Vidyavardhini's College of Engineering and Technology
Department of Artificial Intelligence & Data Science

AY: 2023-24

Class:	TE	Semester:	VI
Course Code:	CSL604	Course Name:	Machine Learning Lab

Name of Student:	Parth Manoj Raut
Roll No.:	44
Experiment No.:	1
Title of the Experiment:	Study of Machine Learning Libraries and tools (Python library, TensorFlow, keras,...)
Date of Performance:	
Date of Submission:	

Evaluation

Performance Indicator	Max. Marks	Marks Obtained
Performance	5	
Understanding	5	
Journal work and timely submission	10	
Total	20	

Performance Indicator	Exceed Expectations (EE)	Meet Expectations (ME)	Below Expectations (BE)
Performance	4-5	2-3	1
Understanding	4-5	2-3	1
Journal work and timely submission	8-10	5-8	1-4

Checked by

Name of Faculty   : Mr Raunak Joshi

Signature   :

Date   :

Aim: Study of Machine Learning Libraries and tools (Python library, TensorFlow, keras,...)

Objective: Ability to understand the different libraries and their function used for data preprocessing and model development.

Theory:

Python is one of the most popular and widely used programming languages and has replaced many programming languages in the industry.
There are a lot of reasons why Python is popular among developers and one of them is that it has an amazingly large collection of libraries that users can work with.It contains a numerous number of algorithms for implementing standard machine learning and data mining tasks like reducing dimensionality, classification, regression, clustering, and model selection.

Numpy
Numpy is considered as one of the most popular machine learning library in Python.
TensorFlow and other libraries uses Numpy internally for performing multiple operations on Tensors. Array interface is the best and the most important feature of Numpy.

Features Of Numpy

1. **Interactive:** Numpy is very interactive and easy to use.
2. **Mathematics:** Makes complex mathematical implementations very simple.
3. **Intuitive:** Makes coding real easy and grasping the concepts is easy.
4. **Lot of Interaction:** Widely used, hence a lot of open source contribution.

This interface can be utilized for expressing images, sound waves, and other binary raw streams as an array of real numbers in N-dimensional.
For implementing this library for machine learning having knowledge of Numpy is important for full stack developers.

Matplotlib: Visualization with Python

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible. Matplotlib is a python library used to create 2D graphs and plots by using python scripts. It has a module named pyplot which makes things easy for plotting by providing feature to control line styles, font properties, formatting axes etc. It supports a very wide variety of graphs and plots namely - histogram, bar charts, power spectra, error charts etc. It is used along with NumPy to provide an environment that is an effective open source alternative for MatLab

● Create publication quality plots.
● Make interactive figures that can zoom, pan, update.
● Customize visual style and layout.

- Export to many file formats.
- Embed in JupyterLab and Graphical User Interfaces.
- Use a rich array of third-party packages built on Matplotlib.

Pandas
What Is Pandas?

Pandas is a machine learning library in Python that provides data structures of high-level and a wide variety of tools for analysis. One of the great feature of this library is the ability to translate complex operations with data using one or two commands. Pandas have so many inbuilt methods for grouping, combining data, and filtering, as well as time-series functionality.

Features Of Pandas

Pandas make sure that the entire process of manipulating data will be easier. Support for operations such as Re-indexing, Iteration, Sorting, Aggregations, Concatenations and Visualizations are among the feature highlights of Pandas.

Applications of Pandas?

Currently, there are fewer releases of pandas library which includes hundred of new features, bug fixes, enhancements, and changes in API. The improvements in pandas regards its ability to group and sort data, select best suited output for the apply method, and provides support for performing custom types operations.

Data Analysis among everything else takes the highlight when it comes to usage of Pandas. But, Pandas when used with other libraries and tools ensure high functionality and good amount of flexibility.

Keras
What Is Keras?

Keras is considered as one of the coolest machine learning libraries in Python. It provides an easier mechanism to express neural networks. Keras also provides some of the best utilities for compiling models, processing data-sets, visualization of graphs, and much more.

In the backend, Keras uses either Theano or TensorFlow internally. Some of the most popular neural networks like CNTK can also be used. Keras is comparatively slow when we compare it with other machine learning libraries. Because it creates a computational graph by using

back-end infrastructure and then makes use of it to perform operations. All the models in Keras are portable.'

Features Of Keras

- It runs smoothly on both CPU and GPU.

- Keras supports almost all the models of a neural network – fully connected, convolutional, pooling, recurrent, embedding, etc. Furthermore, these models can be combined to build more complex models.
- Keras, being modular in nature, is incredibly expressive, flexible, and apt for innovative research.
- Keras is a completely Python-based framework, which makes it easy to debug and explore.

Where are we using Keras?

You are already constantly interacting with features built with Keras — it is in use at Netflix, Uber, Yelp, Instacart, Zocdoc, Square, and many others. It is especially popular among startups that place deep learning at the core of their products.

Keras contains numerous implementations of commonly used neural network building blocks such as layers, objectives, activation functions, optimizers and a host of tools to make working with image and text data easier.

Plus, it provides many pre-processed data-sets and pre-trained models like MNIST, VGG, Inception, SqueezeNet, ResNet etc.

Keras is also a favorite among deep learning researchers

TensorFlow

What Is TensorFlow?

If you are currently working on a machine learning project in Python, then you may have heard about this popular open source library known as TensorFlow.

This library was developed by Google in collaboration with Brain Team. TensorFlow is a part of almost every Google application for machine learning.

TensorFlow works like a computational library for writing new algorithms that involve a large number of tensor operations, since neural networks can be easily expressed as computational graphs they can be implemented using TensorFlow as a series of operations on Tensors. Plus, tensors are N-dimensional matrices which represent your data.

Features of TensorFlow

TensorFlow is optimized for speed, it makes use of techniques like XLA for quick linear algebra operations.

1. Responsive Construct

With TensorFlow, we can easily visualize each and every part of the graph which is not an option while using *Numpy* or *SciKit*.

2. Flexible

One of the very important Tensorflow Features is that it is flexible in its operability, meaning it has modularity and the parts of it which you want to make standalone, it offers you that option.

3. Easily Trainable
It is easily trainable on CPU as well as *GPU* for distributed computing.

4. Parallel Neural Network Training
TensorFlow offers pipelining in the sense that you can train multiple *neural networks*and multiple GPUs which makes the models very efficient on large-scale systems.

5. Large Community
Needless to say, if it has been developed by Google, there already is a large team of software engineers who work on stability improvements continuously.

6. Open Source
The best thing about this machine learning library is that it is open source so anyone can use it as long as they have internet connectivity.

Uses of TensorFlow?
You are using TensorFlow daily but indirectly with applications like Google Voice Search or Google Photos. These are the applications of TensorFlow.
All the libraries created in TensorFlow are written in C and C++. However, it has a complicated front-end for Python. Your Python code will get compiled and then executed on TensorFlow distributed execution engine built using C and C++.
The number of applications of TensorFlow is literally unlimited and that is the beauty of TensorFlow.

Conclusion:

In this research on machine learning libraries and tools, we looked at Python libraries such as Numpy, Matplotlib, Pandas, Keras, and TensorFlow, all of which serve different tasks in data preprocessing and model development. Numpy enables interactive mathematical operations, Matplotlib allows for visualization, Pandas simplifies data analysis, Keras makes neural network construction simple, and TensorFlow provides a scalable platform for creating and deploying machine learning models. These libraries enable developers and researchers to efficiently handle a wide range of machine learning tasks, from data manipulation to complicated model training, across multiple domains and applications.