Infoys Springboard

Skill Match Resume Matcher and Skill Recommender

Milestone 1
Batch 4

Submitted By
V.GNANENDHIRAN

ARTIFICIAL INTELLIGENCE

Introduction:

- ➢ Jhon McCarthy first coined the term Artificial Intelligence in the year 1956.
- ➢ Artificial Intelligence (AI) as a field was first introduced in 1956 at the Dartmouth Conference.

What is Artificial Intelligence?

Artificial Intelligence (AI) means making computers or machines smart enough to do tasks that normally need human intelligence.
It helps machines to think, learn, and make decisions like humans.

Examples of AI:

- **Google Assistant / Siri / Alexa** → Answering questions, playing music.
- **Netflix / YouTube** → Suggesting movies and videos.
- **Self-driving Cars** → Cars that can drive on their own. Ex: Tesla
- **Healthcare** → AI predicting diseases.
- **Chatbots** → Talking to customers on websites.

Programming Languages Used in AI

1. **Python** – Most popular, easy to learn, used for machine learning and deep learning.
2. **R** – Used for data analysis and statistics.
3. **Java** – Used in big applications like chatbots and banking systems.
4. **C++** – Used in games and fast AI programs.

How AI is used in technology?

AI is used in many technologies around us to make systems smarter and more efficient. It helps in automation, decision-making, prediction, and personalization.

Examples: Smartphones, Social-Media, Healthcare, Transportation, Banking and Finance, E-commerce and entertainment.

MACHINE LEARNING

- Arthur Samuel first coined the term in Machine Learning in the year 1959.

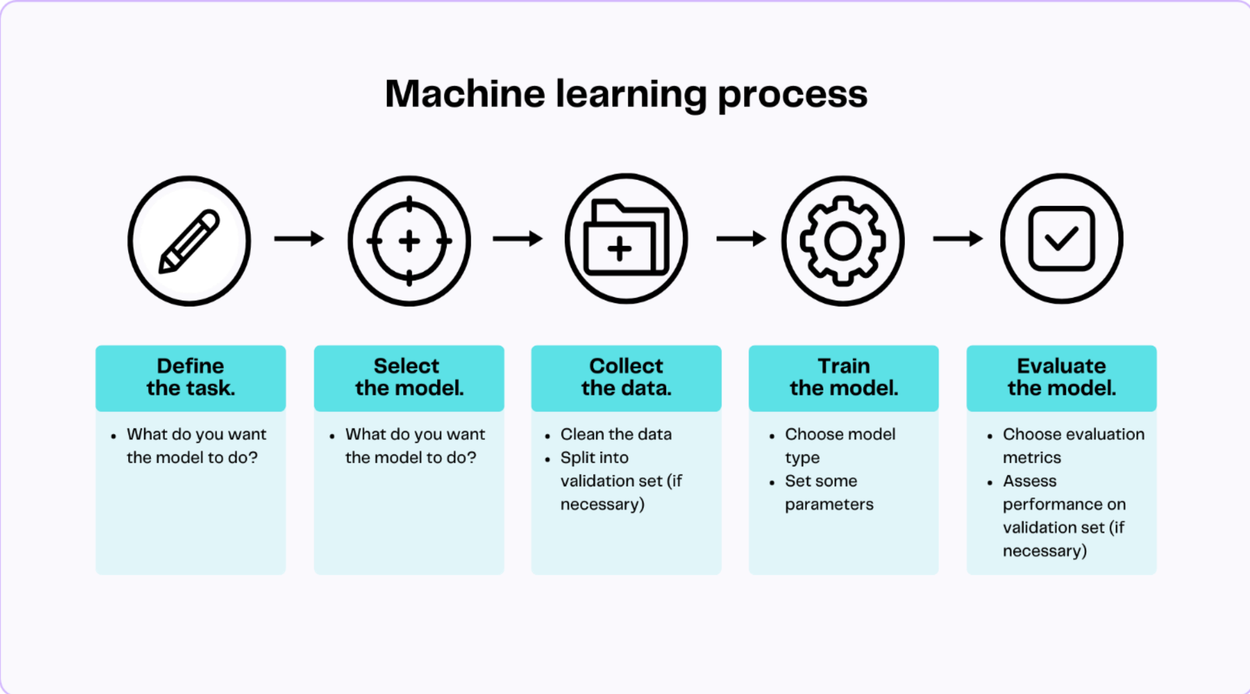
What is Machine Learning?

Machine Learning (ML) is a part of Artificial Intelligence (AI) that allows computers to learn from data and improve their performance without being directly programmed.

Example: Just like humans learn from experience, machines learn from data.

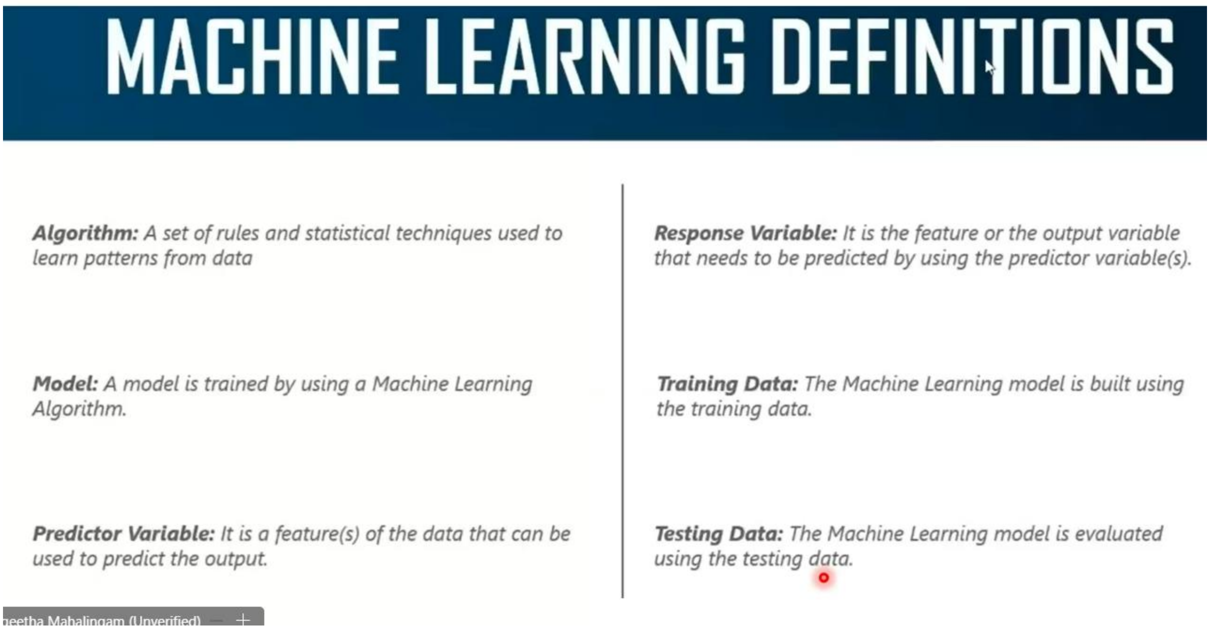
Machine Learning Process:

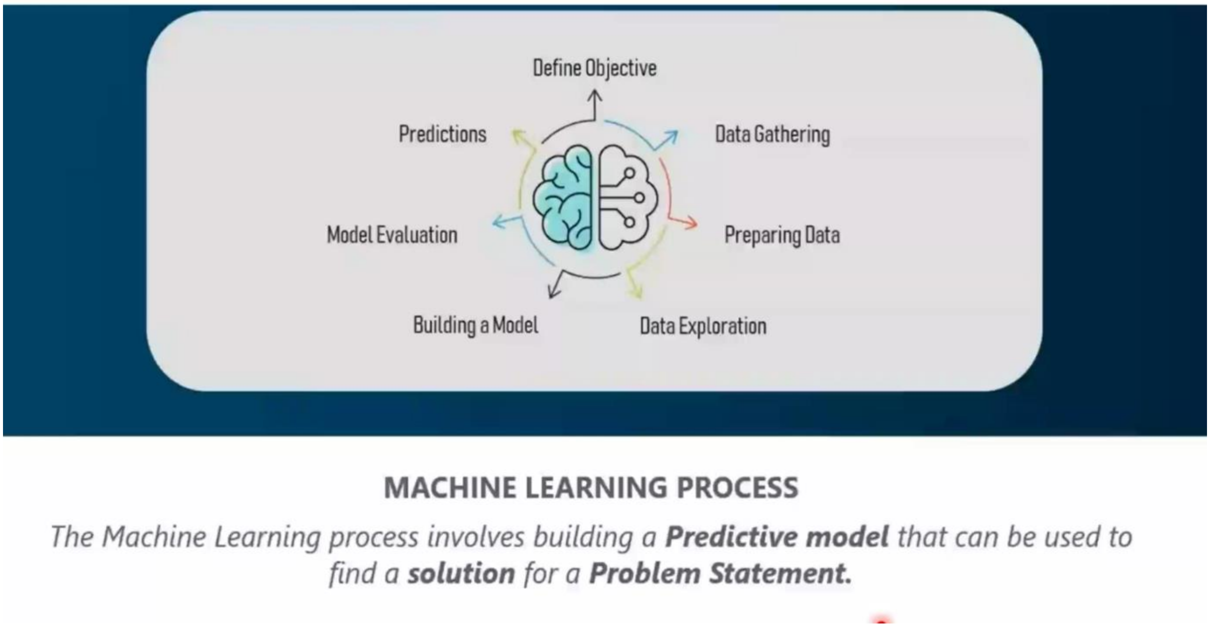
The ML process involves building a predictive model that can be used to find a solution for a problem statement.



