Asteroid Classification Using Multilayer Perceptron

Zhina Babania, Farzanegan 1 high School: zhinababania2006@gmail.com

A R T I C L E   I N F O

A B S T R A C T

Have you ever thought about the destruction of mankind? What causes the destruction of the planet earth? Can we examine one of them? Is there a way to prevent the destruction of the Earth? In this project asteroids are investigated. . A key element of this idea is the new structure of the information processing system. The system consists of a large number of highly interconnected processing elements, called neurons, which work together to solve a problem. We have used python as the programming language to implement the model.

Key Words: *planet earth, asteroids , processing*

1 Introduction

Asteroids play a vital role in the future of humanity, and scientists have shown great attention to them. Asteroids are important for three reasons. The first and most important reason is that they may have been sent by aliens; such as the Oumuamua asteroid, which has been the subject of much debate. The second reason is the possibility that human life continues after the destruction of the planet with the help of asteroids (of course it is not possible to live on asteroids, but it is possible with our knowledge about them, we may be able to reach other planets that are also in the solar system). The third reason is that asteroids can collide with the earth like meteorites and destroy it.

What is our problem? In this project, an attempt has been made to use Python programming language with a computer neural network algorithm to create a program to prevent and threaten the extinction of the Earth's orbit by examining and predicting the most important features of asteroids, and this can answer to some extent. "Are we alone in the world?".

What are our goals now? Building a program to identify and predict the properties of asteroids (large half-diameters), as well as learning more about the space and world we live in, learning about the computer neural network in Python, and encouraging others to Follow up on the possibility of Earth being destroyed by asteroids and becoming interested in knowing one of the types of celestial bodies in space.

In the field of knowledge, we should have some astronomical information about asteroids, which also includes the characteristics of asteroids. Next we need to know enough about the neural network, which is actually our research method as well as programming, because in this project I used the Python programming language, so we need to know Python very well, which includes a number of libraries. Python is important and finally we must know how to make software with Python so that we can create a good relationship between the program and the user.

1-1 Asteroid Criticism

Why asteroid criticism is important to us. Asteroids play a key role in the future of humanity, and scientists have paid close attention to them. Asteroids are important for three main reasons. The first and most important reason is that they may have been sent by aliens, or in fact the same aliens, to spy on Earth (like the much-discussed asteroid Amu Amua). The second reason is the possibility of human life after the destruction of the Earth with the help of asteroids (of course, life on asteroids is not possible, but with proper knowledge of them, other planets can be found for life). The third reason is that asteroids can hit the earth like meteors and destroy it.

Destroying asteroids is not so easy and we must have a lot of information about them to be able to prevent their damage. As you can see, if we try to destroy asteroids with nuclear energy, they will become a large number of little asteroids (Fig.1).

Fig. 1: The importance of Asteroids

1-2 Characteristics of Asteroids

Some important features of asteroids, such as Elliptic orbit by eccentricity, perihelion distance and Longitude of the ascending node are shown in figure (2). By using these features we can be able to predict semi-major axis.
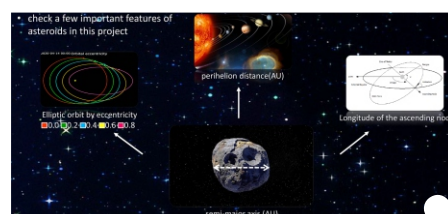

Fig. 2: Some important features of asteroids

1-3 Data in NASA about Asteroid

In 2013, NASA introduced the "Big Asteroid Challenge", to be more prepared for such events. One of the activities offered in this challenge was to collect information about a large number of asteroids in the Solar System and to study the construction of bands for detecting asteroids. Finding out the material composition of the asteroids is also helpful before deciding which strategy is appropriate and what to expect. In this work, we investigate the hypothesis of some scientists about the connection between the destruction of the Earth and asteroids. For this reason, we are using the data collected by NASA about all discovered asteroids (approximately 839737 asteroids).

In this dataset we have features of each asteroid like location, components, and so much more. We adopt a machine learning method to classify asteroids based on these features. Artificial intelligence (AI) is a branch of computer science whose main purpose is to produce intelligent machines capable of performing tasks requiring human intelligence. We have trained neural networks for our asteroid classification task. A neural network is an idea for information processing inspired by the biological nervous system, which processes information like the brain.

