

Graphical Interface to Improve Python Language Teaching and Image Processing

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Abstract— The increase in knowledge of programming languages is increasingly high due to current business and educational demands, in many cases it has been reflected that advanced knowledge of a programming language for careers in natural sciences and engineering have improved the possibility of getting a decent job with a good working environment. Many universities propose programming courses on a large scale and in a general way so that the student can investigate and deepen the topics, but when the course is carried out without any structure or interface with which the students present a great interest in it, they tend to fail or regularly make basic schedules to only pass the course. That is why a graphical interface system is proposed to improve the teaching of the Python language due to its various functionalities and improve the interest of image processing. Obtaining as results that, of the 100 students and teachers within the branch of natural sciences and engineering, using 9 indicators of satisfaction an average of 6 thus indicating that the graphic interface does help in the process of learning and interaction of the person did the programming and processing of images. It is concluded that the use of graphical interfaces for any type of teaching is quite useful due to the simulation mode that all these have, thus improving the level of interaction of the student and the possibilities of tests that can be carried out before the implementation or design in real.

Keywords— GUI, Python, graphical interface, PyQt, artificial intelligence.

I. INTRODUCTION

A programming language is considered a formal language with well-parameterized and defined grammatical rules, these rules are used by programmers to write series of instructions or sequences forming algorithms capable of controlling, administering, processing and handling a physical or logical behavior of a computer system[1].

The birth of the programming language occurred because formerly the mathematical and logical operation of a computer is based on extensive strings of number 0 and 1, known as the binary language, that is why to facilitate the work of the logical modification of the system it was decided to implement a translator to replace the 0 and 1 in words or strings of words that are based on the most spoken language of This being English, this was adapted to the requirements of each language and then became combinations of handling, structuring and modification of data[2].

Currently there are a large number of programming languages available, because each of them was created or improved based on the need and ease they provide to programmers when programming systems, among the classification of programming languages we have: machine language that is used by any computer and is based mainly on binary code, Low-level programming languages that can vary depending on the computer used and high-level programming language is one that uses commands and words for the concatenation of a physical or logical action of the system. Among the most used languages are: C, C++ and C# programming, Java, Python, PHP, SQL, Ruby, Visual Basic.NET, R programming language, Kotlin, Scheme, Pascal, etc.[3]

Based on Stack Overflow, a reference website for programmers, it estimates that more than 16 million are professional developers or students at the university level due to the complexity of the queries in addition to the functionalities they look for on the website, it also indicates that Python is a programming language with greater growth due to the versatility and functionality in current systems, it also mentions that before Java and JavaScript were the most requested but in June 2017, that changed to Python falling the two languages that historically had the highest percentage of visits. [4]

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This has led to Python being the most requested in many companies, among the advantages of learning Python is that it is easy to conceptualize because its syntax was designed to be interpreted and concise, it is versatile because it is used in various applications in data science, data analysis and software engineering making it the preferred one for programmers and finally the high labor demand due to that many industrial, business, educational sectors, etc., are looking for professionals with knowledge in Python programming, being indispensable the knowledge of it. [5]

Several universities are adding to the educational curriculum relations to natural sciences and engineering the knowledge of Python programming due to its growing labor demand today, but in many cases the teaching is done in a traditional way, which does not encourage the university to deepen programming, in addition in many cases there are companies that have not been coupled to the virtual topic and that is why they do not require programmers, thus decreasing the demand generated by other companies. [6]

II. LITERATURE REVIEW

In [7], the authors mention that there is a tendency to develop simple graphical interfaces, since it contributes to a better user experience, in addition it is mentioned that a graphical user interface is the main means with which a user interacts with information. That is why they designed a graphical interface system using MATLAB to improve user interaction with the computer. For this, they made an algorithm based on artificial intelligence, which was able to translate simple commands into mathematical processes so that when the user adds a classic mathematical command, it becomes the mathematical model thus improving the learning of the course and in addition to the programming itself. Obtaining as a result a 15% improvement in the speed of learning in the M programming language, in addition to a cognitive improvement when performing mathematical processes mentally. The authors conclude that graphical interfaces improve the user experience when performing any action and more if it is complemented by education or data memory.