1. **Define Objective**
   - Identify the problem you want to solve.
   - Example: Predict student marks, forecast sales, detect spam, etc.
2. **Data Gathering**
   - Collect relevant data from sources (databases, files, sensors, etc).
3. **Preparing Data**
   - Clean the data (handle missing values, duplicates, errors).
   - Transform into suitable format for analysis.
4. **Data Exploration**
   - Analyse patterns, relationships, and insights in the data.
   - Use statistical tools and visualization.
5. **Building a Model**

   - Choose a machine learning algorithm (e.g., regression, decision tree, neural networks).
   - Train the model on the prepared dataset.
6. **Model Evaluation**
   - Test the model using metrics like accuracy, precision, recall, etc.
   - Compare with baseline or other models.
7. **Predictions**
   - Deploy the trained model to make predictions on new data.
   - Continuously monitor and update the model for better performance.





<u>NUMPY</u>

Definition:

→NumPy (Numerical Python) is a Python library used for working with numbers and arrays.

→It helps in doing mathematical, statistical, and scientific calculations quickly and easily.

Practical tasks:

```python
#Numpy arrays

#list
list_1 = [1,2,3,4,5]
print(list_1)
type(list_1)
```

```
[1, 2, 3, 4, 5]
```

```
list
```

```python
np_array = np.array([1,2,3,4,5])
print(np_array)
type(np_array)
```

```
[1 2 3 4 5]
```

```
numpy.ndarray
```

```python
#creating a one dimensional array
a = np.array([1,2,3,4])
print(a)
```

```
[1 2 3 4]
```

```python
import numpy as np
n1=np.array([10,20,30,40,50,60])
n2=np.array([50,60,70,80,90])
print(np.intersect1d(n1,n2))
print(np.setdiff1d(n1,n2))
print(np.setdiff1d(n2,n1))
```

```
[50 60]
[10 20 30 40]
[70 80 90]
```

```python
a.shape #shape represents no of rows and columns in a particular array
```

```
(4,)
```

```python
b = np.array([(1,2,3,4),(5,6,7,8)])
print(b)
```

```
[[1 2 3 4]
 [5 6 7 8]]
```

```python
b.shape
```

```
(2, 4)
```

```python
c = np.array([(1,2,3,4),(5,6,7,8)],dtype = float)
print(c)
```

```
[[1. 2. 3. 4.]
 [5. 6. 7. 8.]]
```

- np.vstack() → stacks arrays vertically (row-wise)

```python
# Horizontal stack
print(np.hstack((n1, n2)))
```

```
[10 20 30 40 50 60]
```

```python
print(np.column_stack((n1, n2))) # Column-wise stack
```

```
[[10 40]
 [20 50]
 [30 60]]
```

```python
import numpy as np

n1 = np.random.randint(1, 100, 5)
print(n1)
```

[3] ✓ 0.0s Python

```
[64 92 93 92 89]
```

```python
import numpy as np

n1 = np.array([[1, 2, 3], [4, 5, 6]])
print(n1.shape)
```

[4] ✓ 0.0s Python

```
(2, 3)
```

```python
import numpy as np

n1 = np.array([10, 20, 30])
n2 = np.array([40, 50, 60])
# Vertical stack
print(np.vstack((n1, n2)))
```

[5] ✓ 0.0s Python

```
[[10 20 30]
 [40 50 60]]
```

- np.hstack() → stacks arrays horizontally (column-wise)
- np.column_stack() → stacks arrays as columns side by side

```python
#reshaping a array
a = np.random.randint(0,10,(2,3))
print(a)
print(a.shape)
```

[35] Python

```
[[7 5 1]
 [9 6 6]]
(2, 3)
```

```python
b = a.reshape(3,2)
print(b)
print(b.shape)
```

[36] Python

```
[[7 5]
 [1 9]
 [6 6]]
(3, 2)
```

```python
import numpy as np

arr = np.array([[1, 2, 3], [4, 5, 6]])
print("Array:\n", arr)
print("Dimensions (ndim):", arr.ndim)
print("Shape:", arr.shape)
```

[15] ✓ 0.0s Python

```
Array:
 [[1 2 3]
 [4 5 6]]
Dimensions (ndim): 2
Shape: (2, 3)
```

- n1
  → A 3×3 2D array.
- n1[0]
  → First row (index 0) = [1 2 3].
- n1[:,1]
  → All rows (:) but only the 2nd column (1) → [2 5 8].

- n1.transpose()

  → Swaps rows ↔ columns.

Original rows → become columns

Original columns → become rows

```python
import numpy as np

n1 = np.array([[1,2,3],[4,5,6],[7,8,9]])
print(n1)
print(n1[0])
```

[8] ✓ 0.0s Python

```
[[1 2 3]
 [4 5 6]
 [7 8 9]]
[1 2 3]
```

```python
print(n1[:,1])
```

[10] ✓ 0.0s Python

```
[2 5 8]
```

```python
print(n1.transpose())
```

[11] ✓ 0.0s Python

```
[[1 4 7]
 [2 5 8]
 [3 6 9]]
```

```python
import numpy as np

# Create two arrays
a = np.array([10, 20, 30])
b = np.array([1, 2, 3])

print("Addition:", a + b)          # or np.add(a, b)

print("Subtraction:", a - b)       # or np.subtract(a, b)

print("Multiplication:", a * b)    # or np.multiply(a, b)

print("Division:", a / b)          # or np.divide(a, b)

print("Power:", a ** b)            # or np.power(a, b)

print("Modulus:", a % b)           # or np.mod(a, b)
```

[14] ✓ 0.0s Python

```
Addition: [11 22 33]
Subtraction: [ 9 18 27]
Multiplication: [10 40 90]
Division: [10. 10. 10.]
Power: [   10   400 27000]
Modulus: [0 0 0]
```

- n1.shape
  → (2, 3) means 2 rows and 3 columns.
- np.mean(n2)
  → Average = (10 + 20 + 30 + 60) / 4 = 30.0
- np.std(n2) (Standard Deviation)
  → Measures how spread out the numbers are ≈ 18.71
- np.median(n2)
  → Middle value when sorted = [10, 20, 30, 60] → middle between 20 and 30 → 25.0

```python
import numpy as np

n1 = np.array([[1, 2, 3], [4, 5, 6]])
print(n1.shape)

n2 = np.array([10, 20, 30, 60])
print(np.mean(n2))
print(np.std(n2))
print(np.median(n2))
```

[12] ✓ 0.0s Python

```
(2, 3)
30.0
18.708286933869708
25.0
```

```python
# Matrix Multiplication
n1 = np.array([[1, 2], [3, 4], [5, 6]])    # Shape: (3, 2)
n2 = np.array([[7, 8, 9], [10, 11, 12]])   # Shape: (2, 3)

print(n1.dot(n2))
```

[13] ✓ 0.0s Python

```
[[ 27  30  33]
 [ 61  68  75]
 [ 95 106 117]]
```

PANDAS

→Pandas is a Python library used for data analysis and data manipulation.

