CASE STUDIES
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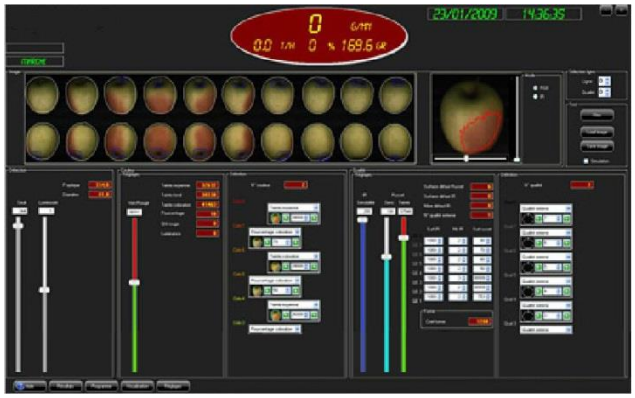
Fruit Sorting and Inspection

It is estimated that more than 30 per cent of fruits and vegetables grown for North American consumers are discarded before they reach grocery store shelves because of cosmetic imperfections. An apple is too small, a pear is the wrong colour or a cucumber is misshapen. Imperfect produce that does manage to reach supermarkets remains unsold for the most part and ultimately ends up in landfill sites. In this era of skyrocketing food costs and global shortages it is in everyone's best interests—growers, packers, distributors, retailers, and consumers—to reduce this waste.

A French multi-national company has designed and manufactured several different types of "sizers", which ensures produce is the correct size, shape and colour, as well as being free from defects. These are conveyors with 1 to 10 parallel lanes and 1 to 64 outlets that process different types of fruit ranging from cherry tomatoes to melons. The number of lanes determines the processing capacity of the machine—10 to 15 pieces of fruit per second, per lane—and the number of outlets defines the number of categories that the machine can sort.

One of these systems is a sophisticated, fully automatic vision system that sorts fruit as it moves along a sizer. The system allows packers to accurately grade fruit according to pre-established quality and colour criteria to meet market requirements. Processing and packaging costs are reduced as substandard fruit is immediately removed from production batches.



A 3D display provides the operator with information on a piece of fruit's size, colour and any defects.

The vision system includes proprietary double sensor CMOS high-resolution cameras (one colour and one infrared camera per lane), acquisition boards, and LED lighting. Twenty colour pictures and 20 infrared pictures are taken of each piece of fruit as it moves and rotates forward—covering 100 % of its surface. The vision system can perform optical sizing (equatorial or maximum diameter, volume integration), colour sorting (eight different criteria), and detection of external defects on the fruit.

The images are then processed using the Matrox Imaging Library (MIL) toolkit. Binarisation and blob analysis are used to separate the fruit from its background and to obtain dimensions like Feret diameters and elongation, for example. The HLS (Hue, Luminosity, Saturation) colour space conversion and statistical functions are used for colour processing. Convolutions and custom-designed algorithms recognize stems and cores, and reject fruit with defects on the skin like black spots or russet.

The system's intuitive user interface, which includes a 3D display, lets operators adjust quality and sorting parameters in real-time. These parameters can be stored for future use. The system gives production managers the ability to analyse the data gathered from the vision system and generate statistics by producer, by orchard or field, by species, or by variety of fruit. Reports provide metrics on the batch of fruit that is being processed including size, weight, diameter, colour, and quality.

Original article courtesy of Matrox Imaging