In [8] a user interface is developed in MATLAB focused on the analysis of brain tumors, implementing the Support Vector Machine algorithm. In [9] a graphical interface is developed in MATLAB in which different methods are implemented for the active segmentation of contours in TOMus. In [10] a graphical interface is developed for the analysis of civil structures with drones, implementing algorithms for the detection of cracks. [11] A graphical interface is implemented to analyze and identify breast cancer and calcification in mammogram images using image processing functions. In [12] an authentication system is developed with a graphical interface that implements feature extraction algorithms, in addition to algorithms for protecting biometric templates. [13] proposes a MATLAB-based graphical user interface for segmentation of blood vessels by applying various algorithms to distinguish an image as normal or abnormal. In [14] a system is proposed for the location of the optical disc and the optical cup in order to detect possible cases of glaucoma, in fundus images. In [15] a graphical user interface designed for the detection of diabetic foot is implemented, through the application of various image processing algorithms.

In [16], the author mentions that the industrial revolution 4.0 is based on optimization and industrial processes, this has led to the implementation of robust and efficient calculation tools in such processes, in addition to the respective training that operators must have for the manipulation of tools. For this reason, the author proposes the design of a graphical interface that can communicate between an algorithm designed and implemented in Python, to optimize plant simulations, which will help improve competitiveness. As a result, the operator who used the graphical interface was able to optimize processes efficiently without having any programming knowledge. The author concludes that the support of external graphical interfaces is necessary to train people based on a current system, this to improve competently and cognitively.

III. METHODOLOGY

With the advancement of technology, software development has become more important, as well as its teaching, so the following research work was developed as a Python language teaching software, in addition to being able to use it for basic image processing; this is born from the constant need to process images, with which multiple research projects are developed, in addition to being focused on training new students.

The methodology of this work can be done in 3 stages that are: The definition of the options available for image processing, the content that will show and finally the record or history of the processes carried out with the software, the stages mentioned we can see graphically in Figure 1.

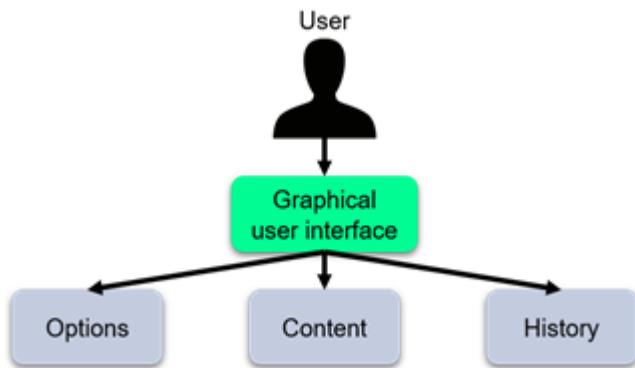


Figure 1. General diagram of the methodology applied.

A. Available options.

Various algorithms have been implemented for image processing, as well as basic control options; all this can be seen represented graphically in Figure 2.

