Python: The Most Advanced Programming Language for Computer Science Applications

Prof. Anup Maurya[1], Rinku Jagtap[2], Kalyani Jadhav[3], Apurva Patil[4], Manishankar Tripathi[5]

Assistant Professor, Department of Computer Engineering[1]

Students, Department of Computer Engineering[2,3,4,5]

Chhatrapati Shivaji Maharaj Institute of Technology, Panvel, Maharashtra, India

Abstract: *In last few years, there has been an advancement in programming languages due to different libraries that are introduced. All the developers in this modern era prefer programming language that provides a built-in module/library which can make their work easy. This paper describes the advancement of one such language "Python" and it's increasing popularity through different statistical data and graphs. In this paper, we explore all the built-in libraries for all different computer science domains such as Data Science, Machine Learning, Image Processing, Deep Learning, Natural Language Processing, Data Visualization, Cloud Computing, Speech recognition, etc. We have also included Memory management in Python. Different frameworks for Python which can make the front-end work easier are also mentioned*

Keywords: Python, Python libraries, Memory allocation, Data Structure, Framework

I. INTRODUCTION

In 1991, Python language was developed by Guido van Rossum. There is an interesting story behind giving the name "Python" to the programming language. At the time of development of python, the developer was reading the script "Monty's Python Flying which is a BBC series. While reading this book he got an idea to name the programming language as "Python" to have a short and unique name. Python is object- oriented, interpreted, and interactive programming language. It provides highlevel data structures such as list, tuples, sets, associative arrays (called dictionaries), dynamic typing and binding, modules, classes, exceptions, automatic memory management, etc. It is also used for parallel computing system and has a comparatively simple and easy syntax for coding and still it is a powerful programming language. Python has the interpreter for java known as JPython, which is similar to the interpreter for C language. Python has many advantages over any other languages, like it has varieties of library which reduces the code to one-third for programmer and due to this Python has reached at the +highest peak in terms of Machine Learning. Difficulty is faced by many while solving problems(Lawan et al, 2015), this research will help providing knowledge about different libraries and motivate them to use Python.

Version 1

Python reached version 1.0 in January 1994. The major new features included in this release were the functional programming tool lambda, map ,filter and reduce.

The last version released while Van Rossum was at CWI was Python 1.2. In 1995, Van Rossum continued his work on Python at the corporation for national research (CNRI) in Reston Virginia from where he released several versions.

By version 1.4, Python had acquired several new features. Notable among these are the Modula-3 inspired keyword arguments (which are also similar to common lip's keyword arguments) and built-in support for complex numbers. Also included is a basic form of data hiding by name mangling though this is easily bypassed.

During Van Rossum's stay at CNRI, he launched the Computer Programming for Everybody (CP4E) initiative, intending to make programming more accessible to more people, with a basic "literacy" in programming languages, similar to the basic English literacy and mathematics skills required by most employers. Python served a central role in this: because of its focus on clean syntax, it was already suitable, and CP4E's goals bore similarities to its predecessor, ABC. The project was funded by DARPA As of 2007, the CP4E project is inactive, and while Python attempts to be easily learnable and not too arcane in its syntax and semantics, outreach to non-programmers is not an active concern.

ISSN
2581-9429
IJARSCT

Version 2

Python 2.0, released October 2000 introduced list comprehension, a feature borrowed from the functional programming languages SETL and Haskell. Python's syntax for this construct is very similar to Haskell's, apart from Haskell's preference for punctuation characters and Python's preference for alphabetic keywords. Python 2.0 also introduced a garbage collector capable of collecting reference cycles.

Python 2.1 was close to Python 1.6.1, as well as Python 2.0. Its license was renamed python software foundation license. All code, documentation and specifications added, from the time of Python 2.1's alpha release on, is owned by the python software foundation (PSF), a non-profit organization formed in 2001, modelled after the Apache software foundation. The release included a change to the language specification to support nested scopes, like other statistically coped languages. (The feature was turned off by default, and not required, until Python 2.2.)

Python 2.2 was released in December 2001, a major innovation was the unification of Python's types (types written in C) and classes (types written in Python) into one hierarchy. This single unification made Python's object model purely and consistently object oriented. Also added were generators which were inspired by icon.

Historic Python logos used on Windows (left) and the Macintosh (centre), and the logo used since version 2.5 (right).

