

BOTTLE INSPECTION WITH NEUROMEM

THE APPLICATION

A contributing factor to the reputation of a brewery is the consistency of its bottle filling level. If such control is easy for a wine maker, it is a little fuzzier for a beer maker since the foam does not have time to settle by the time the bottle is inserted in its 6-pack package. On the other hand, under jam circumstances, the foam may have totally settled when the bottle is inspected for its filling level. This spectrum of foam and texture variations calls for a smart vision system, yet ruggedized and addressing brewery-floor requirements such as NO computer installation, limited space, humidity, splashes, and, most of all, an autonomous operation at power-up.

This application note describes how to implement a beer bottle inspection system based on the NeuroMem technology.

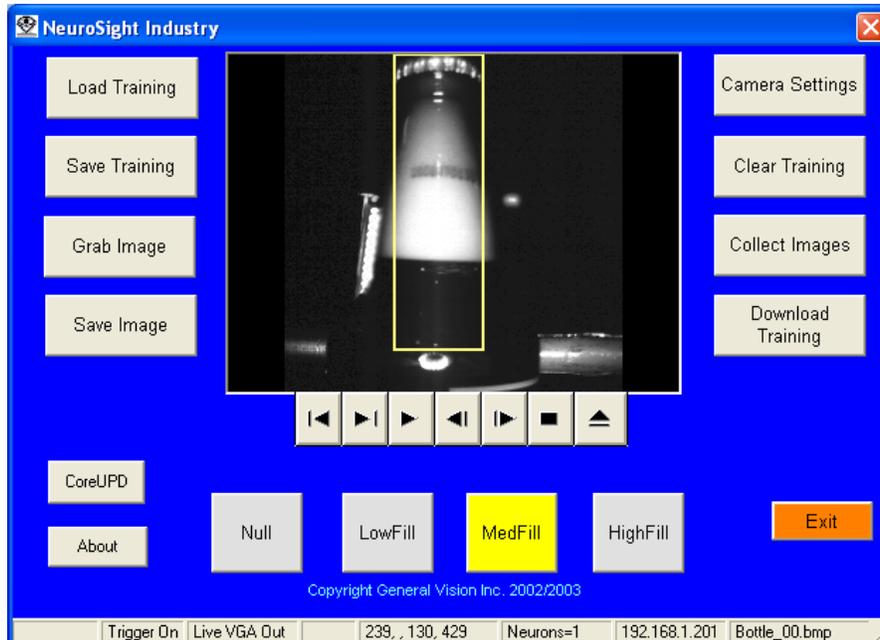
THE METHOD

General Vision's smart camera (MTVS) trained with a touch-screen based Image Knowledge Builder (IKB) software can recognize good and bad bottles as they pass on the production at a speed of 30 units per seconds and divert the ones which are empty, low-filled or with no caps. Thanks to the simplicity of the user interface and intelligence embedded in the camera, there is no need to describe why a bottle is not good. The operator simply shows examples of defects justifying a rejection whether they relate to the cap, the label or filling level.

The camera is equipped with an LED ring light and affixed to a photo-detector which generates a trigger pulse each time a bottle passes by. The system can be mounted at various locations along the bottle conveyor but near an accumulation table for the rejected bottles. Upon each trigger signal, the camera grabs an image, decides if the level of beer is acceptable and if the cap is present. If either diagnostics fails, the opto-coupled output line of the camera activates an ejector and the bottle is diverted from the conveyor. Production statistics are recorded in the camera reporting the number of bottles per "fill level" since the last reset.



The real-time training and decision making process is possible thanks to the CM1K neural network chip integrated into the camera and controlled by the CogniSight firmware. After learning a sufficient number of examples and verifying that the camera classifies the bottles accurately, the recognition engine can be saved for re-use or portability to another MTVS camera installed on another similar line.



For a thorough validation of the recognition engine, the Image Knowledge Builder features an image collection utility which can grab a large number of images in batch mode and dispatch them to disk in separate folder depending on their classification (i.e high, medium or low fill). This means that the operator can review off-line if the recognition engine has a correct throughput and accuracy.



Several project files or knowledge bases can be saved. For example, if the brewery uses different size of bottles and color of glass, you can define one project per model of bottle. You can also envision to teach for a same model a conservative engine and a moderate engine and to be able to switch between them to adapt to seasonal market demand. You can load the camera with a new knowledge at any time and save it in your on-board memory so it can resume inspection autonomously with no need for a PC.