Developing interactive learning resources for Python and Machine Learning

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Introduction

This poster describes the details from a project that aims to develop interactive learning resources for students in the field of computing to facilitate the student's task of understanding and practicing specific topics in computing. The interactive learning resources were devised by using Jupyter Lab. From another point of view, before devising the interactive content, a supplementary technical guide was devised to provide additional learning resources to students using the interactive workshops.

Justification

The topics that were selected to be discussed through the devised learning resources were practical programming and machine learning. These specific topics were selected due to their current importance in the job market for computer scientists and engineers. The topic of programming has always been essential for the computer scientists and engineers. On the other hand, the topic of machine learning, which is a sub-topic of artificial intelligence (AI), is important due to how the topic of AI has been projected to transform the global economy (Johansson, n.d.).

Design process

To execute the different scripts offered throughout the technical guide and the developed interactive learning material for Python and Machine Learning, a Jupyter Lab environment had to be set-up. To setup the Jupyter Lab environment an Ubuntu virtual machine (VM) was created, and the following packages were installed into the VM: Anaconda, cling, Jupyter lab, xeus-cling (C++ Jupyter kernel). After the setup, the technical guide was devised as a supplement to the interactive learning resources. The technical guide was developed to include the following topics: Compiler theory and practical programming, algorithms and data structures, and data science for machine learning.

Once the supplementary technical guide was devised, two workshops were created. One workshop covered the topic of programming basics with Python and another covered the topic of supervised machine learning with Python. Each workshop was composed of four main sections and for each section there were a series of examples and exercises. Additionally, these workshops have been made available in a GitHub repository.

Results

The project of developing learning resources for students in computing produced two main results: the supplementary technical guide and the interactive workshops. An example of the workshops and scripts offered in the technical guide is shown in Figures 1-3.

```cpp
#include <iostream>
using namespace std;

int grade = 80;

if(grade > 89)
std::cout <<
"You got an A!";
else
    if(grade > 79)
    std::cout <<
    "You got an B!";
    else
        if(grade > 69)
        std::cout <<
        "You got an C!";
        else
            if(grade > 59)
            std::cout <<
            "You got an D!";
            else
                std::cout <<
                "You got an F!";
```

```
You got an B!
```

Figure 1: if… else statement in C++

```python
grade = 80
if grade > 89:
    print("You "
    "got an A!")
else:
    if grade > 79:
        print("You "
        "got an B!")
    else:
        if grade > 69:
            print("You "
            "got an C!")
        else:
            if grade > 59:
                print("You "
                "got an D!")
            else:
                print("You "
                "got an F!")
```

```
You got an B!
```

Figure 2: if… else statement in Python

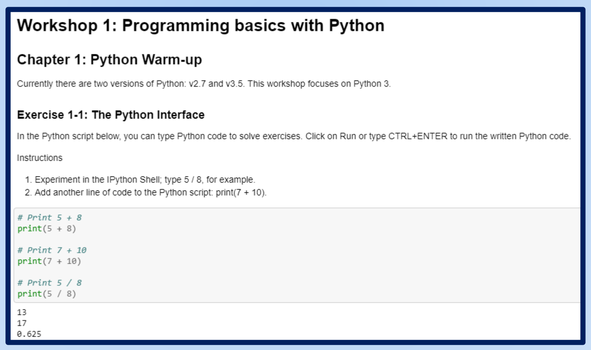

Figure 3: Starting section of the Python workshop

Discussion of results

Through the project two main learning resources were developed which were the supplementary technical guide and the interactive Jupyter notebook workshops. The technical guide may be used by different types of students such as students who are interested in the field of computing but, have not yet started their formal education on the field, students in computing who wish to review concepts they were previously taught, and students who wish to mentor other students in programming concepts, may use the guide as a reference.

Discussion of results (cont.)

From another point of view, the developed workshops are expected to be highly beneficial for community outreach activities since they contain both examples and exercises that presenters may easily discuss while the audience is interacting with code relating to each example and exercise.

Conclusions

The main goal of the project was successfully achieved by developing learning resources that will surely benefit students with the desire to learn. The developed guide and interactive workshops offer students a head start into computer engineering and computer science by teaching them how to use one of the most important tools for the computer scientist and engineer; programming. Additionally, the popular topic of machine learning is discussed to motivate students to learn about topics that are projected to transform our global economy.

Future Work

Developing a technical guide and workshops for topics in computing proved to be a lengthy task due to the large amount of information that could be discussed with simply one sub-topic. For future work, the development of technical guides and workshops for more topics would be recommended to create a more complete guide to the field of computing. The inclusion of the following topics would make for an interesting guide: Operating Systems, Databases, Computer Architecture, Human Computer Interaction, Robotics, Networks, and Theory of computation.

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