I found 2 projects similar to my own project. One is the NASA project. Well, in fact, my project is made easier by the inconvenient project. Since 2013, NASA has categorized all asteroids and predicted all their features; But NASA came to do this, built a robot (I did not write a program) and its activities are still going on. But the good thing about my project is that anyone who is interested in the field of astronomy and asteroids, can easily work with it and does not require any special expertise. It is already available. However, the NASA robot is limited to its own members and the accessibility is a bit tricky. I also found an article that dealt with the same classification of asteroids, but its method and databset were different from mine, and of course its output was different from mine, and this person did not write a program like me at all, as if it were a research on Classification of asteroids done.

2 Methods

Our research method is with neural networks. A neural network is an idea for information processing inspired by a biological nervous system that processes information like the brain. The main element of this idea is the new structure of the information processing system. This system is made up of a large number of interconnected processing elements called neurons that work together to solve problems.

Well now in this project we get a machine learning method for predicting the large half diameter of an asteroid based on input characteristics. Artificial intelligence, or AI, is a branch of computer science that aims to produce intelligent machines capable of performing tasks that require human intelligence. Then we came here to train neural networks for our asteroid task (Fig. 3).
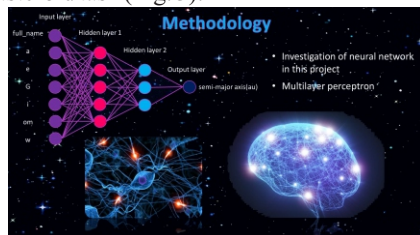

Fig. 3: Methodology

Regarding why we used multilayer perceptron, I must say that: There are different ways to categorize data. Now that we wanted to use artificial intelligence and neural networks, the simplest way we could get good results is multilayer perceptron, When we arrived, we selected two neural layers consisting of several neurons, which are sigmoid and relu.
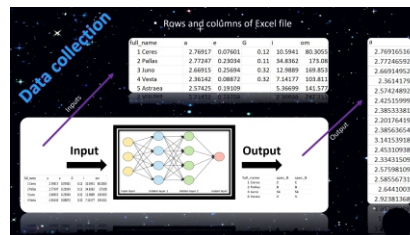

Fig. 4: Data Collection

We have used python as the programming language to implement the model. The libraries which we have primarily used in python are NumPy and pandas for data analyzing, sklearn for pre-processing, implementing the dense layers and model evaluation, matplotlib and seaborn for data visualization and we used Tkinter to build the app. We also used keras , tensorflow and xlrd for the other part of our program.

Now we want to show what it looks like when we run the program: Well! When we run the program, a window called AI opens for us. To use the program, we have to click on the Browse button (browse) exactly as shown in Figure 1, and then we have to select the Excel file we want. Then, this link comes up, we have to click on the Press button. Now the program starts running, but due to the large size of the Excel file, our program takes a while. When the program is completely run, 5 Excel files are saved in a folder called CSV and we can see the program output.

3 Results and Conclusions

In summary: In this work we discussed asteroids and why it is important to learn more about them and predict their properties, and we also used data provided by NASA on about eight hundred thousand asteroids and their characteristics. . In our project, we chose a two-layer neural network that predicts a large half-diameter with relatively high accuracy due to a set of asteroid features that are about twenty. And finally, we will easily complete our program in the form of a few Excel files that are our output.

In this project, like many other projects, there were some limitations, for example, because I did not have all the information about the asteroids, so it made it harder for me to write a program, and it took me a long time to program.

Other than that, many asteroids have not yet been discovered at all, and if they had been discovered, my program could have run much better now. Well, the next limitation was that I could not use all the properties of asteroids like the ones I showed in this photo, because being a string means being a set of letters and not a number, and my program can only categorize and predict based on a set of numbers not strings. The last limitation of my program was that because I coded in Python, the program crashes and runs slower than other programming languages such as C ++. But the slowness of the program is natural. It is a heavy program as well.

Now, if we want to look at the future of the project, for example, we can predict other features of the asteroid

instead of the large half-diameter. We can also work with nebulae, stars or planets instead of asteroids, or we can even use different subjects instead of astronomy.

References

[1]   Available: https:// www. sarpoosh. com/ science/ scientific articles/ extinction dinosaurs earth 980623 html.

[2]   C.Q. Choi , " Asteroids: Fun Facts and Information About Asteroids," 20 Sep 2017 . Online]. Available: https:// www. space. com/ 51 asteroids formation discovery and
exploration. html. [Accessed 19 12 2019.

[3]   Deep Asteroid," Open Nasa, [Online]. Available: https:// open. nasa. gov/ innovation space/ deep asteroid/. [Accessed 7 11 1398.

[4]   NASA Asteroid Classification," [Online]. Available: https:// towardsdatascience. com/ nasa asteroid classification 6949 bda 3 b 1 da.