Using AI to count and map craters on the moon

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Side view of the crater Moltke taken from Apollo 10. Credit: Public Domain

A team of researchers affiliated with several institutions in China, one from Italy and one from Iceland has used a machine-learning artificial intelligence application to count and note the location of over 100,000 craters on the moon. In their paper published in the journal *Nature Communications,* the group describes programming their system to recognize craters by training it with data collected by Chinese lunar orbiters.

Prior work identifying and mapping craters on the moon has tended to be a slow process—it has generally been done by hand, with researchers studying photographs and transferring those observations to maps or moon globes. In this new effort, the researchers have found a way to dramatically speed up the process by teaching a computer to identify craters and then to count them.

Teaching a computer to recognize craters on the moon has been a difficult process due to the many forms craters can take. Not all are round, and they are of different ages, which means defining characteristics have eroded over long periods of time. Scientists would like to map all of the craters on the moon and to date each one of them—doing so could provide a unique way to study the history of the solar system.

The new approach by the team working in China involved training a machine-learning application on the basics of craters. It was then trained to see craters with a broader perspective with data from China's Chang'e-1 and Chang'e-2 lunar orbiters. Once the system had learned what to look for, the researchers used it to analyze data from the Chang'e

5 lander, which was part of the Chinese mission that retrieved rocks from the moon's surface. The AI app used that data to identify and count craters on the mid- and low-latitude regions of the moon. The new system counted 109,956 craters—far more than have ever been counted on the moon before. It also kept track of the location of each of the craters it found and placed each one into a predefined geological time period based on how much the crater had eroded.

More information: Chen Yang et al. Lunar impact crater identification and age estimation with Chang'E data by deep and transfer learning, *Nature Communications* (2020). DOI: 10.1038/s41467-020-20215-y

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