Python 2.5 was released in September 2006 and introduced the with statement, which encloses a code block within a context manager (for example, acquiring a lock before the block of code is run and releasing the lock afterwards, or opening a file and then closing it),allowing Resource Acquisition Is Initialization (RAII)-like behaviour and replacing a common try/finally idiom.

Python 2.6 was released to coincide with Python 3.0, and included some features from that release, as well as a "warnings" mode that highlighted the use of features that were removed in Python 3.0. Similarly, Python 2.7 coincided with and included features from Python 3.1, which was released on June 26, 2009. Parallel 2.x and 3.x releases then ceased, and Python 2.7 was the last release in the 2.x series. In November 2014, it was announced that Python 2.7 would be supported until 2020, but users were encouraged to move to Python 3 as soon as possible. Python 2.7 support ended on January 1, 2020, along with cold freeze of 2.7 development branch. A final release, 2.7.18, occurred on April 20, 2020, and included fixes for critical bugs and release blockers. This marked the end-of-life of Python 2.

Version 3

Python 3.0 (also called "Python 3000" or "Py3K") was released on December 3, 2008. It was designed to rectify fundamental design flaws in the language – the changes required could not be implemented while retaining full backwards compatibility with the 2.x series, which necessitated a new major version number. The guiding principle of Python 3 was: "reduce feature duplication by removing old ways of doing things".

Python 3.0 was developed with the same philosophy as in prior versions. However, as Python had accumulated new and redundant ways to program the same task, Python 3.0 had an emphasis on removing duplicative constructs and modules, in keeping with the zen of python: "There should be one— and preferably only one —obvious way to do it".

Nonetheless, Python 3.0 remained a multi-paradigm language. Coders could still follow object-oriented, structured, and functional programming paradigms, among others, but within such broad choices, the details were intended to be more obvious in Python 3.0 than they were in Python 2.x.
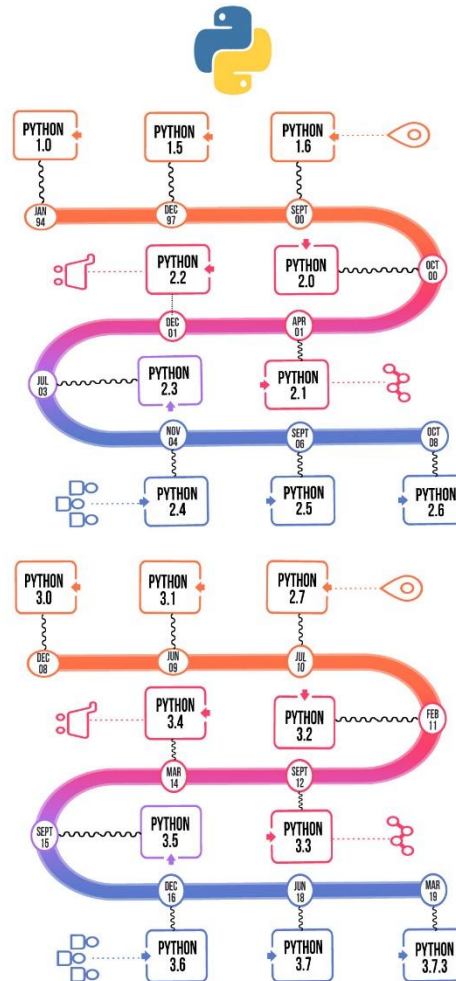
II. FEATURES OF PYTHON

• Simple and Easy to learn: Python which is extremely simple and easy so the python easy to read and easy to learn, since it is closely resembles in English language.

• Supportive community: Python has been around for three decades, which has been plenty of time for a developed, supportive community to grow up around the language. From official documentation to YouTube tutorials, Python learners of all ages and skill levels can find the support they need to improve their knowledge of the language.

• Web Development: Web programming with python provides a lot of choices as python has an array of frameworks for developing website. There are so many frameworks available in Python such as Django, flask, pylon and so on. Python is majorly used in the web development.

• Use in big data and machine learning: Big data and machine learning are two of the hottest trends in computer science right now, helping enterprises transform their workflows and processes. Python is the language in which much of this research and development takes place. As the second most popular tool for analytics and data science, Python powers countless data processing workloads in organizations around the world. Meanwhile, Python libraries such as OpenCV for computer vision and TensorFlow for neural networks are used in thousands of machine learning projects every day.

