Histograms, Legends, Colors, and Subplots in Matplotlib

1. Histograms

A histogram is a graphical representation of the distribution of numerical data, where the data is divided into bins (intervals) and the frequency of data in each bin is displayed.

Syntax for a Histogram

plt.hist(data, bins, color, label, edgecolor, alpha)

- **data**: The data to be plotted.
- **bins**: The number of intervals for dividing the data.
- **color**: Sets the color of the bars.
- **label**: Adds a label for the legend.
- **edgecolor**: Sets the color of the bin edges.
- **alpha**: Controls the transparency of the bars (value between 0 and 1).

2. Legends

Legends describe the content of the plot. Each plot element with a label is added to the legend.

3. Colors

You can customize colors for plots using:

- Named colors: "blue", "red", etc.
- RGB or hex codes: "#FF5733".
- Predefined colormaps: cmap="viridis".

4. Subplots

Subplots allow you to create multiple plots within a single figure.

Example Program

```
import matplotlib.pyplot as plt
import numpy as np
```

```
# Generate random data
data1 = np.random.normal(50, 10, 500) # Data with mean=50, std=10
data2 = np.random.normal(60, 15, 500) # Data with mean=60, std=15

# Create a figure with subplots
fig, axes = plt.subplots(1, 2, figsize=(12, 6))

# Plot Histogram 1
axes[0].hist(data1, bins=15, color='skyblue', edgecolor='black', alpha=0.7, label='Data1
Distribution')
axes[0].set_title("Histogram of Data1")
axes[0].set_xlabel("Value")
axes[0].set_ylabel("Frequency")
axes[0].legend()

# Plot Histogram 2
axes[1].hist(data2, bins=15, color='orange', edgecolor='black', alpha=0.7, label='Data2
Distribution')
axes[1].set_title("Histogram of Data2")
axes[1].set_xlabel("Value")
axes[1].set_ylabel("Frequency")
axes[1].legend()

# Adjust layout and display the plot
plt.tight_layout()
plt.show()
```

Data Generation:

- **np.random.normal(mean, std, size)**: Generates normally distributed random data.
    - data1: Mean = 50, Standard Deviation = 10, 500 data points.
    - data2: Mean = 60, Standard Deviation = 15, 500 data points.

Subplots:

- **fig, axes = plt.subplots(1, 2, figsize=(12, 6))**:
    - Creates a single row (1) with two columns (2) of plots.
    - figsize=(12, 6): Sets the overall figure size to 12x6 inches.

Histogram for Data1:

- **axes[0].hist()**:
    - Plots data1 in the first subplot.
    - bins=15: Divides data into 15 intervals.

o color='skyblue': Sets the bar color.
o edgecolor='black': Sets the edges of the bars to black.
o alpha=0.7: Makes the bars slightly transparent.
o label='Data1 Distribution': Adds a label for the legend.

Histogram for Data2:

- **axes[1].hist**():
  o Similar parameters as axes[0].hist(), but plots data2 in the second subplot.
  o Uses a different color (orange) for visual distinction.

Legends:

