Using machine vision for 3-D printing

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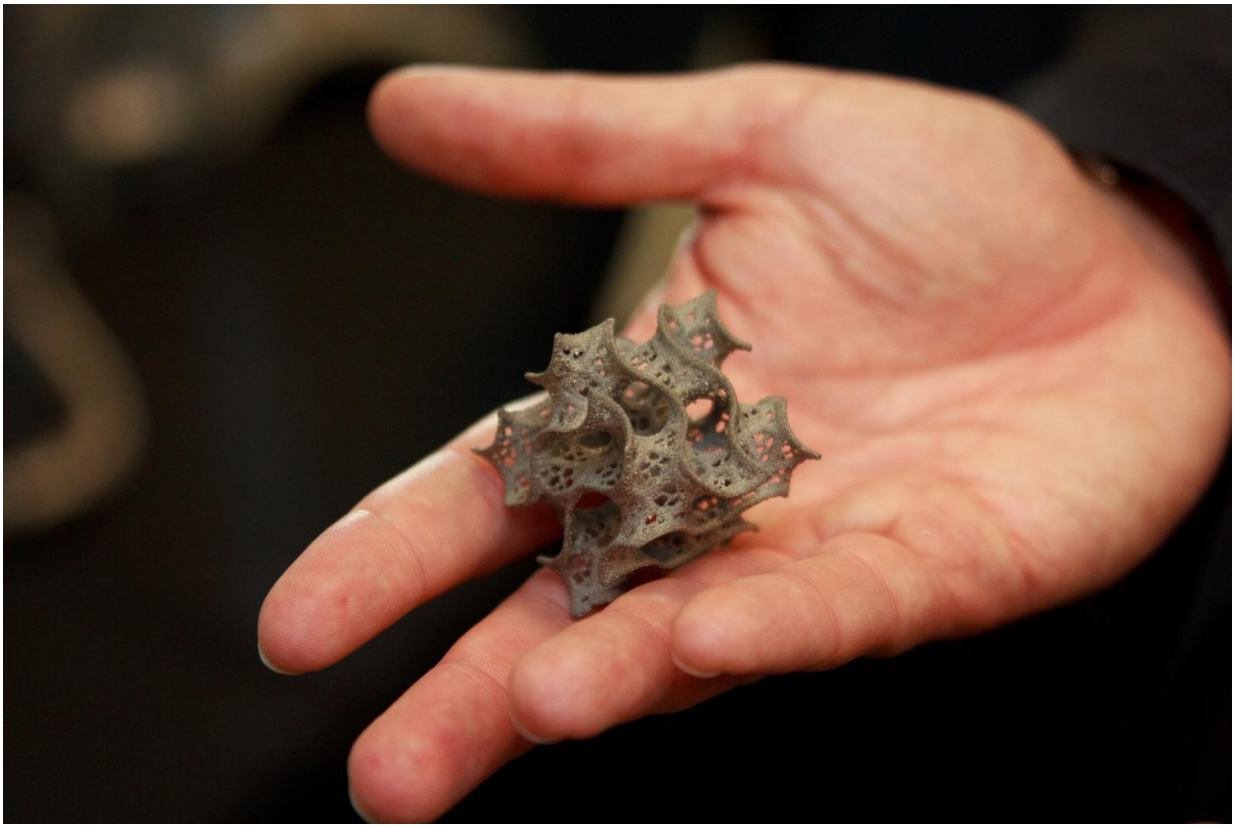

Credit: Neil Richmond

Researchers from Carnegie Mellon University's College of Engineering have developed machine vision technology that can autonomously identify and sort metal 3-D printing powder types with an accuracy of more than 95 percent—more precisely than current manual methods, which also require much more effort and time. This cutting-edge system

will enable 3-D printing machine users to accurately test and qualify printed metal parts for any number of applications, including aerospace and medical devices. The CMU research team expects that this technology will be integrated into the 3-D printing field within the next five years.

"In traditional manufacturing, parts are often qualified through destructive testing. A company might produce multiple parts and physically test them to see how they hold up to stress and fatigue. However, that costs a lot of time and money, so it should be avoided in additive manufacturing in order to preserve the on-demand nature of 3-D printing," explains Elizabeth Holm, professor of materials science and engineering at Carnegie Mellon, and primary investigator of this research. "We therefore are looking to new qualification concepts like machine learning to guarantee successful 3-D printed builds."

By training a computer to autonomously identify and sort powders, Holm and her team can easily recognize whether or not a metal powder has the microstructural qualities associated with production of a part with desired properties, such as strength, fatigue life, and toughness.

In the study, "Computer vision and machine vision for autonomous characterization of AM powder feedstocks," Holm and her team applied computer vision and machine learning methods to eight different commercial feedstock powders. They found that the machine vision system captures more about metal 3-D printing powder than is possible with normal manual measurement. It can measure important information such as how big particles are, how particles group together, the surface roughness of particles, and the shape of particles. The team also found that technology can tell metal powder types apart even when humans cannot.

"Importantly, the machine vision approach is autonomous, objective, and

repeatable. This type of standardization is necessary to advance quality assurance in the field," says Holm.

Holm and her team are leaders in the additive manufacturing field for their use of machine vision for qualification of materials. This computer science technique has rarely been applied to the materials science and engineering space, but holds promise for future research in autonomous microstructural analysis.

The study was recently published in *JOM*, the Journal of the Minerals, Metals, and Materials Society.

More information: Brian L. DeCost et al, Computer Vision and Machine Learning for Autonomous Characterization of AM Powder Feedstocks, *JOM* (2016). DOI: 10.1007/s11837-016-2226-1

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