

Comparison and Analysis of Programming Languages for Artificial Intelligence

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Abstract: Undoubtedly, a lot of attention has been paid to the topic of artificial intelligence (AI) in recent years. In a number of industries, including medical, engineering, education, government, and others, AI is being used to offer answers to issues. We give a systematic literature assessment with an emphasis on the Evolution of AI programming languages in order to analyse the state of the art of research in the field of AI. I then discussed the advantages and disadvantages of the programming languages used for analysis and prediction utilising AI approaches. There are numerous programming languages that are used with AI, including Python, R, C++, Java, MATLAB, Octave, and Julia. This comparison and analysis provides information on these languages' capabilities, restrictions, and applications, as well as their use and features. The information in this review may help AI practitioners and researchers select the best languages to use when putting their cutting-edge AI techniques into practise.

Keywords: Programming Language, Artificial Intelligence, Python, R Programming, C++, MATLAB.

I. INTRODUCTION

Preferences or prejudices that may be held towards a certain programming language may be taken into consideration when developing any application. The computational efficiency, learning curve, rate of development, and intrinsic properties of a language should all be taken into consideration before making a decision.

Given the variety of programming languages currently in use [1] and each one's unique traits, it is vital to compare each one's key advantages and disadvantages as well as the speed at which its programmes run. As a result, many businesses focus on using a certain programming language for their developments. However, the majority favour the formation of multilingual expert work teams [2].

One could wonder which programming language to use to acquire the best results for the same because many of them include machine learning libraries for analysis in artificial intelligence [2]. Without any background knowledge, trying to choose the best language for oneself is like being a confused and intrigued child in a toy store. Therefore, I suggest reading this essay, which will provide some clarification on the subject. We'll also take a look at some of the machine learning and deep learning libraries that each of them offers. Only four programming languages—out of a total of seven—have been chosen for this study in order to better grasp their traits, potential, advantages, and disadvantages.

II. PYTHON PROGRAMMING LANGUAGE

Since the early 1990s, the Python programming language has played a crucial role in powering Google's internal framework [3]. Python has enthusiastic designers and is being used in a variety of applications, including Quora, YouTube, Instagram, Facebook, Dropbox, and many other places. Python is also widely utilised across many IT firms and enables simple coordination of work within various development teams. Therefore, Python is the programming language to use if you want a flexible and multi-purpose one that is supported by a vast network of inventors and extendible Artificial Intelligence products.

Tensorflow for deep learning, Numpy for mathematical operations, Pandas for file operations, Pytorch for deep learning, Sklearn for classification and regression algorithms, OpenCV and Dlib for computer vision, and Matplotlib for data visualisation are a few of the packages that are supported in Python for machine learning [4]. With all these advantages, Python also has certain drawbacks, such as being slower than competing languages like C++ and having trouble supporting multithreading. The topmost IDEs are shown in the Fig. 1.

