

Python Libraries and Packages for Neural Networks-A Survey

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Abstract- Python is the scripting language that is scalable, reliable, platform independent. Using python packages for networking makes it more secure, automated and ease of use. It helps network engineers to a greater extent as it can create an environment that is more flexible, easily tested, troubleshot and virtualized.

In this paper, the survey of different papers that used python modules and libraries for networking are taken and analyzed with metrics like performance, reliability and stability because of using python packages and libraries.

Index Terms- scripting, platform independent, flexible, troubleshot, performance, reliability, stability, secure, ease of use

I. INTRODUCTION

This survey paper depicts the various python packages that are been used in networking which drastically increases the performance of networking objects.

II. SIGNIFICANCE OF PYTHON

The significance of python is described as follows,

- a. Python is a High -level language
- b. Python is an Interpreter level language.
- c. Python is an Object-oriented scripting language
- d. Python is a portable language
- e. Python is scalable in nature.
- f. Python is an extendable language
- g. Python is an interactive language
- h. Python supports GUI Programming language
- i. Python supports a broad standard library that can run on Windows, Macintosh, Linux

III. SIGNIFICANCE OF NEURAL NETWORKS

The significance of neural network is described as follows,

- a. It is an organic learning process.
- b. More Flexible approach.
- c. Nonlinear data processing.
- d. Secures information
- e. Fault tolerance.
- f. Cost effective.
- g. Self-repair.
- h. Connects geographic boundaries.

IV. PYTHON LIBRARIES AND PACKAGES FOR NETWORKING

a. Tensorflow python

TensorFlow is an open-source library for numerical computation in which it uses data flow graphs. The Google Brain Team researchers developed this with the Machine Intelligence research organization by Google. TensorFlow is open source and available to the public. It is also good for distributed computing.

b. Keras python

Keras has algorithms for optimizers, normalization, and activation layers. It also deals with Convolutional Neural Networks and lets you build sequence-based and graph-based networks. One limitation is that it doesn't support multi-GPU environments for training a network in parallel.

c. Apache mxnet

mxnet delivers an amazing number of language bindings for languages like C++, Python, R, JavaScript, and more. It does great with distributed computing and lets us train a network across CPU/GPU machines. The only downside is that we need a little more code to run an experiment in it.

d. Caffe

Caffe is a deep learning framework that is fast and modular. This isn't a library but provides bindings into Python. Caffe can process nearly 60 million images per day on a K40 GPU. However, it isn't as easy to turn hyper parameters with it programmatically.

e. Theano python

Without NumPy, we couldn't have SciPy, scikit-learn, and scikit-image. Similarly, Theano serves as a base for many. It is a library that will let you define, optimize, and evaluate mathematical expressions that involve multidimensional arrays. It is tightly integrated with NumPy and transparently uses the GPU.

f. Microsoft cognitive toolkit

The Microsoft Cognitive Toolkit is a unified Deep Learning toolkit. It describes neural networks using a directed graph in computational steps.

e. PyTorch

PyTorch is a Tensor and Dynamic neural network in Python. It observes strong GPU acceleration, is open-source, and we can use it for applications like natural language processing. You can refer to this link to install PyTorch

f. Lasagne

Lasagne is a lightweight Python library that helps us build and train neural networks in Theano. You can install it using Python pip.

g. Nolearn

nolearn wraps Lasagne into an API that is more user-friendly. All code it holds is compatible with scikit-learn. We can use it for applications like Deep Belief Networks (DBNs).

h. 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. Theano optimizes and stabilizes these for us and compiles them to the backend we want.

i. Pyzmq

This library is light weight and it supports messaging framework and delivers the messages at a faster rate.

V. RELATED RESEARCH WORKS

A. Large-Scale Machine Learning on Heterogeneous Distributed Systems.

The Google Brain project started in 2011 to explore the use of very-large-scale deep neural networks,

both for research and for use in Google's products. As part of the early work in this project, we built DistBelief, our first-generation scalable distributed training and inference system [14], and this system has served us well. We and others at Google have performed a wide variety of research using DistBelief including work on unsupervised learning [31], language representation [35, 52], models for image classification and object detection [16, 48], video classification [27], speech recognition [56, 21, 20], *Corresponding authors: Jeffrey Dean and Rajat Monga: sequence prediction [47], move selection for Go [34], pedestrian detection [2], reinforcement learning [38], and other areas [17, 5].

