



SCORPION
VISION LIMITED

AI BASED POST HARVEST VEGETABLE PROCESSING

I OVERVIEW



↑ Leeks cut too short dry out.

Traditional optical sorting and grading systems use classic machine vision to look for features in the product image. These are known or expected features, such as the tip of a carrot or the flat bit of the stem on a leek when it transitions to the roots. Most of the time these features conform to a pattern or shape that is expected. With an organic object such as a vegetable, there is never a fixed size, shape or colour of anything, and this presents a problem to classic camera systems that only rely on known shapes or patterns because the variation means that there will always be a high percentage of unknowns.

In an automation system that relies on classic machine vision, this can translate to a relatively poor yield output from the machine.

60%

of leeks may be correctly processed with the roots cut correctly at the exact point.

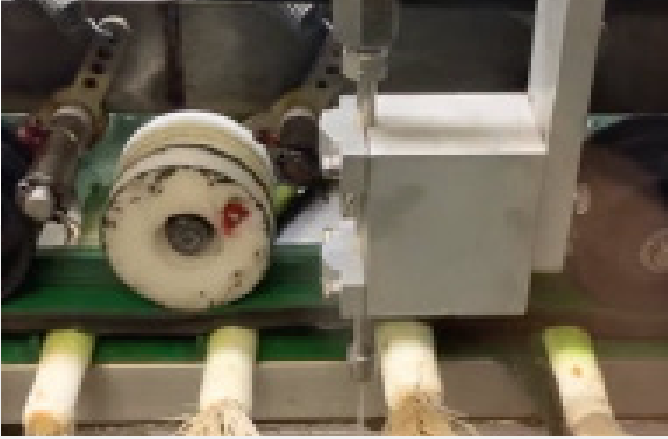
20%

of leeks may be cut roughly, at a poor angle or slightly too short/too long.

20%

of leeks may be written off or not cut at all.

AN EXAMPLE SCENARIO

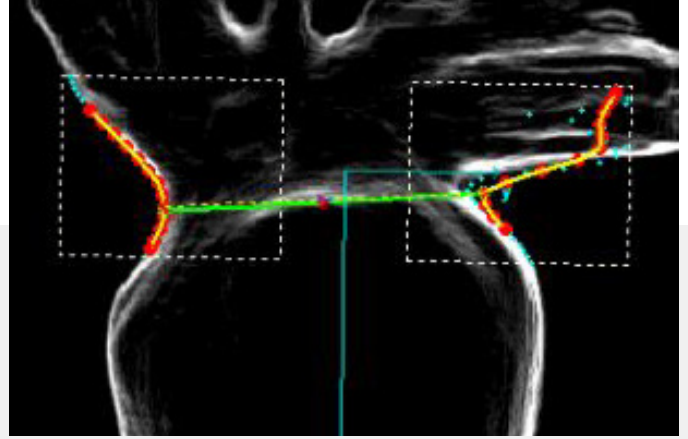


TRADITIONAL TRIMMING SYSTEM

An optical leek trimming system is designed to cut the root from the stem base to within a millimetre. This is important as if it is cut too short and into the stem, the leek will dry out very quickly reducing shelf life. Or, it may cut into the roots, leaving roots attached, requiring the product to be re-worked.

So it may be that:

- 60% of leeks may be correctly processed with the roots cut correctly at the exact point.
- 20% of leeks may be cut roughly, at a poor angle or slightly too short/too long.
- 20% of leeks may be written off or not cut at all.



PRECISION CUTTING

Applying AI improves machine vision performance dramatically. In the leek trimming example given, it can be quite difficult to determine the stem plate when it is obscured by roots or other debris. Showing the machine some examples of the stem plate in a variety of conditions and highlighting the important features means that the machine can make its own conclusion about what it sees and identifies.

The result is much more robust image processing. As described earlier, the biggest challenge when processing organic products is inconsistency in the produce itself. A machine vision system that utilises AI can remove the doubt and improve the decision making so much so that repeatability can be increased to near 99%.

| 3D MACHINE VISION



AGRICULTURAL WASHDOWN CAMERA

Stereo Vision

Neural Network

AI + 3D = Precision and Repeatability

Utilising stereo vision enables a machine to sense depth. This translates into the ability to measure the profile across an object and not just the outer dimensions. In the case of the leek, this means the 3D measurement of the stem creates additional data for the decision making process as the shape of the stem can be taken into account.

APPLICATION LIST

Grading: Poorly formed product can be identified and removed.



The same 3D and AI technology can be used on any vegetable to supplement the work of a human being. A person who uses their two eyes and hands to manipulate a vegetable so that it is cut accurately, removing unwanted sections, does not require extensive skills to achieve the task. The key is the knowledge of the vegetable and the cut that is required - which can be emulated by a 3D+AI enabled robotic system. Typically, one robot can theoretically process one vegetable per second.

Existing Applications include the following:

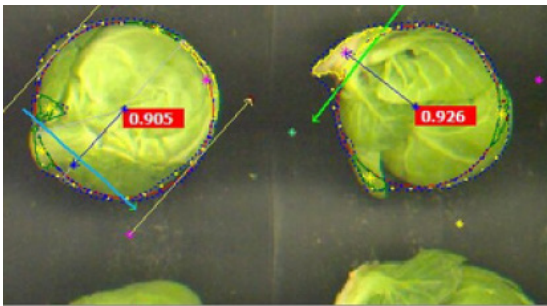
PRODUCT GRADING

All produce can be graded using AI to some extent. Damage from harvesting, root fly and other parasites as well as size can all be assessed before the product is processed. This can improve the machine automation yield.

Theoretical throughput is based on 100% successful automated infeed. In reality this is very difficult to achieve. Estimated yield is around 85-90% of product.