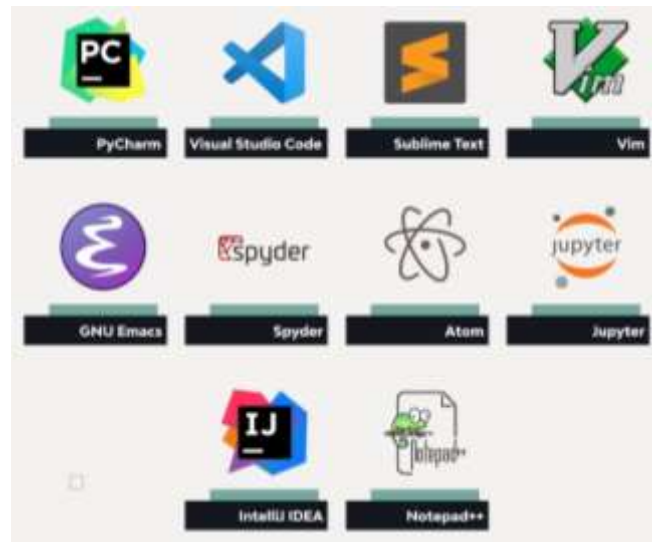


Fig. 1 Top 10 IDEs for Python Programming

Its benefits include being a general-purpose language. Python can be used in your project venture when dealing with something other than statistics or measurements, such as when developing a new and functional website, because many people think it is a superior choice. It has a huge selection of necessary libraries. Many libraries that are crucial for data construction and control are supported by Python. Consider the Scikit-learn event, which offers tools for data mining and analysis and helps in comparable Artificial Intelligence comfort when using Python. Additionally, a Pandas package aids engineers in creating unmatched structures and information assessment tools, reducing the development time. For your advancement group requests, among the significant R functionalities, you can go for RPy2 when working on a project.

Lack of a centralised repository and limited selection of R libraries are drawbacks. Due to its dynamic composition, it is constrained to look for specific capabilities in some circumstances and to track shortcomings linked to the incorrect assignment of various data types to related aspects.

III. R PROGRAMMING LANGUAGE

If there is another language that is frequently used for machine learning and data analysis, it is R, not Python. People have been utilising it for a variety of machine learning applications, and it has truly emerged as a fantastic alternative [4]. R has many important advantages, starting with its excellent library support and graphs and continuing with its vast growth with many for us to seek assistance from due to its open nature.

Kernlab for regression and classification-based operations, Ggplot for data visualisation, Caret for regression and classification based operations, Plotly for data visualisation, MLr3 for various machine learning workflows, Rpart and SuperML for machine learning, and DataExplorer for data exploration are a few of the important packages that are supported by R.

R programming was developed by statisticians primarily for analysts, although any engineer can predict the similarities by taking a glance at its syntax. A person who wants to gain a deeper understanding of the fundamentals of fabrication and its nuances creatively may choose to use R, which is a language used for scientific calculations linked to machine and deep learning derived from statistics. The IDEs for R programming are displayed beneath Fig 2.

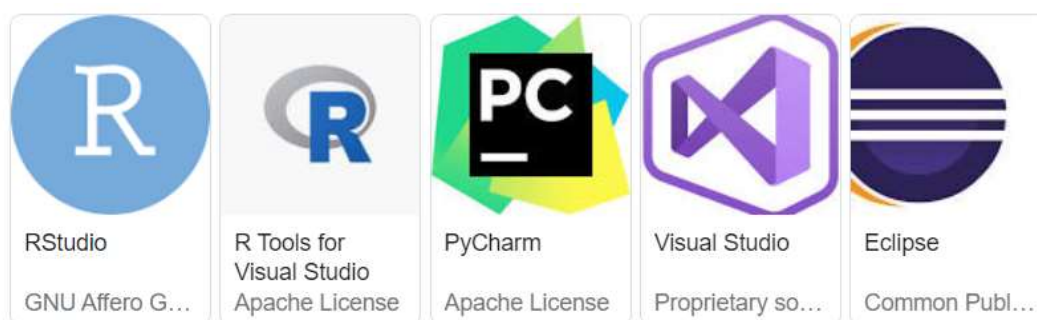


Fig 2. R Programming IDEs

It is appropriate for statistical analysis. R is the greatest option if data representation or analysis is at the centre of your business venture because it allows for quick prototyping while also utilising datasets to configure AI/deep

learning/machine learning models in your projects. It contains lots of beneficial libraries and tools for analysing statistical data. Similar to Python, the R language has a number of bundles that can help you present your machine/deep learning projects more effectively. For instance, Caret promotes the R's artificial intelligence capabilities with its novel arrangement of skills, which helps with the productive creation of predictive models. Users of R can benefit from the advanced data analysis packages that stretch the pre- and post-demonstrating phases when aiming at explicit assignments like model acceptance or even information representation throughout research.

