Neural Net Technology Is Key to Self-Learning Vision System

BY MARTY WEIL

As a result of Acuity Imaging's (Nashua, NH) Mentorvision inspection system, which combines the adaptability of a neural network with machine vision and image analysis software, manufacturers can now perform qualitative, automated inspections. According to Bruce Smyth, mathematician for Acuity, Mentorvision represents a new class of machine vision which it calls "intelligent vision."

"Mentorvision utilizes state-of-the-art, neural network technology in order to achieve real intelligence about the product being inspected," claims Smyth. "The end result is an inspection system that addresses demand in the packaging industry for global inspection and aesthetic quality assurance."

The Windows-based Mentorvision product recognizes a wide variety of defects in packaging from precise measurement to unpredictable flaws such as drips, wrinkles, dirt, or wrong labels. By employing a "show-and-go" approach, Mentorvision "learns" a product by viewing good and bad product on the production line and receiving instructions as to which is which from the operator.

"The show-and-go aspect of the system will revolutionize packing inspection," according to Smyth, "because the Mentorvision inspection system provides qualitative inspection—in other words, it looks for anything, anywhere, anytime.

"For example, on a food package, the requirement may be to identify packages with drips, yet the drip may be anywhere and any size on the package," according to Smyth. "Mentorvision is designed for such inspection applications, where quality is highly valued but not necessarily measurable or geometric in nature."

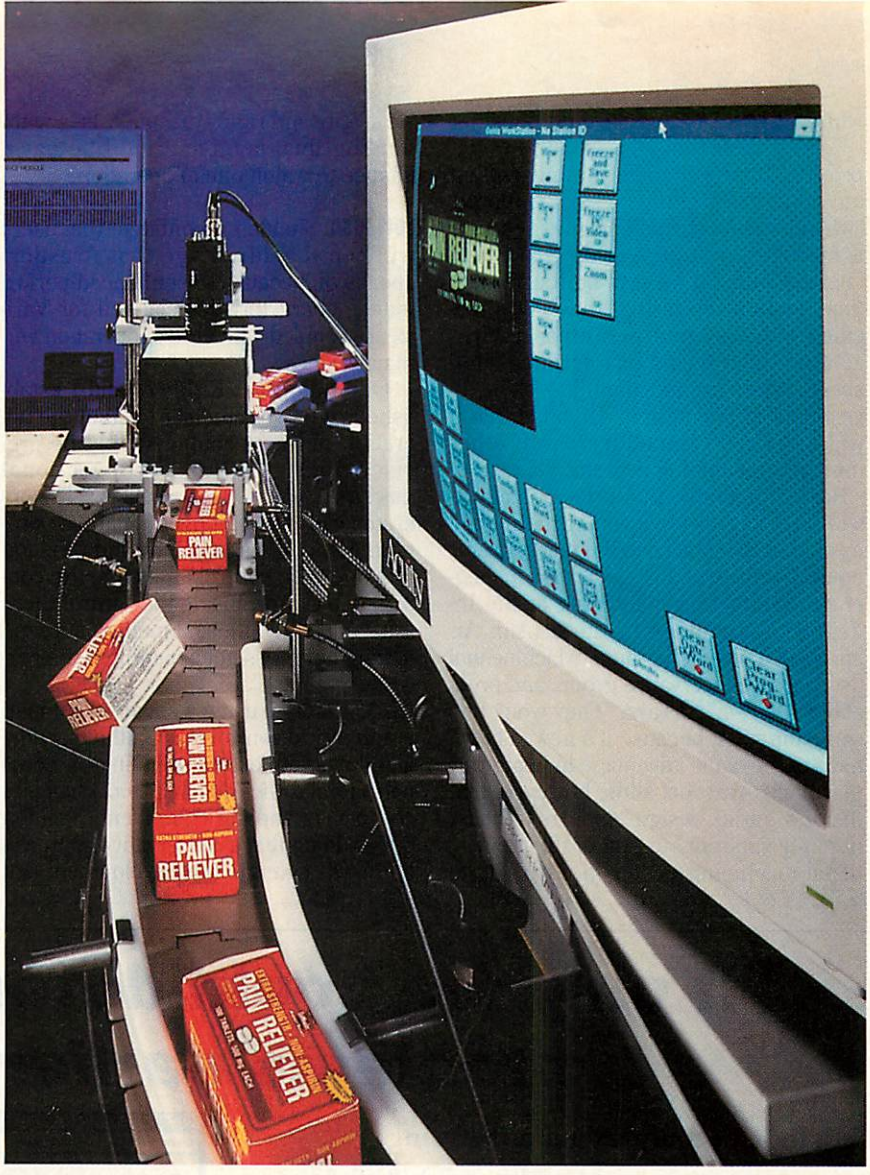

Photo courtesy, Acuity Imaging Inc.

