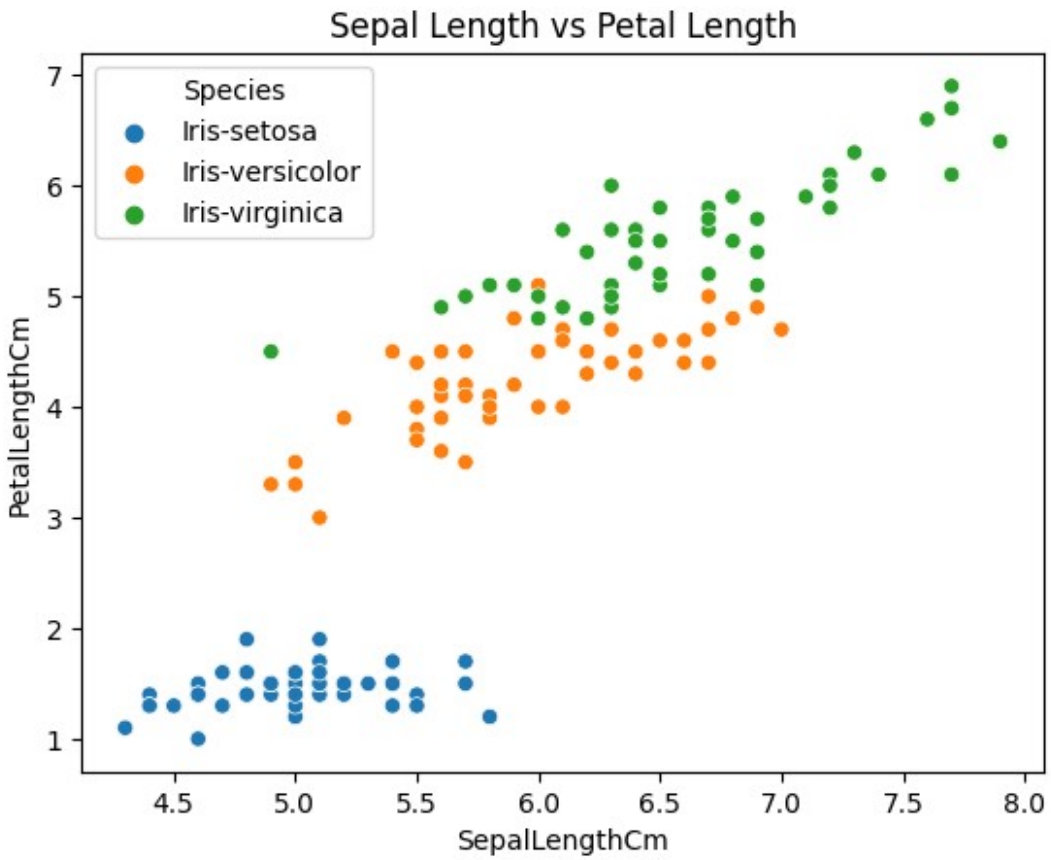




```
plt.figure(figsize=(8, 6))
sns.heatmap(df.drop('Species', axis=1).corr(), annot=True,
cmap='YlGnBu')
plt.title('Correlation Heatmap')
plt.show()
```




```
sns.scatterplot(x='SepalLengthCm', y='PetalLengthCm', hue='Species',
data=df)
plt.title('Sepal Length vs Petal Length')
plt.show()
```


Sepal Length vs Petal Length
Species
Iris-setosa
Iris-versicolor
Iris-virginica
PetalLengthCm
SepalLengthCm
1
2
3
4
5
6
7
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0

Summary

🔍 Insights from EDA

No missing or duplicate rows were found.

Petal features (length & width) are highly effective at separating species.

Setosa is clearly separable; Virginica and Versicolor have some overlap.

PetalLengthCm`and`PetalWidthCm` show strong correlation.

Sepal features are less informative than petal features for classification.

