A Survey on Python Libraries and Packages for Deep Learning

[1]R.Kiruba Tharani, [2]Dr. S. Saradhambekai,

[1]*PG Student, Department of Information Technology, PSG College of Technology, Coimbatore-4, India*
[2]*Assistant Professor (Sr. Gr), Department of Information Technology, PSG College of Technology, Coimbatore-4, India*

Abstract- **Python is a universal scripting language used for wide range of applications. It is ease of use and compactable across different operating systems. Python is well known for its concise, readable code, and is almost peerless when it comes to ease of use and simplicity, particularly provides numerous advantages for applications in the deep learning.**

In this paper, the survey of various papers that used python modules and libraries for deep learning are taken and analyzed with metrics like performance, high precision stability and accuracy obtained of using python packages and libraries in deep learning.

Index Terms- python, deep learning, CNN, face recognition, scripting, machine learning, keras, tensor flow, theano.

I. INTRODUCTION

This survey paper illustrates the various python packages that are been used in deep learning which significantly increases the performance of complex real world problems.

II. SIGNIFICANCE OF PYTHON

The significance of python is described as follows,
a. Python is Beginner's Language - Python is a great language for the beginner programmers and supports the development of a wide range of applications
b. Python is Interpreted- It converts the source code into intermediate language which is again translated to machine language.
c. Python is Interactive- Python prompt helps to interact with the interpreter directly to write programs.
d. Python is Object-Oriented- Python supports Object-Oriented style or technique of programming which encapsulates code within the objects
e. Python is Easy-to-maintain – The source code is fairly easy-to-maintain
f. A Broad Standard Library – Python's greatest strengths is the huge volume of the library is very portable and cross-platform compatible
g. Python is Portable – Python can run on a wide range of hardware.
h. Databases – Python provides interfaces to all major commercial databases
i. Python is Scalable - Python provides a good structure and supports large programs

III. SIGNIFICANCE OF DEEP LEARNING

The significance of deep learning is described as follows,
a. Deep Learning is the best in performance on problems that particularly outperforms other solutions in different domains. This includes speech recognition, image classification, natural language processing etc.
b. It is one of the most time-consuming parts of machine learning practice. Utilization of common resources
c. It can be adapted to solve new and complex problems.
d. It has the potential to solve the real world applications.
e. Deep Learning unlocks the repository of unstructured big data.
f. It provides massive amount of data, to solve problems end to end.
g. It takes much less time to run.

IV. PYTHON LIBRARIES AND PACKAGES FOR DEEP LEARNING

a. TensorFlow Python
    TensorFlow is a python library for numerical computation uses data flow graphs. The Google Brain Team researchers developed tensorflow with the Machine Intelligence research organization. TensorFlow is an open source and available to the public and works great for distributed computing.

b. Keras Python
    Keras is written in python and an open source framework. It is efficient of running on top of TensorFlow, Microsoft Cognitive Toolkit, and Theano. It is designed to enable fast experimentation with deep neural networks and focuses on being user-friendly, modular, and extensible.

c. Apache MXNet
    Apache MXNet is an open-source deep learning software framework which is used to train, and deploy deep neural networks. It is scalable, which supports a flexible programming model and multiple programming languages like python.

d. Theano Python
    Theano is a Python library and enhancing compiler for manipulating and evaluating mathematical expressions, especially matrix-valued ones. In this computations are expressed using a NumPy-esque syntax and compiled to run efficiently

e. PyTorch
    PyTorch is an open-source machine learning library for Python, based on Torch, used for applications such as natural language processing. It is primarily developed by Facebook's artificial-intelligence research group, and Uber's "Pyro" Probabilistic programming language software is built on it.

f. Lasange
    Lasagne is a lightweight Python library that helps us build and train neural networks in Theano. This is a HTTP client library that supports HTTP libraries.

g. PyLearn2
    PyLearn2 is a machine learning library with most functionality built on top of Theano. It is possible to write PyLearn2 plugins making use of mathematical expressions.