Demerits: Simultaneously challenging to understand and simple to code poorly. Weak typing can be risky because some functions have a ferocious penchant for returning unexpected types of objects. Specificity compared to many other languages, such example vector indexation starting with 1 instead of 0. Sometimes the syntax for resolving issues is not immediately apparent. Because there are so many libraries, it is impossible to consider the documentation of less well-known ones to be complete.

IV. C++ PROGRAMMING LANGUAGE

Popular programming language C++ is well-known and adored for its quickness and effectiveness [5]. It swiftly runs code, making it a great option for applications involving neural networks and machine learning. Because many AI-focused applications are quite complicated, utilising a powerful programming language like C++ can help develop software that performs remarkably effectively.

Although C++ is not often the first choice for AI-focused apps, it is important to note because of how prevalent it is in the sector. Although this language runs and operates very effectively, the cost is that it is more difficult to write. Because of this, C++ is a fantastic choice for resource-intensive applications. It is also occasionally used in conjunction with other languages to create apps with an AI focus.

The OpenCV library is one example of a C++-based utility for AI-related applications [6]. This library is one of the largest machine learning and computer vision libraries accessible, and it supports a variety of programming languages, including C++. Computer vision algorithms can process video input to extract information such as faces, objects, and more. They can also create 3D scans of real-world things. C++, like everything else, has drawbacks of its own, though. In contrast to Python, which is beginner-friendly, it is more syntax driven. also lacks Python's superior library support.

Some of the popular C++ libraries and frameworks for AI include [7]:

- [TensorFlow](#): A deep learning and machine learning open-source library created for massive AI projects.
- [OpenCV](#): A computer vision and image processing open-source library that is used for applications including object detection, face recognition, and image segmentation.
- [Boost](#): A group of C++ libraries for diverse purposes, such as data analysis and machine learning.
- [Armadillo](#): A C++ library for linear algebra is used for operations on matrices, eigenvalue decomposition, and singular value decomposition, among other things.

V. MATLAB

Computer vision applications can be creatively used with MATLAB, or Matrix Laboratory, which offers machine learning procedures [8]. We will now discuss the kinds of features that MATLAB supports in order to help you understand it better.

First off, MATLAB is simple to learn and comprehend because it is not restricted by syntax. Additionally, MATLAB offers a tonne of built-in functions and a graphical user interface to help learners comprehend concepts. Additionally, it has a MATLAB compiler that is useful for coding in the same language.

Engineers and scientists may quickly and effectively assess and create systems and products using the programming environment MATLAB [9]. The MATLAB language, a matrix-based language that enables the most natural expression of computer mathematics, is the core of MATLAB. One of the greatest programming languages for handling the Deep Learning matrices in an easy-to-understand way is MATLAB.

Signal data, audio data, image data, and video data can all be labelled using interactive Deep Learning programmes available in MATLAB. One of the most time-consuming Deep Learning jobs is labelling, and MATLAB is the best tool for automating it.

In cases when there is a lack of sufficient data for the appropriate situations, MATLAB can assist in creating synthetic data. Given that Deep Learning relies heavily on a vast array of datasets, this is a big advantage.

MATLAB has limitations much like other languages do. The programming language cannot be used for free or is not readily accessible. A trial version is only available for 30 days; after that, consumers must purchase the package to continue using it. This suggests that its intended audience may be limited to researchers. Additionally, because the MATLAB compiler is expensive to purchase, there is little community or forum support available to assist users and trainees.

VI. CONCLUSION:

Depending on the type of research, both R and Python have areas of interest with a wide range of applications when it comes to machine and deep learning. Since most fundamental tasks relate to at least one of these dialects, when you master both of them, you might be able to improve on these two universes. As an alternative, you can use Python for the initial stages of data exploitation and then input the final data into R, which employs the widely-proven techniques and is improved for quantifiable examination schedules after being integrated with the language. Along similar lines, you may also use Python as a pre-handling library for R programmes or R as your library for Python. When it comes down to it, you should make sure you select a programme that will enable you to achieve results far more quickly whenever you need to complete a project with extreme precision. You can get more information about how to create the best language for your project by getting in touch with the author via email.

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