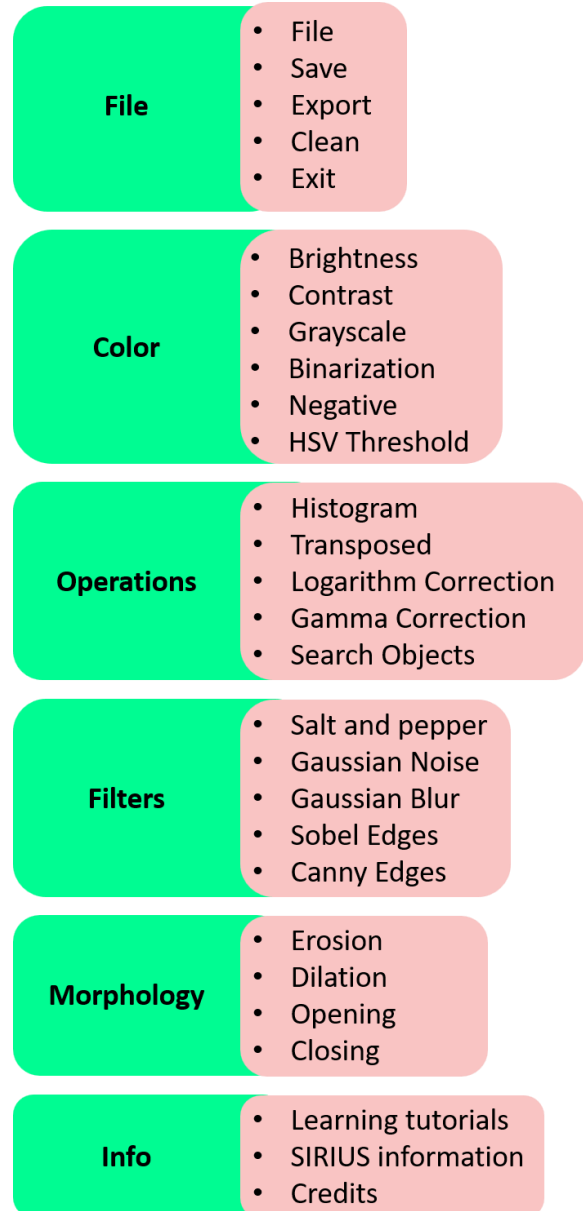


Figure 2. Basic control options and algorithms available.

The control alternatives, we can see it within the "File" category, from which we can open an image, save it, export all the changes, restart and exit the interface; In addition to this option there are several alternatives for image processing, organized into 4 categories, which we: Color, Operations, Filters and Morphology, within which we find the implementation of various algorithms that help us with image processing, for example to modify the brightness, convert to grayscale, make a logarithmic correction, search for objects, apply Gaussian blur, detect sobel or canny edges, erode or dilate an image, among other available options.

Within the options there is a special section that "Info", where we can find 3 sections, the first dedicated to the teaching of programming with Python and image processing; the second focused on teaching how it is built, in addition to the integration of new options; finally, the credits section.

B. Content.

The content section is developed to display everything related to image processing, depending on the option chosen from the options menu; this section is divided into 3 content boxes, which can be seen in Figure 3.

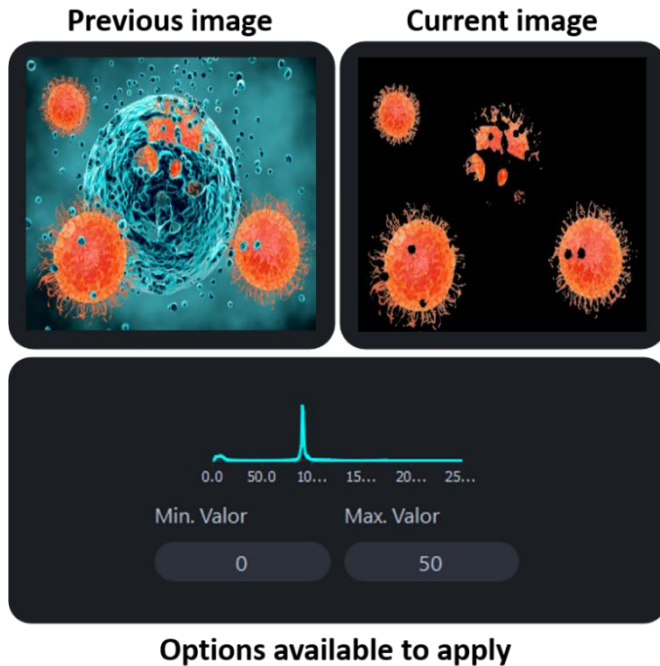


Figure 3. Content boxes.

When a new image is uploaded, it is displayed in the upper right section, which is the area in which the images generated after applying some processing algorithms are displayed; in the upper left area all the images before applying an algorithm will be shown finally in the lower section the available options of the chosen algorithm will be shown, that way we can see the image before and after applying some image processing algorithm.

C. History

This section shows the history of changes that were made to an image, a general scheme of the algorithm that adds data to the history we can see in figure 4.