Practical Tasks:

```python
import pandas as pd
s1 = pd.Series([1, 2, 4, 5])
print(s1)
```

[16] ✓ 17.2s Python

```
0    1
1    2
2    4
3    5
dtype: int64
```

```python
s2 = pd.Series([6, 7, 9, 2], index=['a', 'b', 'c', 'd'])
print(s2)
```

[17] ✓ 0.0s Python

```
a    6
b    7
c    9
d    2
dtype: int64
```

```python
import pandas as pd

n1 = pd.Series({'a': 10, 'b': 20, 'c': 30})
print(n1)
```

[18] ✓ 0.0s Python

```
a    10
b    20
c    30
dtype: int64
```

- pd.Series({key: value}) → creates a Series from a dictionary.
- The keys become the index labels (a, b, c)

- The values become the data (10, 20, 30).

```python
import pandas as pd

n1 = pd.Series({'a': 10, 'b': 20, 'c': 30}, index=['d', 'c', 'a'])
print(n1)
```

[19] ✓ 0.0s Python

```
d     NaN
c    30.0
a    10.0
dtype: float64
```

- Pandas tries to match it with the dictionary keys:
    - 'c' → found → value 30
    - 'a' → found → value 10
    - 'd' → not found → NaN

->The output dtype becomes float64 because of the NaN.

```python
print(s1.iloc[-1])    # Output: 5
print(s1[-1:])        # Output: Series containing last element
```

[25] ✓ 0.0s Python

```
5
3    5
dtype: int64
```

```python
import pandas as pd

s1 = pd.Series([1, 2, 4, 5])
s2 = pd.Series([6, 7, 9, 2], index=['a', 'b', 'c', 'd'])

# First 3 elements
print(s1[:3])
```

3] ✓ 0.0s Python

```
0    1
1    2
2    4
dtype: int64
```

```python
# Last 2 elements
print(s1[-2:])

# Last element
print(s1.iloc[-1])    # prints single value
print(s1[-1:])        # prints as a Series
```

4] ✓ 0.0s Python

```
2    4
3    5
dtype: int64
5
3    5
dtype: int64
```

```python
import pandas as pd

# Create a DataFrame
data = {'Name': ['Arun', 'Anbu', 'Bala'],
        'Age': [25, 30, 35],
        'City': ['Delhi', 'Mumbai', 'Bangalore']}

df = pd.DataFrame(data)

# Display DataFrame
print(df)

# Select 'Age' column
print(df['Age'])

# Compute average age
print(df['Age'].mean())
```

] ✓ 0.0s Python

```
   Name  Age       City
0  Arun   25      Delhi
1  Anbu   30     Mumbai
2  Bala   35  Bangalore
0    25
1    30
2    35
Name: Age, dtype: int64
30.0
```

```python
import pandas as pd

ds = pd.read_csv('Iris.csv')
ds.head()
```

] ✓ 0.0s Python

	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

```python
ds.tail()
```

] ✓ 0.0s Python

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
145	146	6.7	3.0	5.2	2.3	Iris-virginica
146	147	6.3	2.5	5.0	1.9	Iris-virginica
147	148	6.5	3.0	5.2	2.0	Iris-virginica
148	149	6.2	3.4	5.4	2.3	Iris-virginica
149	150	5.9	3.0	5.1	1.8	Iris-virginica

```python
ds.head(2)
```

[35] ✓ 0.0s Python

...

	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

```python
ds.tail(3)
```

[36] ✓ 0.0s Python

...

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
147	148	6.5	3.0	5.2	2.0	Iris-virginica
148	149	6.2	3.4	5.4	2.3	Iris-virginica
149	150	5.9	3.0	5.1	1.8	Iris-virginica

```python
ds.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

```python
ds.shape
```

```
(150, 6)
```

Summary Table

Function	Purpose
read_csv()	Load CSV file into a DataFrame
head(n)	Show first *n* rows (default 5)
tail(n)	Show last *n* rows (default 5)
shape	Get number of rows and columns
describe()	Get summary statistics of numeric columns

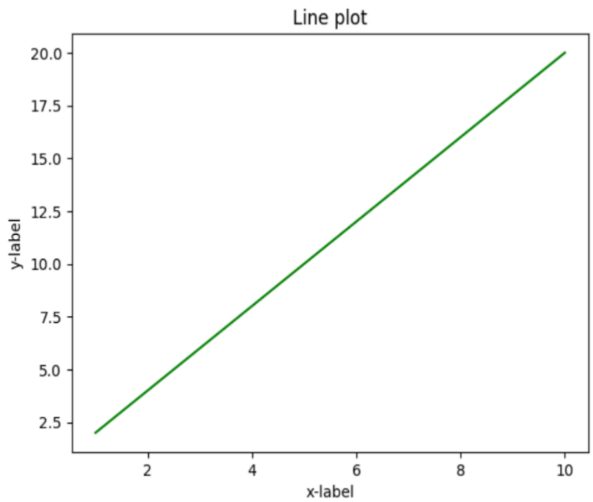
MATPLOTLIB

→Matplotlib is a Python library used for creating graphs, plots, and charts.

→It helps to visualize data in different forms like line charts, bar graphs, pie charts, scatter plots, etc.

Practical Tasks:

```python
import numpy as np
import matplotlib.pyplot as plt
x = np.arange(1,11)
y = 2 * x
plt.plot(x,y,color = 'g')
plt.title("Line plot")
plt.xlabel("x-label")
plt.ylabel("y-label")
plt.show()
```



```python
import numpy as np
#Adding two lines in the same plot
x = np.arange(1,11)
y1= 2 * x
y2 = 3 * x
x
```

[21] ✓ 0.0s Python

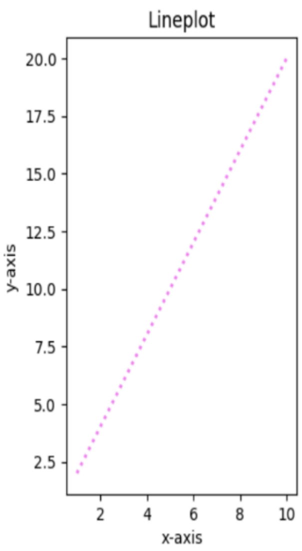
```
array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10])
```

```python

#Adding the subplot
plt.subplot(1,2,1)
plt.plot(x,y1,color='violet',linestyle=':',linewidth = 2)
plt.title('Lineplot')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
```

[22] ✓ 0.0s Python

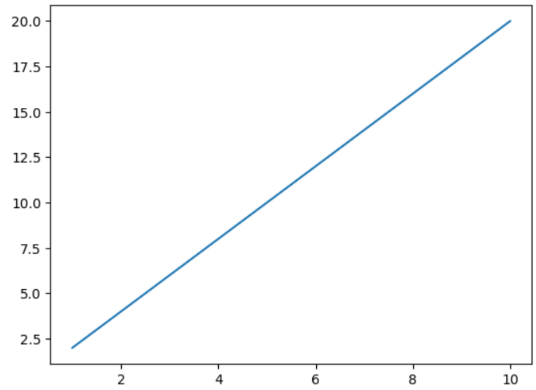
```
Text(0, 0.5, 'y-axis')
```



```python
import numpy as np
from matplotlib import pyplot as plt
# Create an array from 1 to 10
x = np.arange(1, 11)
print(x)
y = 2 * x
print(y)
plt.plot(x, y)
plt.show()
```

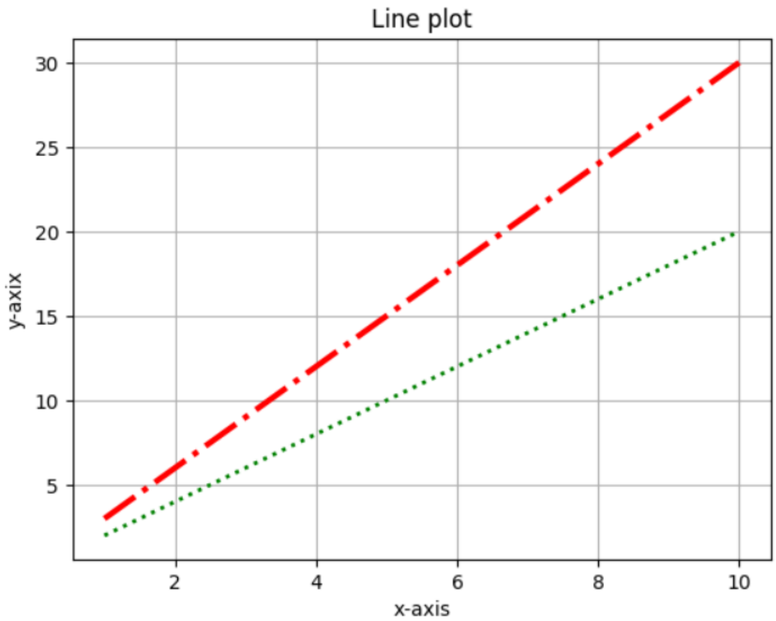
[2] ✓ 0.0s Python