B. Human-level control through deep reinforcement learning.

The theory of reinforcement learning provides a normative account 1, deeply rooted in psychological 2 and neuroscientific3 perspectives on animal behaviour, of how agents may optimize their control of an environment. Touse reinforcement learning successfully insituations approaching real-world complexity, however, agents are confronted with a difficult task: they must derive efficient representations of the environment from high-dimensional sensory inputs, and use these to generalize past experience to new situations. Remarkably, humans and other animals seem to solve this problem through a harmonious combination of reinforcement learning and hierarchical sensory processing systems 4,5 , the former evidenced by a wealth of neural data revealing not able parallels between the phasic signals emitted by dopaminergic neurons and temporal difference reinforcement learning algorithms 3

C. Theano: A Python framework for fast computation of mathematical expressions.

Theano is a Python library that allows to define, optimize, and evaluate mathematical expressions involving multi-dimensional arrays efficiently. Since its introduction in [1] it has been one of the most used CPU and GPU mathematical compilers – especially in the machine learning community [2] – and has shown steady performance improvements [3]. Theano is being actively and continuously developed since 2008, multiple frameworks have been built on top of it and it has been used to produce many state-of-the-art machine learning models. The present article is structured as follows. Section I provides an

overview of the Theano software and its community. Section II presents the principal features of Theano and how to use them, and compares them with other similar projects. Section III focuses on recently-introduced functionalities and improvements. Section IV compares the performance of Theano against Torch7 [4] and TensorFlow [5] on several machine learning models. Section V discusses current limitations of Theano and potential ways of improving it.

D. Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks.

Recent advances in object detection are driven by the success of region proposal methods (e.g., [4]) and region-based convolutional neural networks (RCNNs) [5]. Although region-based CNNs were computationally expensive as originally developed in [5], their cost has been drastically reduced thanks to sharing convolutions across proposals [1], [2]. The latest incarnation, Fast R-CNN [2], achieves near real-time rates using very deep networks [3], when ignoring the time spent on region proposals. Now, proposals are the test-time computational bottleneck in state-of-the-art detection systems. Region proposal methods typically rely on inexpensive features and economical inference schemes. Selective Search [4], one of the most popular methods, greedily merges superpixels based on engineered low-level features.

Yet when compared to efficient detection networks [2], Selective Search is an order of magnitude slower, at 2 seconds per image in a CPU implementation. EdgeBoxes [6] currently provides the best tradeoff between proposal quality and speed, at 0.2 seconds per image. Nevertheless, the region proposal step still consumes as much running time as the detection network.

E: **Serialization and Deserialization of Python Objects using Pickle and cPickle Modules and their Performance Comparison** [5] discusses a way to implement serialization and deserialization of network objects using pickle module.

Here, python is used to sequence the binary object that is produced as a result of serialization and sequenced via the TCP connection. For storing the objects, mongo dB or MySQL is used.

Python objects are used to convert the dictionary keys into string via serialization and that can be converted to any type like numeric, Boolean, collections or the user defined classes.

Pickle is implemented in Windows 7 and Linux distribution. C pickle is identical to pickle but implemented in C language.

Hence on comparing the serialization and deserialization, cpickle is faster compared to the pickle module.

Summary of the Research Related Works – Table 1

S. no	Title	Author Name	Description	Python packages used	Merits	Demerits
A	Large-Scale Machine Learning on Heterogeneous Distributed Systems	Martin Abadi	The Google Brain project started in 2011 to explore the use of very-large-scale deep neural networks.	Caffe	More flexible, Portable.	Limited only for local networks
B	Human-level control through deep reinforcement learning	Volodymyr Mnih, et al.,	The theory of reinforcement learning provides a normative account ¹ , deeply rooted in psychological ² and neuroscientific ³ perspectives on animal behaviour, of how agents may optimize their control of an environment	Keras python	Scalable, runs on all platforms, easy to write short scripts, more compatible than java	It runs only on emulator environment.
C	Theano: A Python framework for fast computation of mathematical expressions.	Rami Al-Rfou et al.,	Theano is a Python library that allows defining, optimizing, and evaluating mathematical expressions involving multi-dimensional arrays efficiently.	Scalpy, sniff	Uses python modules and tools for finding intrusion, Runs on TCP/IP layer	Fundamental method, consumes more power, Runs only on transport layer
D	Network Automation and Abstraction using python programming methods	Mihaila, P., et al.,	Deploying networking automatically and abstraction of legacy networks using open fire and spark running over XMPP clients under TCP layer	Net Miko, Para Miko, cryptography	Faster deployment, secure, troubleshooting is easier	Implemented only on Ubuntu Containers.
E	Serialization and Deserialization of Python Objects using Pickle and cPickle Modules and their Performance Comparison	Rakshit C A., et al.,	Comparing the serialization and deserialization of the network objects via pickle and cpickle module using python objects and found that cpickle module has higher efficiency than pickle module.	Pickle, Cpickle, Caml, Yaml.	Implemented on Windows and Linux containers, provides automated way by loading and dumping the codes associated with network objects.	Ristricted only for two modules such as pickle and cpickle.

VI. CONCLUSION

This survey paper comprises of various python libraries and modules that are been used in networking. With the usage of python, it has eliminated various issues such as lack of stability, lack of reliability. The code size has been relatively reduced such that it enhances the throughput and reduces the memory usage.

Importing the various python networking libraries have made the automated and flexible environment for network engineers to work in.

Since python has inbuilt libraries and also provides a provision to include external modules, it is easier to code the project.

Using the python libraries, it is easy to detect the intrusions in the network and it is easy to detect and remove the intruders from the network [1][3].

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