Communications of BAO, Vol. 67, Issue 2, 2020, pp. 329-334

Asteroid Detection using Machine Learning Algorithm

L.V.R. Chaitanya Prasad[1], T. Anjali Shivani Reddy*[1], and Bhuvaneshwari Kashi[2]

[1]Sreenidhi Institute of Science and Technology, Dept of Electronics and Communications, Telengana, India
[2]CVR College Of Engineering,Dept Of Electronics and Communications, Telengana, India

Abstract

My paper starts from the question many of us wonder 'What if an Asteroid hit Earth? The answer depends on how big an asteroid is in terms of dimension- Let's say an asteroid of baseball ground hits earth, which can completely erase a city. Most of the asteroids are detected by Satellites, Probes and telescopes with large aperture length. Mostly large Telescopes from earth are used for tracking main belt asteroid but what if it gets out of sight from researchers or Scientists; it might take away peoples life. In this paper, I introduced machine learning to detect the asteroid with more than 60 percent of efficiency. The famous Scientist Stephen Hawking wrote in his last book that 'Asteroids are great threatened to the planets'. Machine learning being a one of the best predictive method without explicitly giving any external command. In this paper, I attempt to introduce new machine learning algorithm in the replacement of Astrometrica software with Pan-Starr Telescope real-time Fits file data which is located in Hawaii, USA.

Keywords: *asteroid, astrometrica software, PAN-STAR telescope. machine learning*

1. Introduction to Asteroids

Asteroids are smaller moving objects in space. Every year around thousands of asteroids is entering into earth's orbit apart from meteoroids and comets but only 10-20 we can actually noted. Because many of them evaporate into small particles before reaching the earth. There are different classification of asteroids are done based on composition and their belt orbit- C,S,M based on composition and dark c, bright S, bright M based on their orbit. Some asteroids are found to be in NEO as long as they don't overlap with earth's orbit, we are safe. Most popularly we heard main belt asteroid between planet Mars and Jupiter which has greater probability of entering into earth's atmosphere.

Asteroid impact is one of the reasons for dinosaurs' extinction. They is a theory suggest that a mountain sized asteroid entered into earth atmosphere because of high speed, there was terrible impact on the organisms living on earth. Today in modern world, if an asteroid is detected after danger zone, we still cannot destroy asteroid using any available techniques – for instance if one want to use kinetic method to destroy, it is actually just multiplying own problems or trying with laser might be apt for reasonable size of asteroid but it might not work for huge size asteroid like planetoids. Craters in moon and earth are created by asteroid but if falls in a busy city, and then there will be huge loss to mankind. There are many technologies in use for destruction of these deadly Asteroids but most of the technology must be implemented in space, which is indeed difficult to deal with it. Detecting at first place will be good choice rather than destroying them after reaching the danger zone.

2. Asteroid Detection-current techniques

There are many Satellites and probes in space using a far better image processing to detect asteroid in space. Now a day's people are coming up with the nana satellite and innovative ideas for detection.

*anjalishivani99@gmail.com, Corresponding author

DOI: 10.52526/25792776-2020.67.2-329

Telescopes with large aperture size play prominent role in asteroid detection producing thousands of Fits file. A specific software are used in detecting asteroids from sets.

From my own experience, I got to use one such data in All Indian Asteroid Search Campaign where data is given from international telescope (pan-star) to Researchers, Scientists and common people to discover the asteroid using Astrometrica software by blinking the images the asteroid can be manually detected using brightness and Gaussian curve .

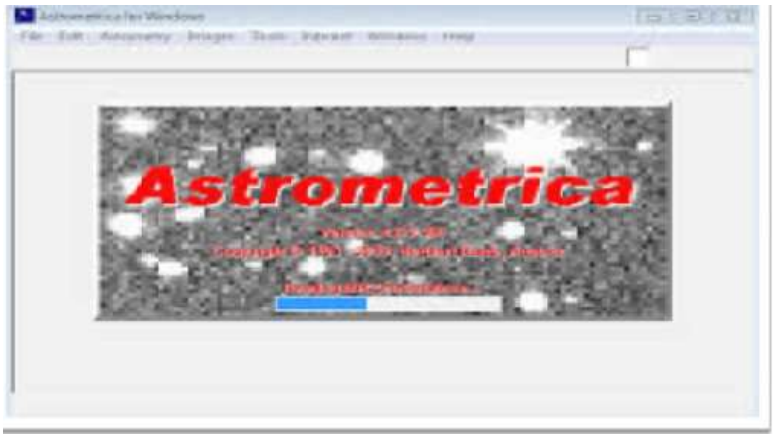

Figure 1. Astrometrica Software

.