```
[ 1  2  3  4  5  6  7  8  9 10]
[ 2  4  6  8 10 12 14 16 18 20]
```

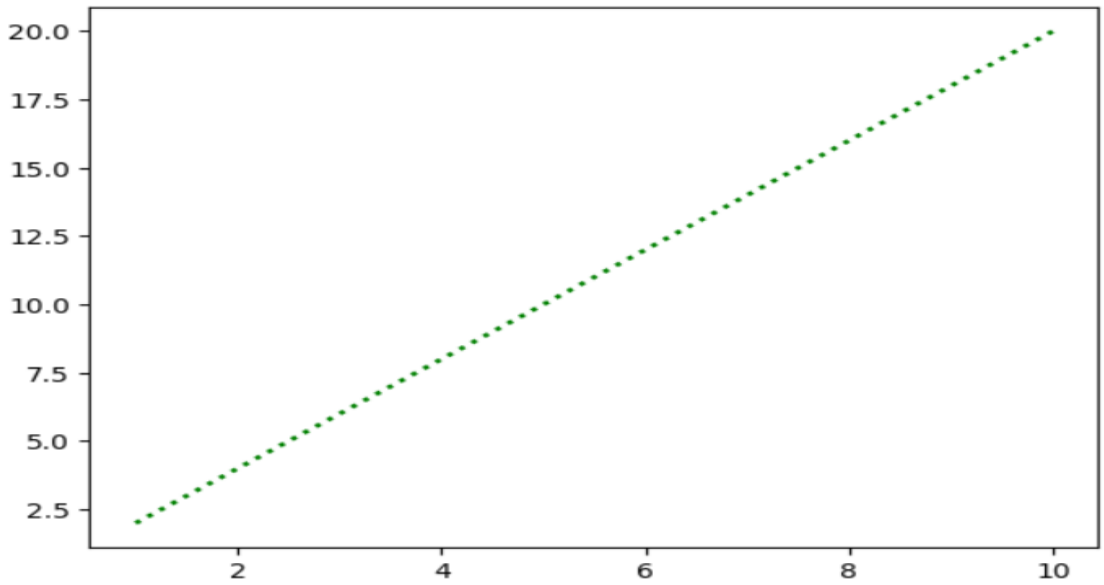



```python
x=np.arange(1,11)
y1=2*x
y2=3*x
plt.plot(x,y1,color='g',linestyle=':',linewidth=2)
plt.plot(x,y2,color='r',linestyle='-.',linewidth=3)
plt.title("Line plot")
plt.xlabel("x-axis")
plt.ylabel("y-axix")
plt.grid(True)
plt.show()
```

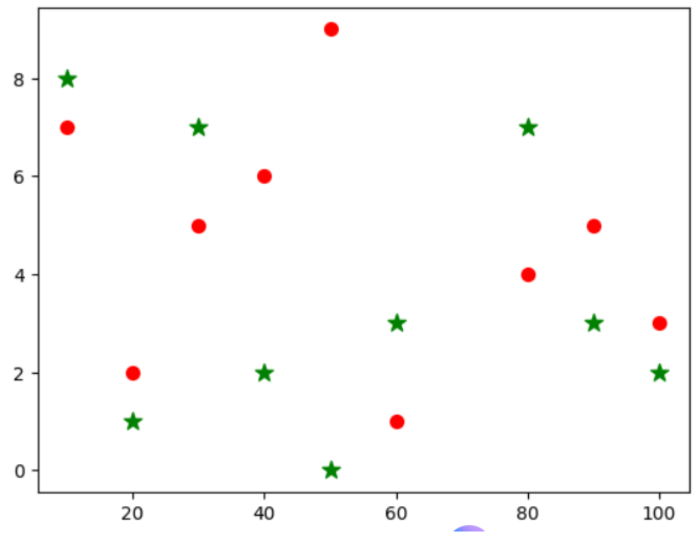
[5] ✓ 0.1s Python



```python
plt.plot(x,y,color='g',linestyle=':',linewidth=2)
plt.show()
```

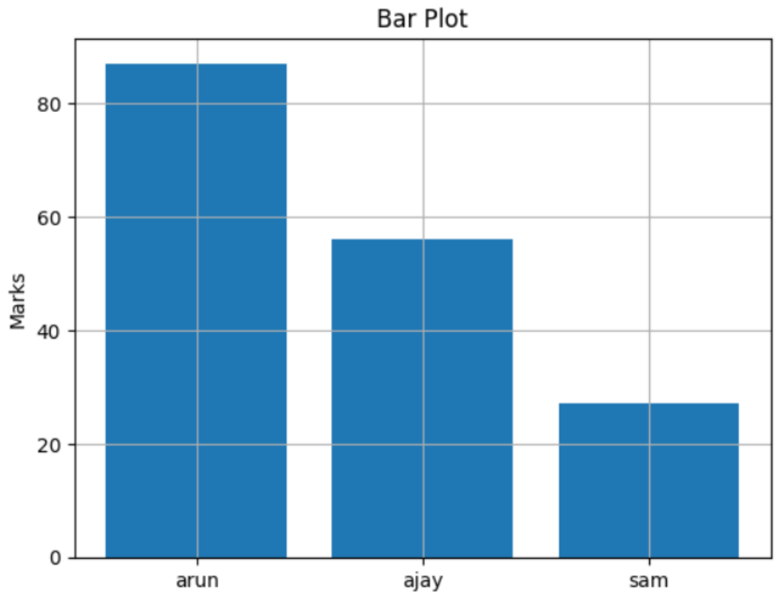



```python
import matplotlib.pyplot as plt
a = [8, 1, 7, 2, 0, 3, 7, 3, 2]
x = [10, 20, 30, 40, 50, 60, 80, 90, 100]
b = [7,2,5,6,9,1,4,5,3]
plt.scatter(x, a, marker="*", c="g", s=100)
plt.scatter(x,b,marker=".",c="r",s=200)
plt.show()
```



```python
from matplotlib import pyplot as plt
student = {"arun": 87, "ajay": 56, "sam": 27}
# Extract names and marks
names = list(student.keys())
values = list(student.values())
plt.bar(names, values)
plt.title("Bar Plot")
plt.xlabel("Names")
plt.ylabel("Marks")
plt.grid(True)
plt.show()
```

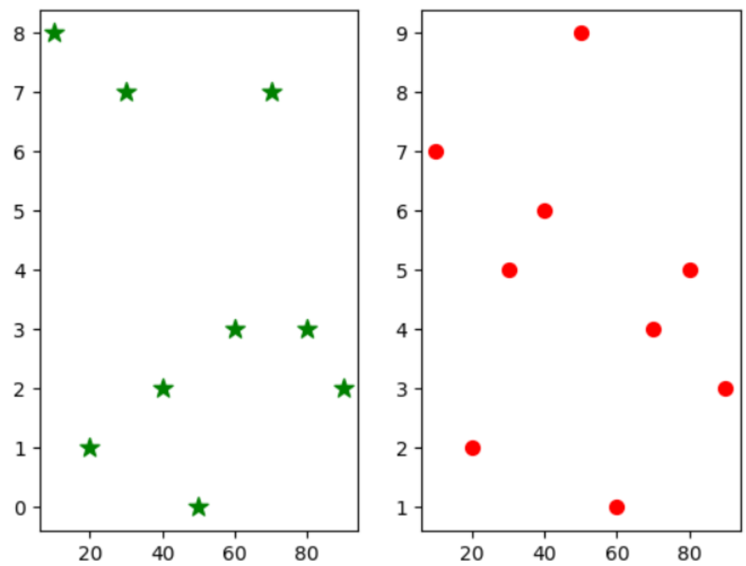
[3] ✓ 0.0s Python



- student → dictionary with names as keys and marks as values.
- list(student.keys()) → converts names to a list → ['arun', 'ajay', 'sam'].
- list(student.values()) → converts marks to a list → [87, 56, 27].
- plt.bar(names, values) → draws vertical bars for each student.
- plt.barh(names,values) →draws horizontal bars for students.
- plt.show() → displays the chart.
- plt.bar(names, values) → plots bars for each student.
- plt.title() → adds a heading on top.
- plt.xlabel() and plt.ylabel() → label the axes.

- plt.grid(True) → shows grid lines for better readability.