APPLICATION LIST

BRUSSEL SPROUT PEELING



| | | | | | | |
|--------|----------|--------|------------------|--------------|-----------------|----------------|
| sprout | Need Cut | No Cut | Stem Orientation | Not measured | Length 39.60 mm | Width 38.40 mm |
| sprout | Need Cut | No Cut | Stem Orientation | Not measured | Length 38.6 mm | Width 36.8 mm |

Reset statistics

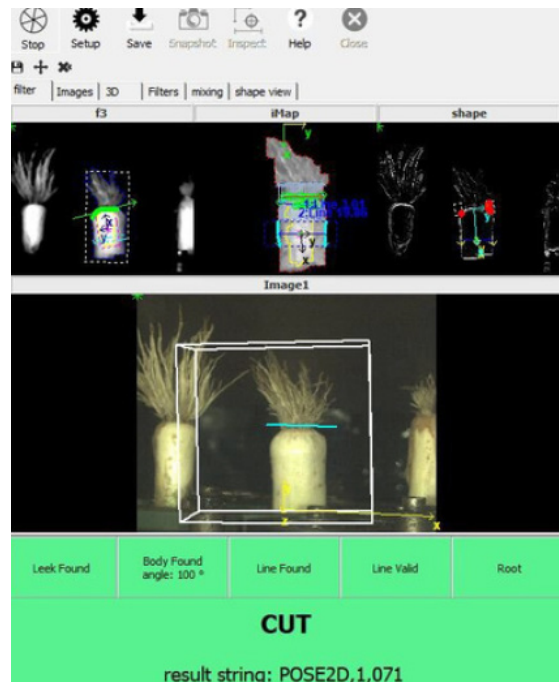
2 Sprout

x1=358.1, y1=-49.6 mm - angle1=131.3 cutpos1=14.4 mm

x2=299.7, y2=-50.2 mm - angle2=217.4 cutpos2=15.3 mm

Robots trim the stem end of the sprout to remove the outer layer of leaves. The system recognises the stem regardless of the variety and cuts a fixed distance from the end. This cut distance can be adjusted.

LEEK TRIMMING



After the leeks are washed, they are passed under a camera which very accurately locates the stem plate to direct a water blade to cut with millimetric accuracy removing the roots and leaving the stem clean and intact.

OPTICAL PROCESS OF SWEDES

ROOT FLY DETECTION

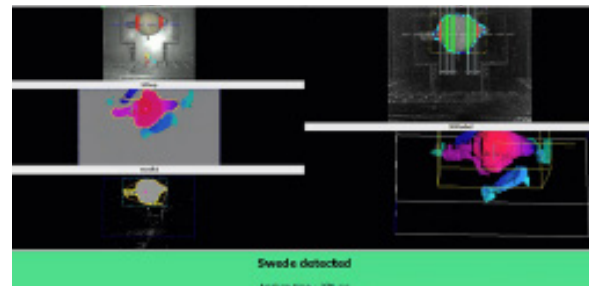


A 3D camera analyses the profile of a swede (or other similar vegetable) and creates an optical cut for both ends of the swede, reducing waste.



▲ Root fly damage can be detected by AI

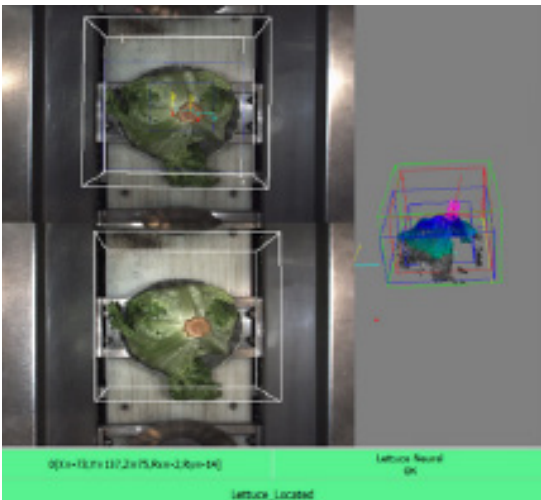
TOP AND TAILING



A 3D camera analyses the profile of a swede (or other similar vegetable) and creates an optical cut for both ends of the swede, reducing waste.

APPLICATION LIST

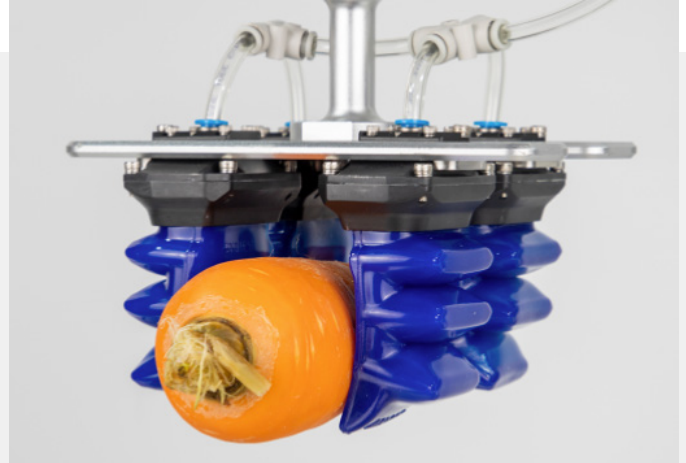
LETTUCE DE-CORING



Automation systems for cutting lettuce and other brassica have been in operation for some time. However, these systems are purely mechanical and do not take into account the product size, how it has grown and its position in the receptacle. The 3D lettuce de-corer analyses the lettuce in real time, calculates the position of the core and directs a robot to extract it with an ultrasonic blade.



CARROT BATONING



Automated carrot batoning is another example of a mechanical only process. Using 3D+AI to measure up the carrot before it is batoned removes any error and food waste.





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THANK YOU