Essential Libraries for Machine Learning

NumPy

NumPy is a core library for numerical computing in Python. It provides support for large, multi-dimensional arrays and matrices, along with a collection of mathematical functions.

```
Example:
import numpy as np
arr = np.array([1, 2, 3, 4, 5])
print(arr.mean())  # Output: 3.0
```

Pandas

Pandas is used for data manipulation and analysis. It provides the DataFrame and Series structures, making it easy to clean, process, and analyze structured data.

```
Example:
import pandas as pd
data = {'Name': ['Alice', 'Bob'], 'Age': [25, 30]}
df = pd.DataFrame(data)
print(df.head())
```

Matplotlib & Seaborn

Matplotlib is a fundamental library for creating static, animated, and interactive visualizations. Seaborn, built on Matplotlib, provides high-level visualization functions for statistical graphics.

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

data = [10, 20, 30, 40, 50]
plt.plot(data)
plt.title("Simple Line Plot")
plt.show()
```

Scikit-learn

Scikit-learn is a popular machine learning library that provides simple and efficient tools for data mining and analysis, including classification, regression, clustering, and model evaluation.

```
Example:
from sklearn.linear_model import LinearRegression
import numpy as np

X = np.array([[1], [2], [3], [4]])
```

```
y = np.array([2, 4, 6, 8])

model = LinearRegression()
model.fit(X, y)
print(model.predict([[5]]))  # Output: [10.]
```

TensorFlow & PyTorch

TensorFlow and PyTorch are deep learning frameworks. TensorFlow, developed by Google, is widely used for large-scale applications, while PyTorch, developed by Facebook, is popular for research and flexibility.

```
Example (TensorFlow):
import tensorflow as tf

x = tf.constant(5)
y = tf.constant(6)
print(tf.add(x, y))  # Output: 11
```

XGBoost & LightGBM

XGBoost and LightGBM are efficient gradient boosting algorithms used for predictive modeling and are commonly used in data science competitions.

```
Example (XGBoost):
from xgboost import XGBClassifier

model = XGBClassifier()
# model.fit(X_train, y_train)  # Example training
```

NLTK & spaCy

NLTK and spaCy are natural language processing (NLP) libraries. NLTK is more research-oriented, while spaCy is optimized for real-world applications.

```
Example (spaCy):
import spacy
nlp = spacy.load("en_core_web_sm")
doc = nlp("Hello, world!")
for token in doc:
    print(token.text)
```

OpenCV

OpenCV is a computer vision library used for image and video processing, including face detection, object recognition, and image transformations.

```
Example:
```

```
import cv2
img = cv2.imread("image.jpg")
cv2.imshow("Image", img)
cv2.waitKey(0)
```