```python
x=[10,20,30,40,50,60,70,80,90]
a=[8,1,7,2,0,3,7,3,2]
b=[7,2,5,6,9,1,4,5,3]
plt.subplot(1,2,1)
plt.scatter(x,a,marker="*",c="g",s=100)
plt.subplot(1,2,2)
plt.scatter(x,b,marker=".",c="r",s=200)
plt.show()
```

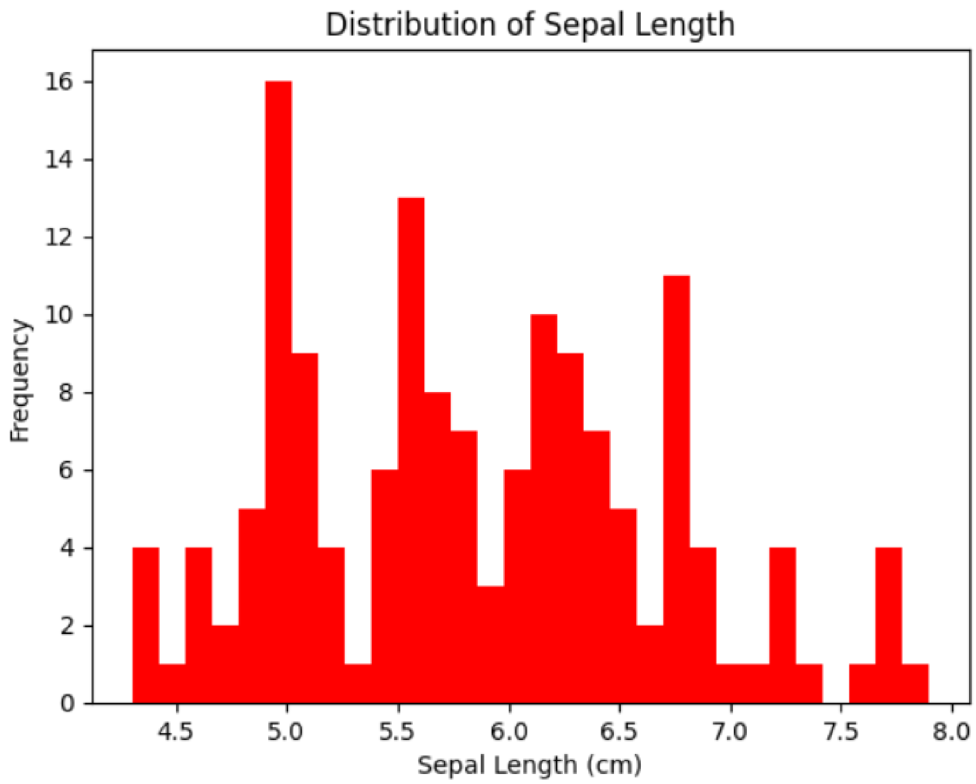


- plt.subplot(1, 2, 1) → means **1 row, 2 columns**, first plot on the **left**.
- plt.subplot(1, 2, 2) → second plot on the **right**.
- plt.scatter() → creates a scatter plot.
- marker, c, and s → control **shape**, **color**, and **size** of points.

```python
iris = pd.read_csv('iris.csv')
print(iris.head(2))
plt.hist(iris['SepalLengthCm'], bins=30, color="r")
plt.title("Distribution of Sepal Length")
plt.xlabel("Sepal Length (cm)")
plt.ylabel("Frequency")
plt.show()
```

[16] ✓ 0.1s Python

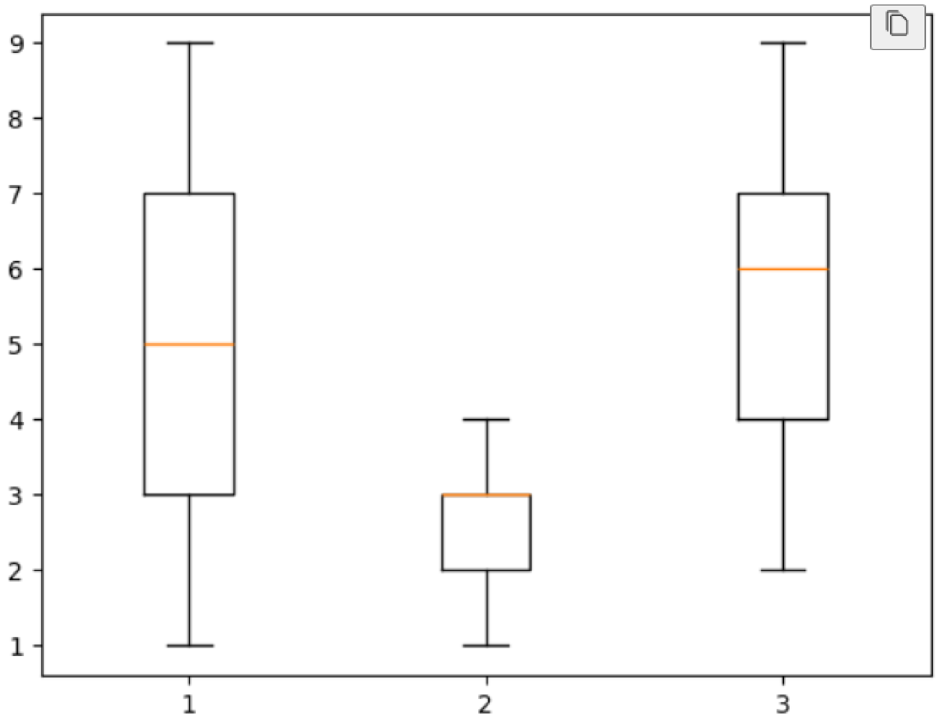
```
   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm      Species
0   1            5.1           3.5            1.4           0.2  Iris-setosa
1   2            4.9           3.0            1.4           0.2  Iris-setosa
```



- iris['Sepal.Length'] → selects the column for Sepal Length.
- plt.hist(..., bins=30) → divides data into 30 intervals to show the frequency distribution.

```python
a=[1,2,3,4,5,6,7,8,9]
b=[1,2,3,4,2,3,4,2,3]
c=[2,4,7,2,6,7,8,9,5]
data=list([a,b,c])
plt.boxplot(data)
plt.show()
```

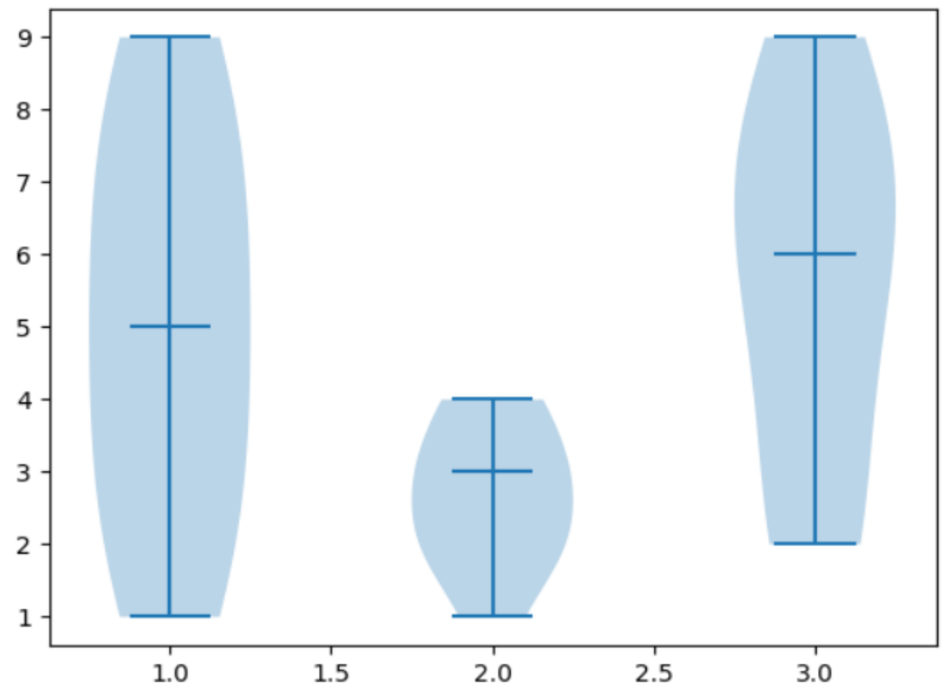
[7] ✓ 0.0s Python



- violin plot(data) → draws a violin plot showing the data’s distribution and density
- data → list of lists (each list is one dataset)
- Show medians=True → displays a horizontal line for the median inside each violin.
- The plot shows how spread out and concentrated each dataset’s values are
- A boxplot (or box-and-whisker plot) shows how data is distributed.

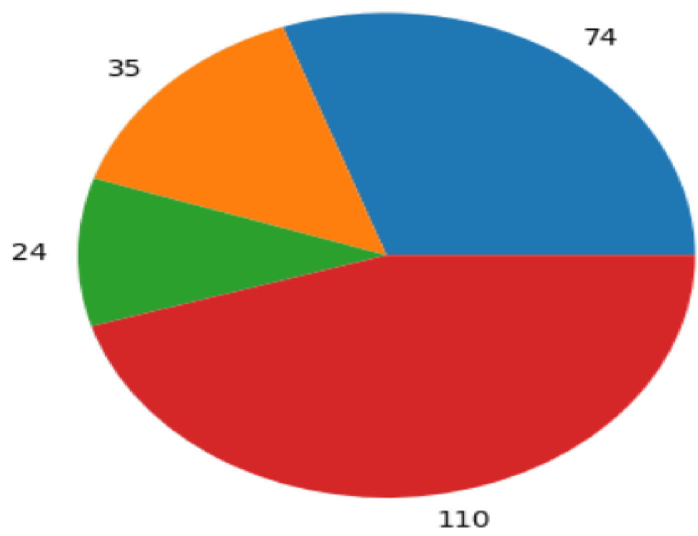
```python
data=list([a,b,c])
plt.violinplot(data,showmedians=True)
plt.show()
```

18] ✓ 0.1s Python



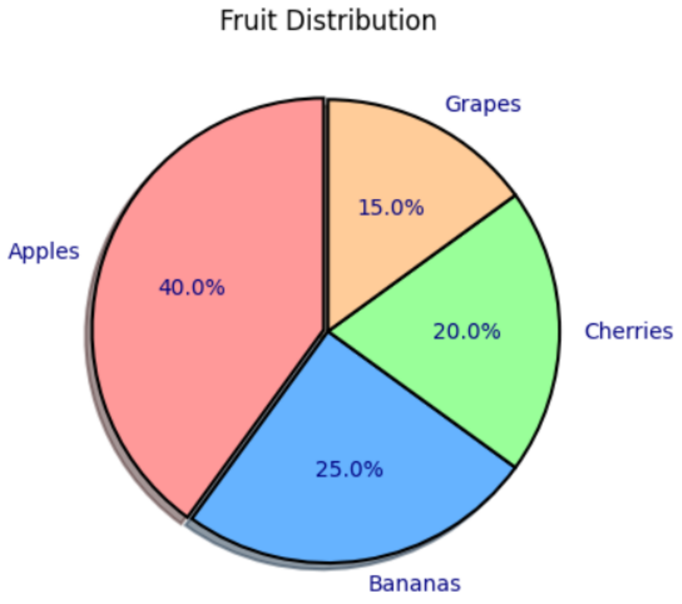

