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Department of Computer Science and Engineering
Premier University

CSE 452: Neural Network & Fuzzy Logic Laboratory

Title: Introduction to Python Library For Machine Learning

Submitted by:

Name	Mohammad Hafizur Rahman Sakib
ID	0222210005101118
Section	C
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Submitted to:
MD Tamim Hossain
Lecturer, Department of CSE
Premier University
Chittagong

Remarks

1) NumPy:

Introduction:

NumPy (Numerical Python) is a fundamental library for numerical computing in Python. It Provides support for large, multi-dimensional arrays and matrices, along with mathmatical functions to operate them.

How to import:

```
import numpy as np
```

What it does:

i) Provides N-dimensional array objects for fast Computations.

ii) offers mathmatical operations (linear algebra, Fourier transformers, etc).

iii) Supports Vectorized operations for improved Performance.

iv) Enables random number generation for Simulations.

v) Acts as the foundation for many other Machine learning libraries. Such as - Pandas, SciPy, Tensorflow.

2) Pandas:

Introduction:

Pandas is a Powerful library for data manipulation and analysis. It introduces DataFrames, which allow easy handling of Structured data.

How to import:

```
import Pandas as Pd
```

What it does:

i) Provides DataFrames for Structured data Storage and manipulation.

ii) Supports data cleaning (handling missing values, duplicates).

iii) Enables data filtering, grouping and aggregation.

iv) Allows time-series data Processing.

v) Facilitates reading/writing data from csv, excel, SQL etc formats.

3) MatPlotLib:

Introduction:

MatPlotLib is a widely used library for creating static, interactive, and animated visualizations in Python.

How to import:

```
import matplotlib.pyplot as plt
```

What it does:

i) Generates line plots, bar charts, histograms, Scatter plots etc.

ii) Supports customization (lables, titles, colors)

iii) Enables Subplots and multi-Panel figures.

iv) Can export visualizations in multiple formats (PNG, Pdf, SVG)

v) works seamlessly with NumPy and Pandas.

4) SciKit-Learn:

Introduction:

Scikit-Learn is the go-to library for traditional machine learning algorithms offering simple and efficient tools for data mining and analysis.

How to import:

```
from sklearn import model_selection,
                    Preprocessing,
                    metrics.
```

What it does:

i) Provides classification, regression, clustering algorithms (SVM, Random forest, K-means)

ii) Includes model selection tools (train-test split, Cross-validation).

iii) offers feature extraction and Preprocessing (Scaling, encoding)

iv) Supports Pipeline creation for streamlined workflows.

v) Includes Performance metrics (accuracy, Precision, recall curves).

5) Tensorflow:

Introduction:

Developed by Google, Tensorflow is an open-source library for deep learning and neural networks.

How to import:

import tensorflow as tf

What it does:

i) Enables building and training deep neural networks.

ii) Supports GPU/TPU acceleration for faster computations.

iii) Provides Keras API for simplified model building.

iv) Used in Computer vision, NLP and reinforcement learning.

v) Allows deployment on mobile and edge devices.

6. Keras:

Introduction:

Keras is a high-level neural networks API that runs on top of Tensorflow making deep learning more accessible.

How to import:

```
from tensorflow import keras
```

What it does:

(i) Simplifies building and training deep learning models.

(ii) Provides Pre-trained models (VGG16, ResNet, BERT).

(iii) Supports CNNs, RNNs and Transformers.

(iv) Allows quick Prototyping with minimal code.

(v) Works with Tensorflow backend for Scalibility.

7) PyTorch:

Introduction:

PyTorch, developed by Facebook, is a flexible deep learning framework known for it's dynamic computation graphs.

How to import:

```
import torch
```

What it does:

(i) Enables dynamic computation graphs (unlike Tensorflow's static graphs)

(ii) Widely used in research and academia.

(iii) Supports automatic differentiation (Autograd)

(iv) Provides GPU acceleration.

(v) Used in NLP (Hugging face), Computer vision, and reinforcement learning.

3. SciPy:

Introduction:
SciPy builds on NumPy and Provides additional Scientific Computing tools.

How to import:

from SciPy import stats, optimize, linalg

What it does:

(i) offers advanced mathmatical functions (integration, optimization)
(ii) Includes statistical distributions and tests.
(iii) Supports signal and image Processing.
(iv) Provides linear algebra-operations.
(v) Used in Scientific research and engineering.

9) Seaborn:

⊞ Introduction:

Seaborn is a statistical data visualization library built on Matplotlib, offering high-level interfaces for attractive graphs.

⊞ How to import:

```
import seaborn as sns
```

⊞ What it does:

(i) Creates statistical visualizations (heatmaps, violin plots, pair plots)

(ii) Simplifies complex data representation.

(iii) Integrates well with Pandas Dataframes.

(iv) Provides built-in themes for better aesthetics.

(v) Helps in exploratory data analysis (EDA)

10) XGBoost:

Introduction:

XGBoost is an optimized gradient boosting library known for it's speed and performance in ML competitions

How to import:

```
import xgboost as xgb
```

What it does:

(i) Implements gradient boosting for classification / regression.

(ii) Handles missing values automatically

(iii) Provides regularization to avoid overfitting.

(iv) Supports parallel processing for faster training.

(v) Widely used in Kaggle competitions and real world application.