•Efficiency: Python represents a different programming paradigm than older languages such as Java and C++. However, this "Pythonic" way of doing things often permits developers to get more done with less work–often in just a few lines of code. What's more, the versatility of Python allows you to use the language across a variety of Efficiency: Python represents a different programming paradigm than older languages such as Java and C++. However, this
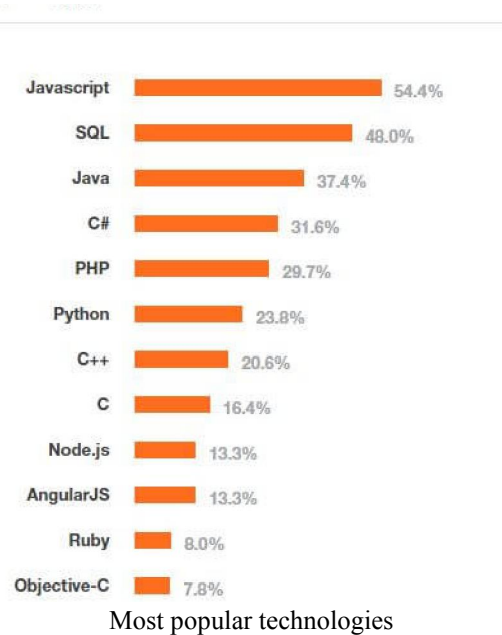
ISSN
2581-9429
IJARSCT

"Pythonic" way of doing things often permits developers to get more done with less work–often in just a few lines of code.

Efficiency: Python represents a different programming paradigm than older languages such as Java and C++. However, this "Pythonic" way of doing things often permits developers to get more done with less work–often in just a few lines of code.

environments, from web development and mobile development to desktop applications and hardware programming.
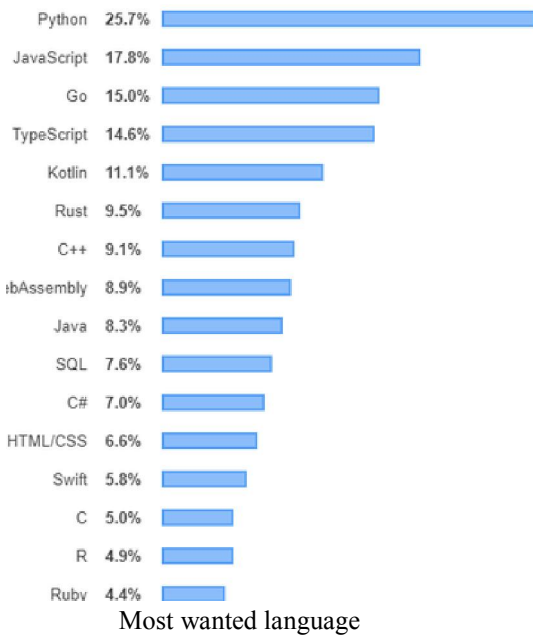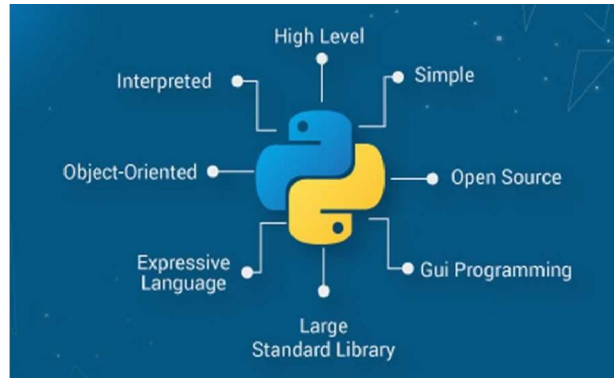
Most wanted language	Most popular technologies

III. BUILT-IN LIBRARIES IN PYTHON FOR COMPUTER SCIENCE APPLICATIONS

3.1 Data Science

Data Science is to develop a different approach to record, store, and analyse the data and using this data to get effective information. Data science aims at achieving ideas and knowledge from any type of data.

Python provides number of libraries for the same as listed below:

• Matplotlib: 2D plot graphs can be made using Matplotlib library.