```python
f=['apple','orange','mango','guava']
quanity=[74,35,24,110]
plt.pie(quanity,labels=quanity)
plt.show()
```

.9] ✓ 0.0s Python



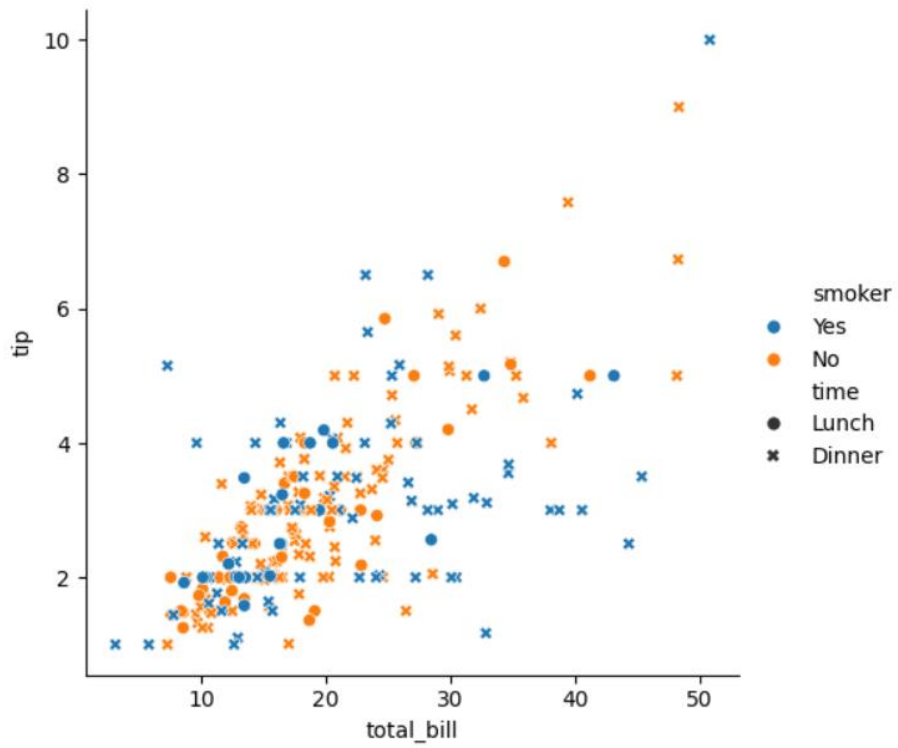
```python
f = ['Apples', 'Bananas', 'Cherries', 'Grapes']
quantity = [40, 25, 20, 15]
colors = ['#ff9999','#66b3ff','#99ff99','#ffcc99']
plt.pie(
    quantity,labels=f,colors=colors,
    autopct='%0.1f%%',
    explode=[0.02, 0, 0, 0], shadow=True,
    startangle=90,
    textprops={'fontsize':10, 'color':'navy'},
    wedgeprops={'edgecolor':'black', 'linewidth':1.5}
)
plt.title('Fruit Distribution')
plt.show()
```

2] ✓ 0.0s Python



```python
sns.relplot(data=ds, x='total_bill', y='tip', hue='smoker', style='time')
plt.show()
```

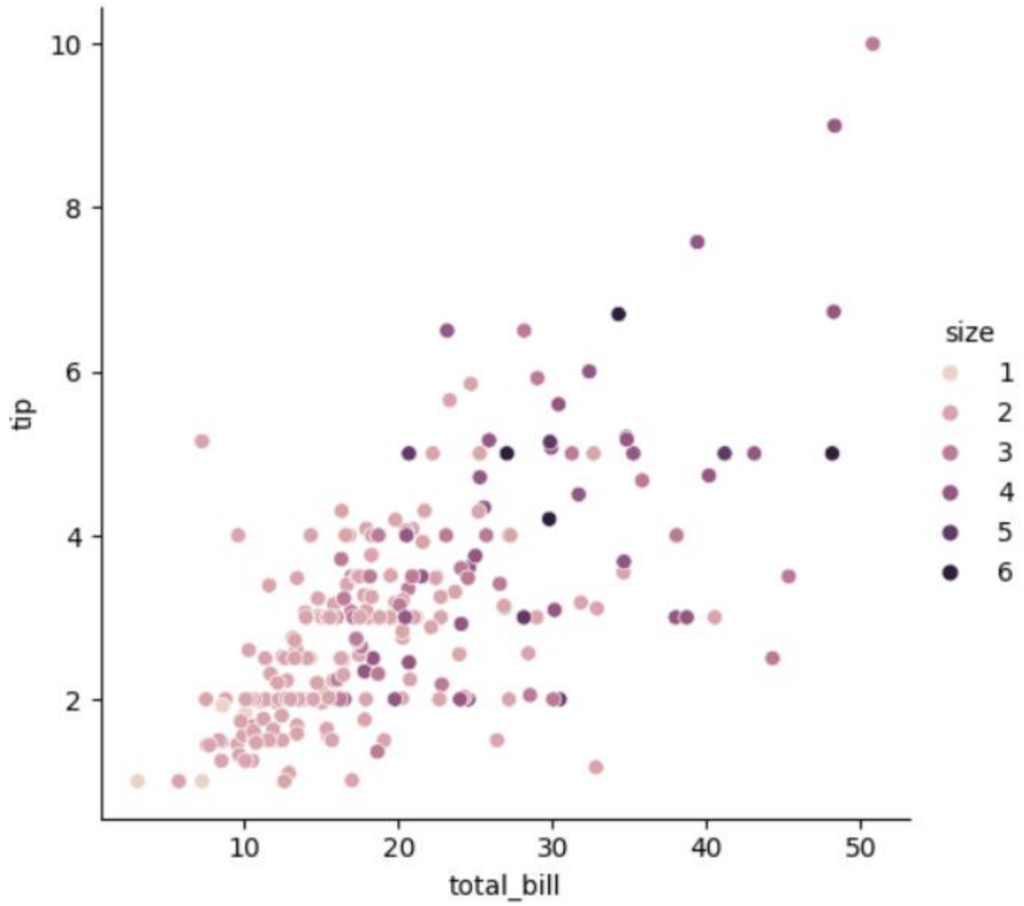
1] ✓ 0.2s Python



Part	Meaning
sns.relplot()	Creates a *relational plot*, showing the relationship between two numeric variables.
data=ds	The dataset (usually a DataFrame, like tips).
x='total_bill'	Variable for the X-axis.
y='tip'	Variable for the Y-axis.
hue='smoker'	Adds color based on whether the person is a smoker or not. Different colors represent different categories.
style='time'	Changes the marker shape based on another variable (like time, day, etc.).