Fits files are accessed from IAISC Website and each set consists of four fits files. These are reduced in size to perform blink operation.

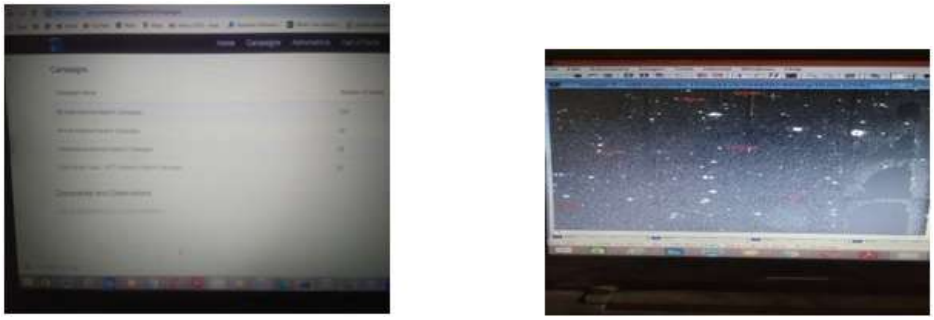

Figure 2. Left panel: Fits file download; right panel: Features of Astronomica

.

Fits files are accessed from IAISC Website and each set consists of four fits files. These are reduced in size to perform blink operation. Using blinking the images the pattern is predicted and named and report is generated as shown. The data can be reduced into required size and converted into pixels from inbuilt feature of software or using python. Reduced data takes any 9 stars as reference from 200 to 400 catalog stars as shown.

3. Replacement of Convenient method of detection with machine learning

Always there may not be possibility of recognizing the asteroid with human eye but machine learning with good test code can actually ease the detection with more efficiency.

Machine learning can be implemented with many software like R, JavaScript but I choose Python with pandas, nunpy,matpy libraries with one more important astronomical library 'astropy' to work on fits file. Anaconda with python 3.7.1 version jupyter notebook i will be further working to obtain the same result as Astrometrica report. Installation pip and following libraries are done in jupyter notebook. Data reduction is performed using numpy and reduced data is displaced by matpy as shown

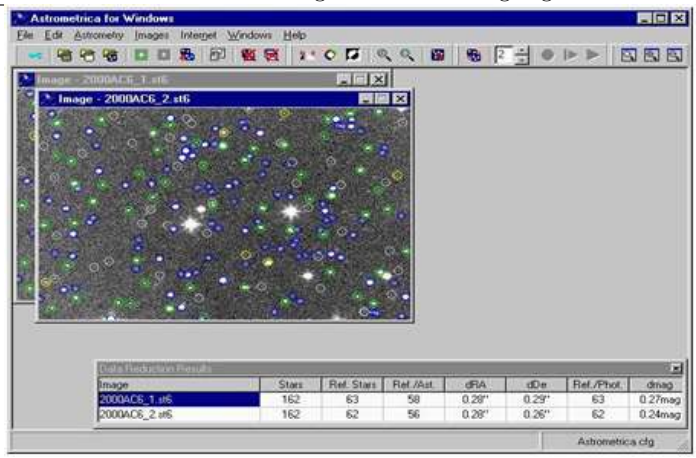

Figure 3.

.

