We should use nukes to deflect asteroids, says astro algorithm

By Jacob Aron

asteroid
What could we do if an asteroid was on a collision course with Earth?
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IF AN asteroid was set to hit Earth, humanity would have to scramble to conduct the world's riskiest experiment. We have never tried to shove a space rock off its course, so any defence effort would be a shot in the dark.

People have come up with ideas – like chucking nuclear weapons at an incoming threat – but with limited asteroid defence budgets, which should we pursue? An algorithm called the Deflector Selector says nukes would do the job about half the time.

To be clear, Erika Nesvold, formerly at the Carnegie Institution for Science in Washington DC, and her team don't suggest we give a computer free reign over nuclear missiles. "We are absolutely not advocating putting the algorithm in charge of asteroid defence," she says.

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Instead, their machine learning algorithm can study a population of potentially hazardous objects, and determine which technology has the best chance of deflecting them from Earth's path.

To build the algorithm, Nesvold and her colleagues simulated six million hypothetical objects with the potential to hit Earth. Next, they looked at how early each could be detected before collision, and the velocity change needed to knock it off course. Finally, they looked at which of three technologies would be best at doing this: nuclear weapons, kinetic impactors or gravity tractors.

Nuclear weapons release an explosive force, while a kinetic impactor is

essentially like trying to shoot one bullet out of the air with a much smaller one. Gravity tractors are more subtle. The idea here is to put a spacecraft near an asteroid, and let its gravitational pull slowly tug the rock off course, but the concept hasn't been tested.

All this number crunching required a cluster of 100 computer cores running for around 40 hours. To bring the timing down, the researchers turned to machine learning. Using the simulation as training data, they taught an algorithm to study a given population of objects and decide which tech had the best chance of deflection. Nesvold says after the algorithm is trained, it can supply an answer in seconds instead of hours.

The team tried their trained algorithm on three populations: hazardous near-Earth asteroids, comets and rubble piles – loose collections of material, rather than solid objects. In each case, nuclear weapons could tackle about 50 per cent of the objects. Kinetic impactors and gravity tractors had lower success rates (arxiv.org/abs/1802.00458).

That might suggest we should invest in nuclear weapons as our asteroid defence of choice, but there are issues when it comes to mounting these on rockets. "The risks created by pursuing a nuclear asteroid defence programme would far outweigh the actual risks posed by asteroid impacts," says Eric Christensen at the Catalina Sky Survey.

The gravity tractor success rates improved when the asteroids were spotted earlier. "That points to the need for better asteroid monitoring and detection surveys," says Nesvold. "Earlier detection of potential impactors will provide more lead time to plan and execute a mission," agrees Christensen.

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