```python
sns.relplot(data=ds, x="total_bill", y="tip", hue="size")
plt.show()
```

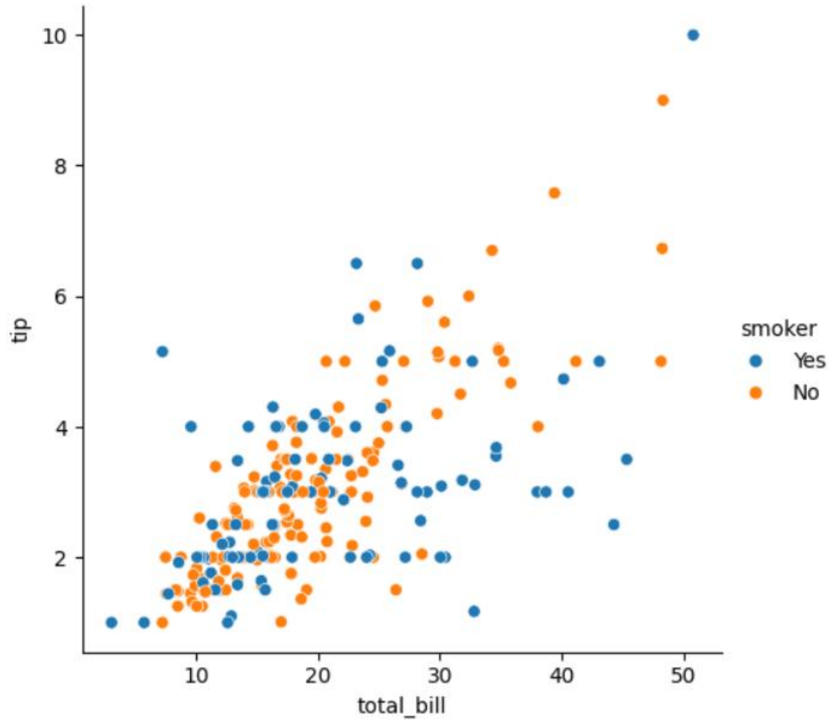
✓ 0.1s Python



Parameter	Description
data=ds	The dataset (e.g., Seaborn’s built-in tips dataset).
x="total_bill"	X-axis → total amount of the bill.
y="tip"	Y-axis → tip amount given.
hue="size"	Color of each point represents the party size (number of people). Different sizes → different colors.

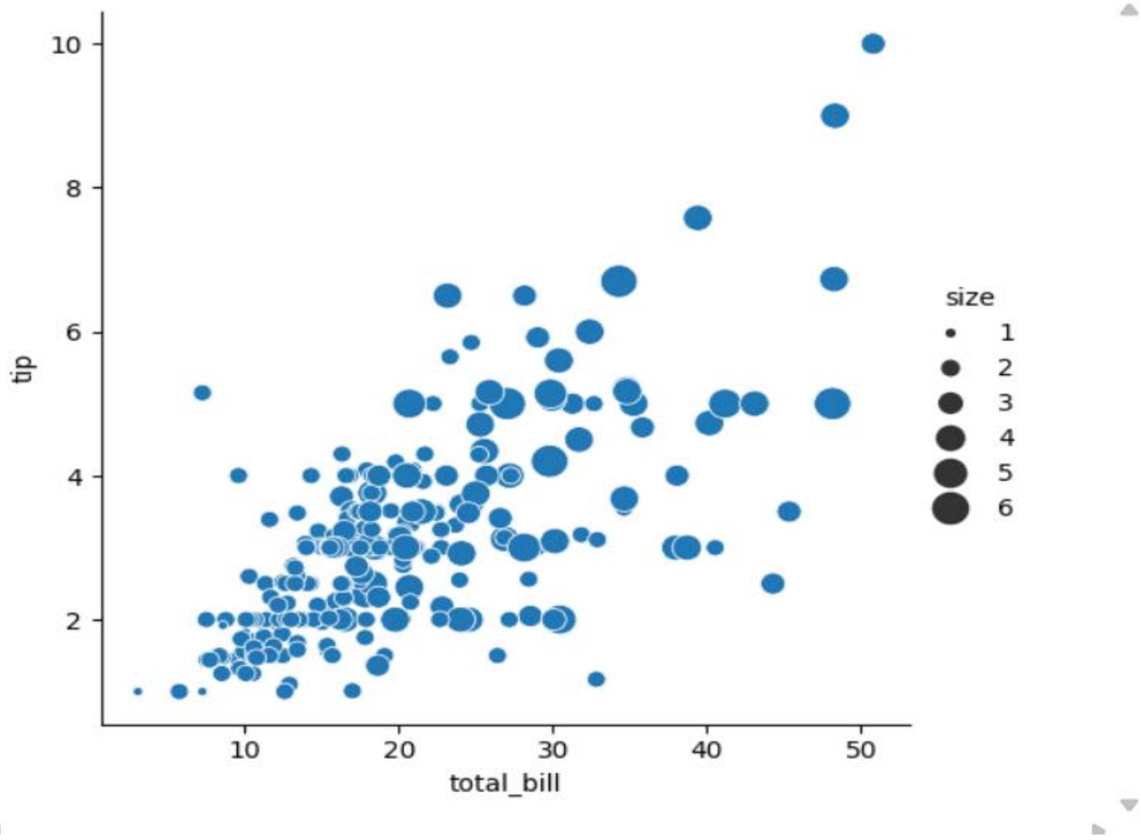
```
import matplotlib.pyplot as plt
sns.relplot(data=ds, x='total_bill', y='tip', hue='smoker')
plt.show()
```

[12] ✓ 0.1s Python



```python
sns.relplot(data=ds, x="total_bill", y="tip", size="size", sizes=(15,200))
plt.show()
```

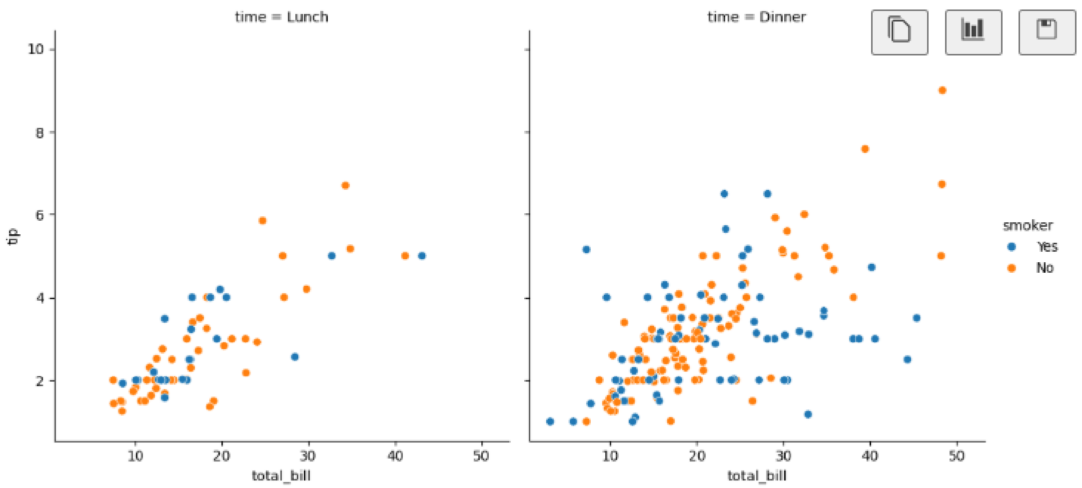
✓ 0.2s Python



Parameter	Description
data=ds	The dataset (for example, Seaborn's built-in tips dataset).
x="total_bill"	Values for the x-axis — total bill amount.
y="tip"	Values for the y-axis — tip amount.
size="size"	Uses the size column to vary the point size — larger dots mean larger party sizes.
sizes=(15, 200)	Sets the range of dot sizes (min 15px, max 200px).