V. RELATED RESEARCH WORKS

A. Modern Face Recognition with Deep Learning
    Jothi Thilaga.P et al., [1] has proposed that most predictable way to measure a face is by using deep learning techniques. A python application is developed to recognize the faces.
    A robust face recognition system developed using python for security and verification causes which could recognize faces independent of the prevailing conditions.
    The python application is used for identifying the faces of the persons that pass by the system or the image is feed into the system by the admin. The user interface is designed in such a way that the admin can decide whether the user can pass through the system or not, which can be automated.
    Histogram of Oriented Gradients (HOGs) is applied for face recognition. The result obtained was the original image turned into a very simple representation that features the basic structure of a face.
    A deep convolutional neural network is used to train the images and store the measurements using OpenFace. OpenFace is the python and torch implementation for facial recognition.
    Python language is used to code the software since python is scalable and portable. It uses network mapper package as a plugin.
    Hence, the result of person identification using HOG techniques performs promising results.

B. A Highly Accurate Deep Learning Based Approach for Developing Wireless Sensor Network Middleware
    Remah A. Alshinina et al [2]., introduced a Secure Wireless Sensor Network Middleware (SWSNM) which is based on an unsupervised learning technique called generative adversarial network algorithm.

    SWSNM consists of two networks:
a. generator (G) network and
b. discriminator (D) network

The framework is implemented in Python with experiments performed using Keras library. It is a high level neural network API. Keras uses a NSL-KDD dataset by using 40 features. The analytical model was developed using MATLAB.

Middlewares bridges the gap between the application and Wireless sensor networks (WSNs) which is an essential medium for the transmission of data.

The paper proposes unsupervised learning for the development of WSNs middleware to provide end-to-end secure system.

Hence, the SWSNM provides stronger security mechanism by recognizing and replacing malicious nodes which leads to lesser energy consumption and higher throughput.

c. Implementation of Deep-Learning based Image Classification on Single Board Computer

Hasbi Ash Shiddieqy et al.,[3], represented a algorithm based on convolutional neural-network which is performed using raspberry pi 3 platform in deep learning.

This approach is implemented using python and tflearn for image classification.

TFlearn is a high level API and a transparent deep learning library built on top of Tensorflow.

The raspberry pi 3 is efficient to run the CNN in 2D.

The images of cats and dogs were used in the classification. The train folder consists of 25,000 images of dogs and cats. The output from these images will be a numpy array 50x50 for every image.

Thus the result shows as the technique implemented in system has the ability to classify two category cat and dog which have many similarity. By increasing the size of network the accuracy can be improved.

d. Data Classification with Deep Learning using Tensorflow

Fatih Ertam et al.,[4], illustrates the Tensorflow, one of the most popular deep learning libraries to classify MNIST dataset, which is frequently used

in data analysis studies. The functions used for implementations are Rectified Linear Unit (ReLu), Hyperbolic Tangent (tanH), Exponential Linear Unit (eLu), sigmoid, softplus and softsign

In this approach, Convolutional Neural Network (CNN) and SoftMax classifier are used as deep learning artificial neural network. The "Modified National Institute of Standards and Technology" (MNIST) is a huge dataset which has hand written numbers used for training of image processing. This dataset was used to measure the performance of the Tensorflow library.

Hence, in this study, a classification task was carried out on the MNIST data set which is widely using TensorFlow in deep learning applications. The accuracy values acquired according to the iteration numbers of the ReLu activation function obtained as the best result.

e. E. A Convolutional Neural Network based on TensorFlow for Face Recognition

Liping Yuan et al.,[5], researched and found that in traditional hand-crafted features, there are uncontrolled environments such as pose, facial expression, illumination and occlusion influencing the accuracy of recognition and it has poor performance. Hence the deep learning method is adopted.

In this paper a Convolutional Neural Network (CNN) based on TensorFlow, It is an open source framework which is used in the effective face recognitions.

Here an experiment is conducted on the Linux system, training CNN model based on TensorFlow.