Designed for high-volume, multiline manufacturing operations where high value is placed on the external or cosmetic appearance of the product, Mentorvision can recognize a wide variety of defects in packaging.

Mentorvision is being used as a beta on one of 12 lines at Colgate Palmolive (Paris, France) to learn the entire set of variable labels and perform a full set of automated inspections. The system is checking for presence/absence of labels, position, correctness of labels, and whether the bottle cap is screwed down.

Prior to Mentorvision, Colgate depended on a label detector to check for presence of the first two labels. Using its neural network technology to learn what comprises a good set of labels, Mentorvision has been fully trained to inspect the production line. MA

Developing a 21st Century Spindle

As Joseph Coppola, chairman and CEO of Giddings & Lewis puts it, "The spindle is one of the most critical elements in a high-performance machine tool. The precision of the machine tool is limited by the precision of the spindle."

That's why, earlier this year, Giddings & Lewis jumped at the chance to take part in a three-year cooperative research project aimed at developing improved spindles.

The project, which is being coordinated by the National Center for Manufacturing Sciences (Ann Arbor, MI), is an outgrowth of the Advanced Technology Program, a federally funded initiative designed to stimulate the development of promising but high-risk technologies that are deemed to have significant potential for promoting U.S. economic growth and competitiveness.

Giddings & Lewis' part in the project will focus primarily on spindle shafts, motors, and bearings, including the development of high-speed, long-life hybrid ceramic bearings with electronically controlled lubrication and advanced cooling systems. Coppola predicts that the new spindles developed through the project "will allow part features to be produced much faster, more accurately, and with fewer machine tools than is now the case in a wide variety of industrial parts."

Giddings & Lewis and other participating companies will have royalty-free, nonexclusive license to any patents that result from the project. The patents will be owned by the National Center for Manufacturing Sciences.

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Acuity Imaging
Mentorvision ..... **RC# 82**
Giddings & Lewis Inc.
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with five- or six-axis metal-cutting needs.

"With this technology we are able to provide six axes of metal cutting without any change in setups," says Coppola, "whereas with conventional five- or six-axis machines, you have setup changes to contend with. So we save our customers time, and on top of that they get a machine with very high-performance characteristics in terms of tolerances and speed. We're excited about it—it's an investment in our future." He adds that it will be priced competitively with other multiaxis machining centers.

How competitive that price actually is will be a key factor in determining the machine's acceptance in the marketplace, notes David Arnsdorf, program manager for tooling and machining at the Industrial Technology Institute (Ann Arbor, MI), a research group. "Machine-tool users are a conservative group, and probably rightly so," he says. "They won't buy something just because it's new. They'll have to see some advantage in using this machine." Arnsdorf adds, however, that the new Variax design "appears to be inherently superior" to that of the conventional machining center in terms of its simplicity and rigidity, though he's withholding final judgment until he has a chance to watch one in operation.

LOW RISK. Sheldon is confident that users will see the advantage that Arnsdorf speaks of, because the enhanced performance characteristics claimed for Variax are coupled with ease of operation and maintenance.

"One thing that Kirkham and I established right from the start is that the operation of this machine should be precisely like that of a conventional machine," according to Sheldon. "The operator can take a conventional part program for a regular machine and run it on this one. The control looks like the control he has now. Inside the control there are some fairly unusual mathematics going on, but that's not apparent to the person using it."

In addition to using a standard computer numerical control (CNC), the machine integrates with existing Giddings & Lewis peripheral devices such as tool changers and pallet-handling equipment, Sheldon says, adding that a conservative approach had been taken in the development and introduction of the machine. "We first cut metal with Variax in February 1991. We wanted to make absolutely sure we understood the machine before we introduced it, and bring a viable machine to market, not a theoretical model."

That conservatism was applied to its construction as well. Sheldon notes that even though he and Kirkham had some ideas for improvements that could be made to ball screws, motors, and other machine components, these weren't incorporated in the initial model of Variax which debuted at IMTS. Instead, they elected to go with standard, field-proven components. "We thought that was very important in terms of removing the customer's perception of risk," he says.

Sheldon adds that he foresees the Variax system winning a solid place for itself in the machining-center marketplace, and eventually in other markets as well. "This is a very general-purpose device," according to Sheldon. "We are making it into a machining center but it could be used in assembly, grinding, or other operations. It is basically a very effective spatial manipulator with flexibility in terms of process."