🎁 Bonus: Interactive Widgets

```
!pip install ipywidgets
```

```
Requirement already satisfied: ipywidgets in
/usr/local/lib/python3.11/dist-packages (8.1.5)
Requirement already satisfied: comm>=0.1.3 in
/usr/local/lib/python3.11/dist-packages (from ipywidgets) (0.2.2)
Requirement already satisfied: ipython>=6.1.0 in
/usr/local/lib/python3.11/dist-packages (from ipywidgets) (7.34.0)
Requirement already satisfied: traitlets>=4.3.1 in
/usr/local/lib/python3.11/dist-packages (from ipywidgets) (5.7.1)
Requirement already satisfied: widgetsnbextension~=4.0.12 in
/usr/local/lib/python3.11/dist-packages (from ipywidgets) (4.0.14)
Requirement already satisfied: jupyterlab-widgets~=3.0.12 in
/usr/local/lib/python3.11/dist-packages (from ipywidgets) (3.0.15)
Requirement already satisfied: setuptools>=18.5 in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (75.2.0)
Requirement already satisfied: jedi>=0.16 in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (0.19.2)
Requirement already satisfied: decorator in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (4.4.2)
Requirement already satisfied: pickleshare in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (0.7.5)
Requirement already satisfied: prompt-toolkit!=3.0.0,!
```

```
=3.0.1,<3.1.0,>=2.0.0 in /usr/local/lib/python3.11/dist-packages (from
ipython>=6.1.0->ipywidgets) (3.0.51)
Requirement already satisfied: pygments in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (2.19.2)
Requirement already satisfied: backcall in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (0.2.0)
Requirement already satisfied: matplotlib-inline in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (0.1.7)
Requirement already satisfied: pexpect>4.3 in
/usr/local/lib/python3.11/dist-packages (from ipython>=6.1.0-
>ipywidgets) (4.9.0)
Requirement already satisfied: parso<0.9.0,>=0.8.4 in
/usr/local/lib/python3.11/dist-packages (from jedi>=0.16-
>ipython>=6.1.0->ipywidgets) (0.8.4)
Requirement already satisfied: ptyprocess>=0.5 in
/usr/local/lib/python3.11/dist-packages (from pexpect>4.3-
>ipython>=6.1.0->ipywidgets) (0.7.0)
Requirement already satisfied: wcwidth in
/usr/local/lib/python3.11/dist-packages (from prompt-toolkit!=3.0.0,!
=3.0.1,<3.1.0,>=2.0.0->ipython>=6.1.0->ipywidgets) (0.2.13)

jupyter nbextension enable --py widgetsnbextension

import ipywidgets as widgets
from IPython.display import display

feature_dropdown = widgets.Dropdown(
    options=['SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm',
'PetalWidthCm'],
    value='SepalLengthCm',
    description='Feature:',
)

bins_slider = widgets.IntSlider(
    value=10,
    min=5,
    max=30,
    step=1,
    description='Bins:',
)

def plot_histogram(feature, bins):
    plt.figure(figsize=(8, 5))
    sns.histplot(df[feature], bins=bins, kde=True)
    plt.title(f'Distribution of {feature} with {bins} Bins')
    plt.xlabel(feature)
    plt.ylabel('Frequency')
```

```
    plt.show()

interactive_hist = widgets.interactive(plot_histogram,
feature=feature_dropdown, bins=bins_slider)
display(interactive_hist)
```

{"model_id":"286076a55d59466fb8fdf3cd7aaad75e","version_major":2,"version_minor":0}

```
species_dropdown = widgets.Dropdown(
    options=df['Species'].unique(),
    value='Iris-setosa',
    description='Species:',
)

def plot_box(species):
    subset = df[df['Species'] == species]
    plt.figure(figsize=(10, 5))
    sns.boxplot(data=subset.drop('Species', axis=1))
    plt.title(f'Boxplot of Features for {species}')
    plt.show()

interactive_box = widgets.interactive(plot_box,
species=species_dropdown)
display(interactive_box)
```

{"model_id":"738b2b64989a4e9481abcc0dbc0fa6ad","version_major":2,"version_minor":0}

```
x_axis = widgets.Dropdown(
    options=['SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm',
'PetalWidthCm'],
    value='SepalLengthCm',
    description='X-axis:',
)

y_axis = widgets.Dropdown(
    options=['SepalLengthCm', 'SepalWidthCm', 'PetalLengthCm',
'PetalWidthCm'],
    value='PetalLengthCm',
    description='Y-axis:',
)

def plot_scatter(x, y):
    plt.figure(figsize=(8, 5))
    sns.scatterplot(x=x, y=y, hue='Species', data=df)
    plt.title(f'{x} vs {y}')
    plt.xlabel(x)
    plt.ylabel(y)
    plt.show()
```

```
interactive_scatter = widgets.interactive(plot_scatter, x=x_axis,
y=y_axis)
display(interactive_scatter)
```

{"model_id":"5bb5b7143be74c5bb61b7e6c7fd008fc","version_major":2,"vers
ion_minor":0}

Summary

Bonus: Interactive Widgets

Users can explore feature distributions by selecting features and bin sizes.

Filtered boxplots help in analyzing per-species feature ranges.

Scatter plot axes are customizable to study relationships.