- **axes[0].legend**() and **axes[1].legend**():
  o Displays the legend for each histogram.
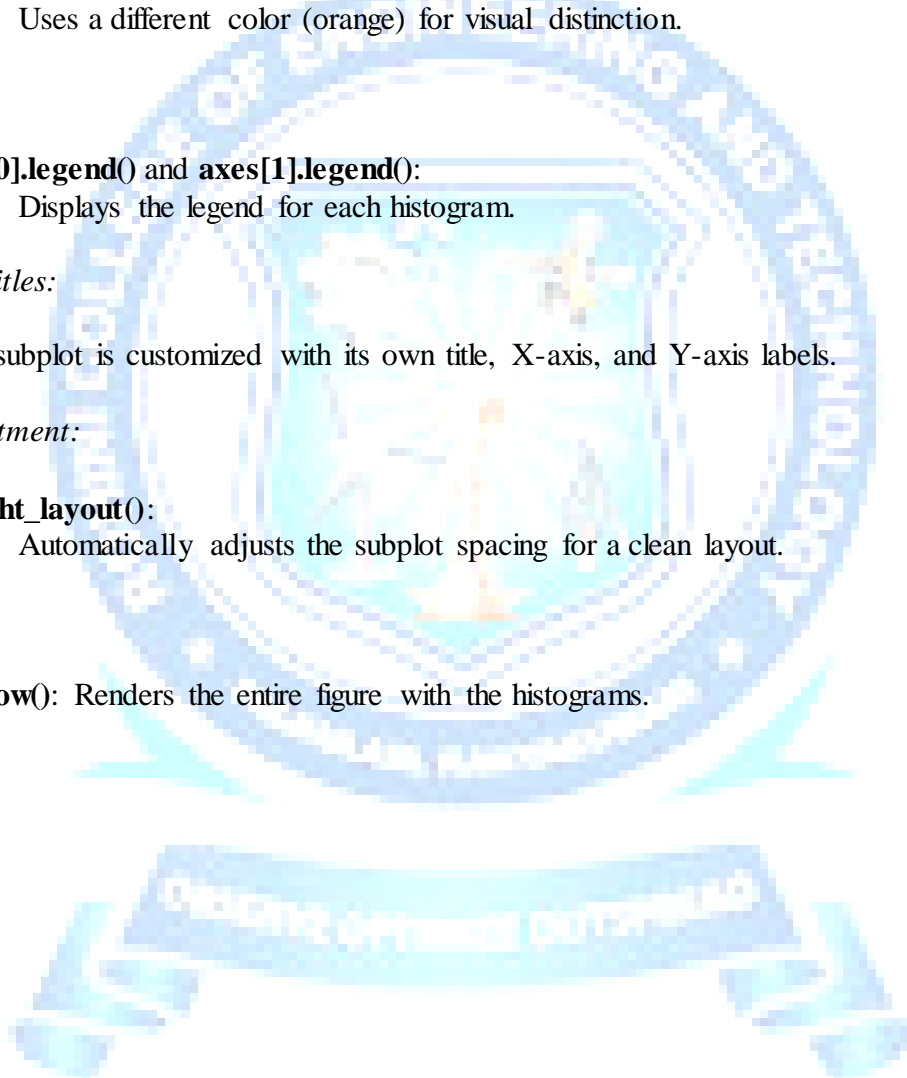
Labels and Titles:

- Each subplot is customized with its own title, X-axis, and Y-axis labels.
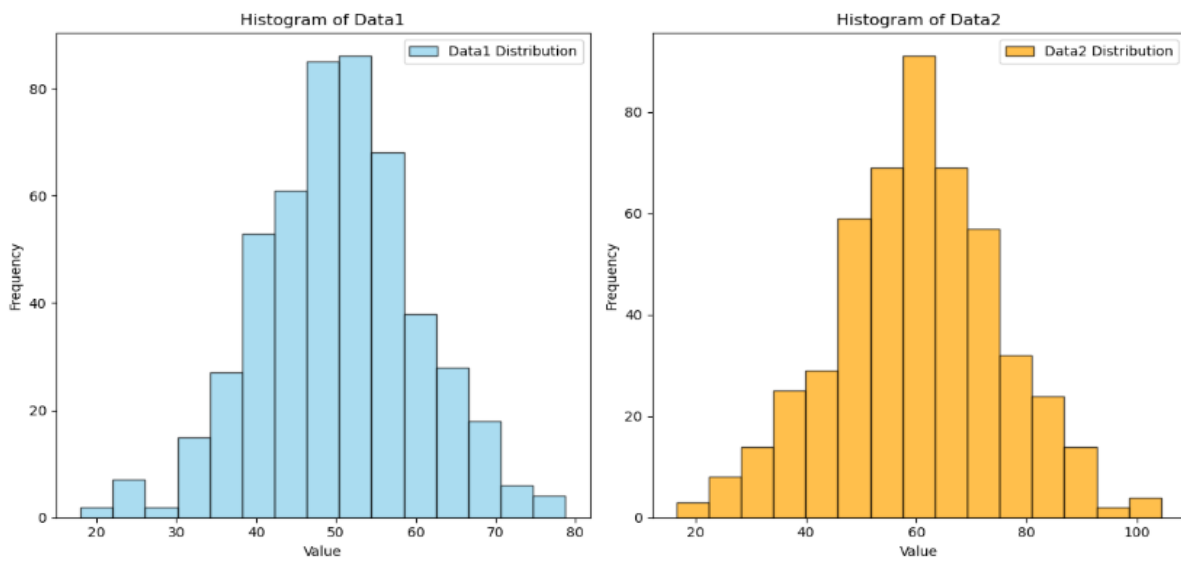
Layout Adjustment:

- **plt.tight_layout**():
  o Automatically adjusts the subplot spacing for a clean layout.

Plot Display:

- **plt.show**(): Renders the entire figure with the histograms.

Output

1. **Subplot 1**: A histogram of data1 with blue bars.
2. **Subplot 2**: A histogram of data2 with orange bars.
3. Both subplots have legends, axis labels, and titles.