```
sns.relplot(data=ds, x="total_bill", y="tip", hue="smoker", col="time")
plt.show()
```

[5] ✓ 0.4s Python

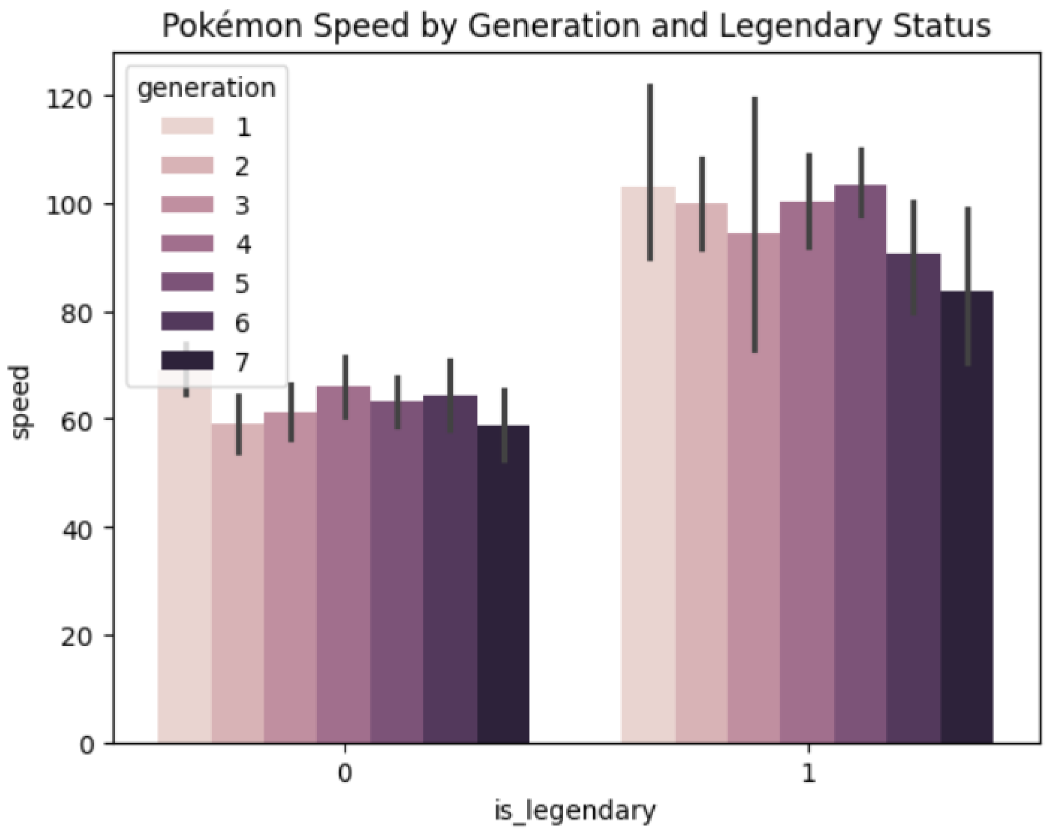


col="time"

Creates separate plots (columns) for each unique value in the time column (Lunch and Dinner)

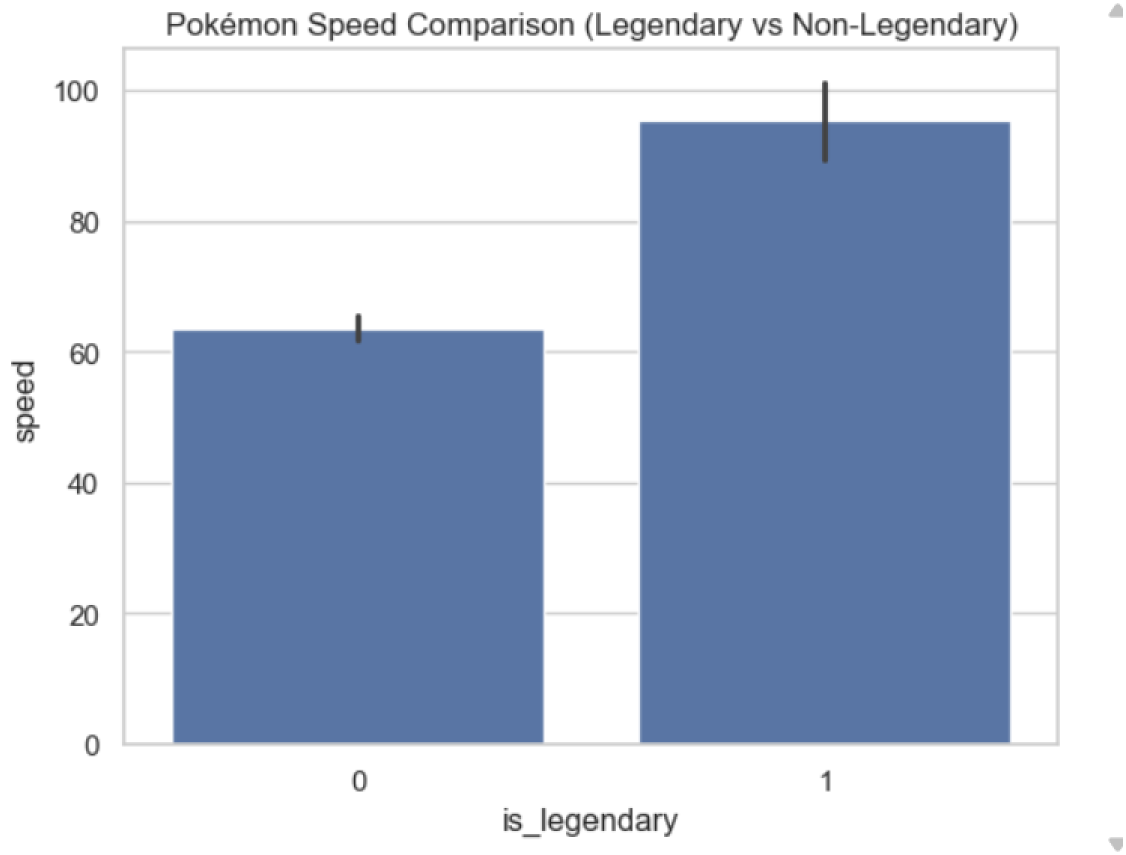
```
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
pokemon = pd.read_csv("Pokemon.csv")
sns.barplot(x="is_legendary", y="speed", hue="generation", data=pokemon)
plt.title("Pokémon Speed by Generation and Legendary Status")
plt.show()
```

21] ✓ 0.4s Python



```
sns.set(style="whitegrid")
# Create bar plot
sns.barplot(x="is_legendary", y="speed", data=pokemon)
plt.title("Pokémon Speed Comparison (Legendary vs Non-Legendary)")
plt.show()
```

22] ✓ 0.1s Pytho

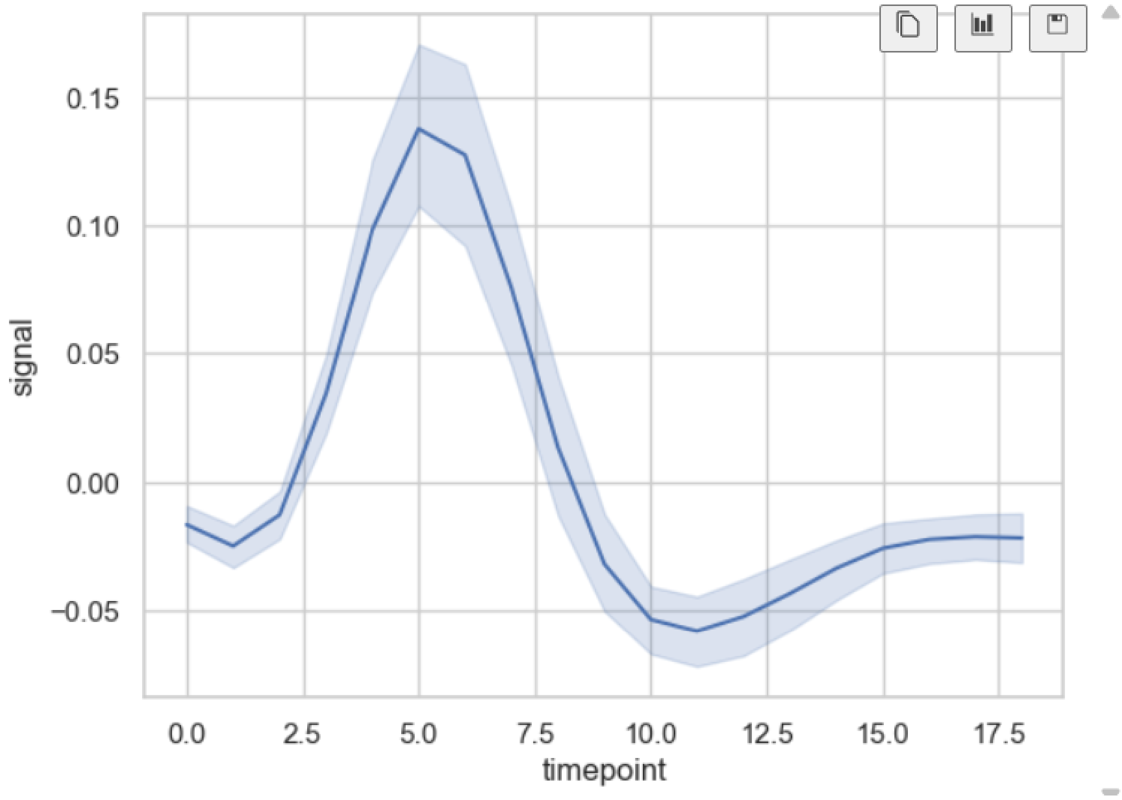


sns.set(style="whitegrid")

Sets a clean background with white grid lines for better readability

```python
sns.lineplot(x="timepoint", y="signal", data=fmri)
plt.show()
```

23] ✓ 0.3s Python



Parameter	Description
x="timepoint"	X-axis → time points during the experiment.
y="signal"	Y-axis → brain signal measurement.
data=fmri	Uses Seaborn’s built-in fMRI dataset

```python
fmri = sns.load_dataset('fmri')
fmri.head()
fmri.shape
sns.relplot(data=fmri, x='timepoint', y='signal')
plt.show()
```

[16] ✓ 1.5s Python