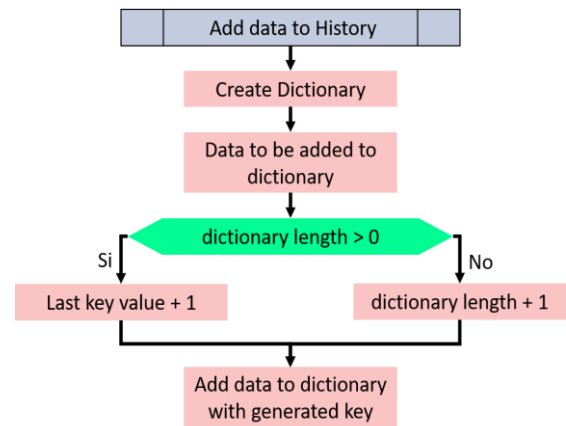


Figure 4. Schematic of the function that saves the modification history.

The algorithm creates an empty dictionary, in addition before adding the data, the value of the last key added is verified, to finally add the data increasing the value of the last key. The history section shows the procedure performed on an image, as well as a thumbnail of it.

IV. RESULTS

The results of the development of our system show an adequate performance, which has been evaluated through a survey, for this, has granted access to 100 people among which there are students and teachers, the participants had to use for their work and to learn, with this group of people 9 indicators were evaluated that are: user experience, expectations, functionality, performance, defects, stability, answer's capacity, speed and net promoter score (NPS); after using the participants assigned a score between 0 to 10. [17]

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With respect to the indicators and results shown in Figure 5, which was obtained from an average of the grades of each indicator, we can note that the evaluation yielded an approximate general average of 6 points, as we can see the defects found by the respondents are minimal, contrary to the user experience and the NPS, which is very good since users could recommend this system more easily, which meets one of the objectives. [17]

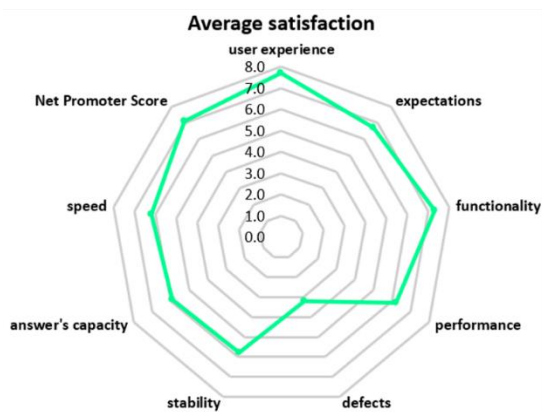


Figure 5. Results of the survey carried out.

In general, we could mention that the development of this research work is following the right path, and thanks to the feedback of the users surveyed, we are able to improve its performance, providing a system with which users feel completely satisfied. [17]

As we can see in figure 6, the design of the graphical interface is shown where we can see all the available options described above.



Figure 6. Graphical interface.

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V. DISCUSSION

In [18] a graphical interface is developed to integrate image processing functions in MATLAB, contrary to the option presented, in which there is a complete graphical interface, in addition to orientation for students. In [19] a graphical interface for image thresholding is created using objective evaluation for brain tumors; in our case the research work has the capacity of thresholdization and segmentation of images, in addition to finding some object of our interest. In [20] a graphical interface for the analysis of tomography and magnetic resonance imaging is developed, with image compression algorithms; by default it is not possible to do image compression, however with the help of the learning module that is incorporated, it is possible to add all the functionalities that are needed. In [21] it is mentioned that ImageJ, which is a public software package based on Java, for general image processing, with useful and extensible functions, in the work we are introduced to Astro ImageJ, which provides specific tools for astronomy, based on ImageJ; in this case, it is not based on astronomy nor does it possess all the ImageJ capabilities, however, it has an educational module, which allows you to learn Python as well as instructions to add new functionalities to the system, thus ensuring that it is completely extensible. Finally we must mention that this system is able to reproduce the processing that is carried out in [22], [23], [24] and [25] in which image processing is performed for various medical applications.

VI. CONCLUSIONS

As we have already seen the development of software over time is developing more and more, it is a program based on Python, oriented to image processing, for this it has multiple functions that help us treat the images; as well as having the teaching option, where students can learn to program in Python in addition to learning to add new options to the system, with this it is possible to add new functionalities.

It is concluded that the system is robust due to the skill with which you can get to process images without the need to have advanced programming knowledge, this provides a better vision to students because they require what the functionalities are first, to then test and test new functionalities improving the experience and educational quality of the user.

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