

# Engineers develop machine that visually inspects and sorts strawberry plants

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Researchers at Carnegie Mellon University's National Robotics Engineering Center (NREC) have developed a plant-sorting machine that uses computer vision and machine learning to inspect and grade harvested strawberry plants and then mechanically sort them by quality — tasks that until now could only be done manually.

In a successful field test this fall, the machine classified and sorted harvested plants more consistently and faster than workers could, with a comparable error rate.

"We're looking forward to using the system," said Liz Ponce, CEO of Lassen Canyon Nursery in Redding, Calif., one of five strawberry plant producers sponsoring the NREC project. "All of our stakeholders feel that it has a lot of potential." The other sponsors are Driscoll Nursery Associates; Nor Cal Nursery, Inc.; Plant Sciences, Inc.; and Crown Nursery LLC. Together, the five producers represent about 85 percent of the California strawberry plant nursery market.

To maintain good strawberry yields, commercial berry growers must replace their plants every year. During the fall harvest season, strawberry plant nursery farms use manual labor to sort several hundred million strawberry plants into good and bad categories — a tedious and costly process.

The strawberry plant sorter uses [computer vision](#) to examine harvested plants that pass by on a conveyor belt. The sorter's novel machine

learning algorithms allow it to be taught how to classify strawberry plants of different sizes, varieties and stages of growth, beyond the simple classification of good and bad plants. This introduces dramatic new efficiencies for strawberry nursery farms, helping them improve quality, streamline production and deliver better strawberry plants to berry growers, which in turn produces better strawberries for consumers.

"The sorter can adapt to plants that vary from year to year, or even within the same growing season," said Christopher Fromme, the project's manager and lead engineer. "It's very flexible."

During a 10-day field test in October, NREC engineers tested the strawberry plant sorter under realistic conditions, where rain and frost change plants' appearance, and roots may contain mud and debris. The prototype system had to sort plants of different varieties and levels of maturity. While in the field, it sorted more than 75,000 strawberry plants. On average, it sorted 5,000 plants per hour, several times faster than human sorting. The NREC hopes to achieve sorting rates of 20,000-30,000 plants per hour with the final system. While the sorter's overall error rate was close to that of human workers, it inspected and sorted plants more consistently.

"That's the beauty of it," Ponce said. "Hand sorting varies more and has more drift in quality."

The successful field trial concludes phase two of a five-phase program that will develop a machine ready for commercial operations. Phase three will develop better methods to separate harvested strawberry plants for inspection, improve the sorter's robustness and ease of use, and integrate it into the nurseries' harvesting and packaging processes.

Provided by Carnegie Mellon University

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