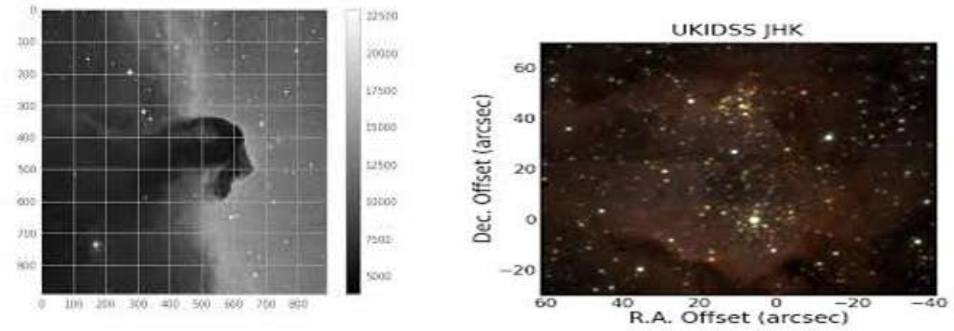

Figure 4.

.

4. Detection of Asteroid and stars

Stars and Asteroids are detected as point source rejecting the fussy type sources using photometry libraries in python. For instance, I used DAO star Finder Algorithm to write the object coordinate system and flux and using numpy the data can be stored in word document.

5. Machine learning Algorithm Implementation

The data with same flux are considered and using machine learning, they are points which form linear equation at least with three data points out of four are named as asteroid. Here a new machine learning algorithm is used to form linear equation based on test data with various cases.

6. Results and Conclusion

Output is verified from overlapping predicted values to original values in graph form as shown.

Here I used 500 data sets to recheck with the prediction and two real time data to verify the asteriods, which it is taking minitues to give predict the asteriods where as in Astrometrica software it takes days and months to detect asteriods. Machine learning technique is indeed useful for this application This paper mostly concentrated on different approach of detecting asteroid including the magnitude classification and convolution method in detail. I conclude that convolution method has high efficiency.

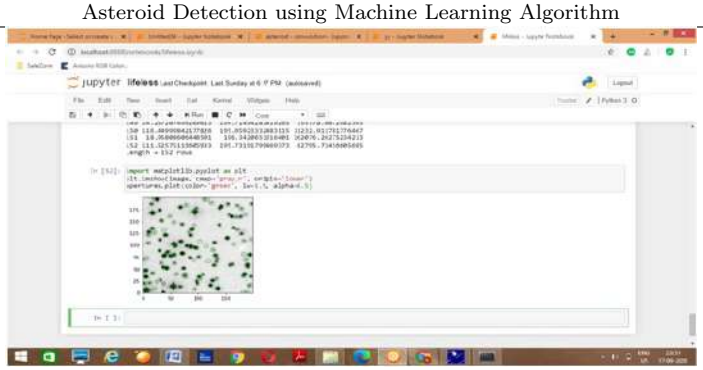

Figure 5.

.

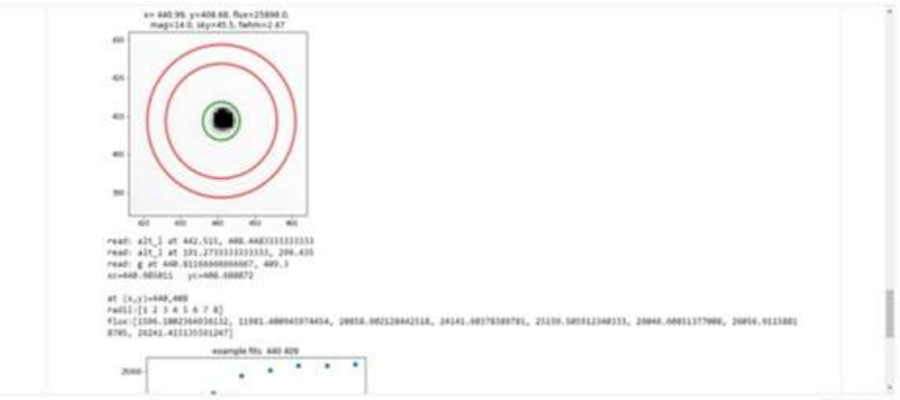

Figure 6.

.

7. Future Scope

One can easily implement this method of prediction with knowledge of python and libraries. Though it requires too much of test data, On positive note: There are many websites data are available like zoo universe. Even one can approach by contacting any receiving telescope ground station

I think more efficiency can be increased by taking Gaussian curve into consideration and latency can be reduced. I am continuing my work further. I will be coming up more efficient algorithm.

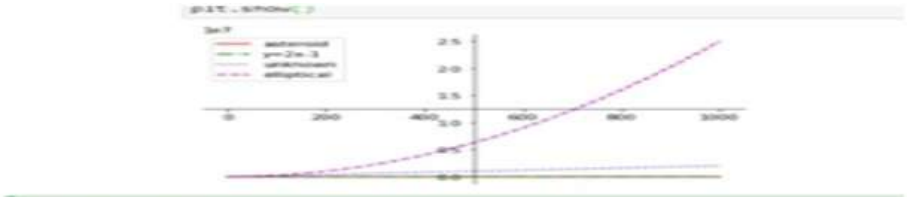

Figure 7.

.

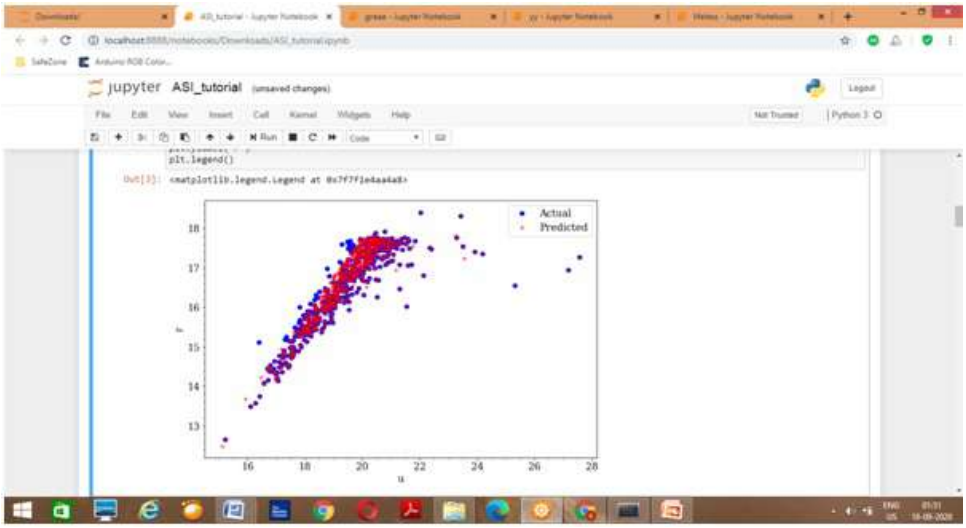

Figure 8.

.

References

1. Asteroid. NASA – Jet Propulsion Laboratory. Retrieved 13 September 2010.

2. Frequently Asked Questions (FAQs) – What Are Asteroids And Comets? CNEOS. Archived from the original on 9 September 2010. Retrieved 13 September 2010.

3. What is the difference between an asteroid and a comet?Cool Cosmos. Infrared Processing and Analysis Center. Retrieved 13 August 2016.

4. Jump up to Rubin, Alan E.; Grossman, Jeffrey N. (January 2010). "Meteorite and meteoroid: new comprehensive definitions". Meteoritic and Planetary Science. 45 (1): 114–122. Bib code: 2010MPS...45..114R. doi:10.1111/j.1945-5100.2009.01009.x.

5. Atkinson, Nancy (2 June 2015). What is the difference between asteroids and meteorites?. Universe Today. Retrieved 13 August 2016.

6. Britt, Robert Roy (4 February 2005). Closest Flyby of Large Asteroid to be Naked-Eye Visible. SPACE.com.

7. Jump up to: Latest Published Data". International Astronomical Union Minor Planet Center. Retrieved 11 March 2020.

8. United Nations General Assembly proclaims 30 June as International Asteroid Day. United Nations Office for Outer Space Affairs (Press release). 7 December 2016. UNIS/OS/478.

9. International cooperation in the peaceful uses of outer space. United Nations. Rapporteur: Awale Ali Kullane. 25 October 2016. Retrieved 6 December 2016.