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USING MACHINE LEARNING TO PREDICT RISK INDEX OF ASTEROID COLLISION

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ABSTRACT

Predicting risk of asteroids colliding with Earth is a challenging exercise. Many asteroids are too small to be detected from Earth in advance and it is difficult to predict their precise orbits. They can only be observed on their final approach. On 15 April 2018, Asteroid 2018 GE3 swept by at half the moon's distance just hours after being detected. Its size was 3 to 6 times that of the space rock that penetrated the skies over Chelyabinsk, Russia, in 2013. Current mechanisms for detecting asteroids on final approach rely on wide-field ground-based telescopes. But these telescopes are not powerful enough to detect the smaller asteroids (less than 140 meters).

As the amount of data coming from sky surveys and ground-based telescopes is rising manifold, the number of astronomers to analyse data is not. Machine learning can be a useful tool to look for patterns in massive data in real time. We used feed forward neural network to create an index which lists the risk of an asteroid colliding with Earth using data from NASAs' Centre for Near Earth Objects (CNEOS). The input layer to this Neural Network constitute of three parameters: velocity of the asteroid, its diameter and apparent magnitude. The output layer of the neural network was the Risk Perception Index modeled on NASA's Palermo Technical

Impact Hazard Scale. It compares the likelihood of the detected potential impact with the average risk posed by objects of the same size or larger over the years until the date of the potential impact.

Interestingly none of the asteroids modeled by our algorithm came up with a positive risk index. It indicates that the risk of an asteroid colliding with Earth is essentially very small but non-zero. The index followed a normal distribution centered at-risk index of -4 on a logarithmic scale. It implies that the current risk is ten thousand times less than a random background event.

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