Thus, the result shows that when compared with traditional hand-crafted features, CNN learning features have better robustness to face recognition in complex environments. TensorFlow is the latest second-generation of Google artificial intelligence, which has been improved in all aspects, better performance, fully open source and can be run on more devices. It obtained the better results for face recognition.

Summary of the Research Related Works – Table 1

	Title	Author Name	Description	Python packages used	Merits	Demerits
A	Modern Face Recognition with Deep Learning	Jothi Thilaga. P et al.,	A robust face recognition system developed using python for security.	Tensorflow Python.	Improves the security level, HighAccuracy rates, Easy integration process	Images quality can be a drawback based on the size.
B	A Highly Accurate Deep Learning Based Approach for Developing Wireless Sensor Network Middleware	Remah A. Alshinina et al.,	An unsupervised learning for the development of WSNs middleware to provides end-to-end secure system.	Keras	Less energy consumption, higher throughput, and Strong security	Estimation of error rates need to be analyzed.
C	Implementation of Deep-Learning based Image Classification on Single Board Computer	Hasbi Ash Shiddieqy et al.,	A deep-learning algorithm based on convolutional neural-network is implemented using python and tflearn for image classification	Tensorflow Python	High accuracy, Reduces cost, Stronger result is obtained.	Reliability problems may occur.
D	Data Classification with Deep Learning using Tensorflow	Fatih Ertam et.al,	A classification task was carried out on the MNIST data set which is widely used in deep learning applications using Tensorflow	Tensorflow Python	Provides fast and effective solutions, and more accurate.	Time taken for classification is high.
E	A Convolutional Neural Network based on TensorFlow for Face Recognition	Liping Yuan., et al.,	The basis of face detection, a Convolutional Neural Network (CNN) using TensorFlow, for face recognition.	Tensorflow Python	Better recognition accuracy and high robustness in complex platforms.	CNN cascade can be used to improve accuracy of face detection.

VI. CONCLUSION

This survey paper comprises of various python libraries and modules which are been used in deep learning. The python standard libraries reduce the length of code to be written significantly.

Python is capable of interacting with most of the other languages and platforms which are used to solve complex algorithms like, Convolutional Networks, Image classification and Neural Networks that are used in the deep learning.

TensorFlow python library is a simplified approach which is used for solving numerical computation using data flow graph. Python enables reusability of code with the packages and libraries offered. This library is used in solving complex applications like face recognitions [5].

Keras library in python is used for solving high complex problems like neural networks. One of the benefit of keras is it can be executed on the top of python libraries like TensorFlow and CNTK (Cognitive Toolkit)

Python supports various libraries and modules that can be used in deep learning wherein extreme complex problems and multi-stage flow graphs are been solved. Python libraries help in reducing the cognitive overhead on developers and make them to concentrate on problem-solving and achieving project goals.

Thus, this survey provides the comparative study of various papers implemented using python libraries and shows the benefits of the python packages used in solving the complex algorithms in deep learning.

REFERENCES

[1] Thilaga, P. J., Khan, B. A., Jones, A. A., & Kumar, N. K. (2018, April). Modern Face Recognition with Deep Learning. In 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT) (pp. 1947-1951). IEEE.

[2] Alshinina, R. A., & Elleithy, K. M. (2018). A Highly Accurate Deep Learning Based Approach for Developing Wireless Sensor Network Middleware. IEEE Access, 6, 29885-29898.

[3] Shiddieqy, H. A., Hariadi, F. I., & Adiono, T. (2017, October). Implementation of deep-learning based image classification on single board computer. In 2017 International

Symposium on Electronics and Smart Devices (ISESD) (pp. 133-137). IEEE.

[4] Ertam, F., & Aydın, G. (2017, October). Data classification with deep learning using Tensorflow. In 2017 International Conference on Computer Science and Engineering (UBMK)(pp. 755-758). IEEE.

[5] Yuan, L., Qu, Z., Zhao, Y., Zhang, H., & Nian, Q. (2017, March). A convolutional neural network based on TensorFlow for face recognition. In 2017 IEEE 2nd Advanced Information Technology, Electronic and Automation Control Conference (IAEAC) (pp. 525-529). IEEE.