• Pandas: Data analysis in finance, statistics, social science, and engineering require different types of data structure and tools

Pygame: Video games are created easily using Pygame. The library has computer graphics and sound libraries which are specially made for python programming language

• Flask: It allows you to build websites and web apps very fast and efficiently which are provided by Pandas. (https://pypi.org).

• NumPy: It is the basic library for scientific computing in Python. (https://pypi.org) Multidimensional arrays and matrices can be done using objects in NumPy, and also routines are provided which allows developers to compute advanced mathematical and statistical functions on those arrays with code if possible. It is also used in Data Structure.

• SciPy: Manipulation and visualization of data is done using a high-level command provided in SciPy. Functions for solving Integrals numerically, computing differential equations, and optimization are included in the package. The library SciPy is also used in Image processing.

Pillow: Python Imaging Library which adds the support for different options like opening, manipulating data, and saving images as different file formats. It is also used in Image processing.

• Statsmodels: Statistical Models can be estimated using this library. Also it can explore
data and perform statistical test. It is also used in machine-learning.

3.2 Machine Learning
Machine learning can also be considered as a subset or part of Artificial Intelligence that can learn automatically and make changes itself from the experience without being externally programming it.(Machine Learning and Deep Learning frameworks and libraries for large-scale data mining).

3.3 Deep Learning
Deep Learning can also be called part of Machine learning. It has a layer of Artificial Neural Network which can learn the unstructured or unlabelled data. (Machine Learning and Deep Learning frameworks and libraries for large-scale data mining).

3.4 Image Processing
Image processing is specially used to do some operations on an image to get a better-quality image or to find some useful information from it. It works like signal processing in which we take input as image and output may vary, like it can be image or characteristic features which is associated with that image.

3.5 Game Development
Game Development is used to create games and describes the design, development, and release of a game. Before game development, it is important to think about the game mechanics, rewards, player engagement, and level designing.

3.6 Networking
Python provides two-level access to networking. One low level, in which one can access the basic socket support in the same OS that permits implementation for clients and servers to do connection-orientation and connectionless protocols.

3.7 Data Visualization
Data visualization is used to represent the information in the form of a chart, diagram, and pictures.

3.8 Speech Recognition
Speech recognition is used to convert the human voice to computer understandable language using different software or different hardware. It has many applications, like to give command to computer do perform any particular task without even writing or working physically.

IV. THIS SECTION INCLUDES INFORMATION ABOUT THE DIFFERENT FRAMEWORKS USED IN PYTHON

Frameworks: A collection of different modules/packages which are used by developer to write web-applications or services without requirement of handling minor details such as protocols, socket, or process management.

4.1 Full Stack Framework

It is a framework that tries to provide nearly everything i.e. from web serving to database management right down to HTML generation — which a developer could need to build an application.

Few Full Stack Frameworks :

• Django • Turbo Gears • web2py • Cubic web

• Tornado • Giotto • Grok • Pylon • Reahi

• wheezy.web •Zopez • kiss. Py •Lino •Nagare

• Pylatte

4.2 Non-full Stack

These frameworks do not provide extra functionalities and features to the developers. They have to add huge code and components manually here. Few Non-Full Frameworks are: • Bottle • Cherry.Py • Flask • Hug • Pyramid

• AppWsgi • BlueBream • More Path • Bobo

• Bocadillo • Clastic • Divmod Nevow • Falcon

V. CONCLUSION

Python is growing rapidly and has reached to 3rd rank in terms of best programming language. It is seen that; Python has many libraries which makes it unique from other programming languages. It's popularity and ratings are increasing day by day along with the demand of Python programmers all over the world.

REFERENCES

[1]. PYTHON CURRENT TREND APPLICATIONS- AN OVERVIEW POPULAR WEB DEVELOPMENT FRAMEWORKS IN PYTHON

[2]. A.L.Sayeth Saabith, MMM.Fareez, T.VinothrajCentre for Information Communication Technology Faculty of Science, Eastern University, Vantharoomulai, Sri Lanka Finance Department Eastern University, Vantharoomulai, Sri Lanka

[3]. Centre for Information Communication Technology Faculty of Science, Eastern University, Vantharoomulai, Sri Lanka

[4]. https://en.wikipedia.org/wiki/History_of_Python

[5]. Python: The Most Advanced Programming Language for Computer Science Applications Akshit J. Dhruv, Reema Patel and Nishant Doshi Computer Science and Engineering, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat