A Review :

Quality inspection of food products by computer vision

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ABSTRACT
With increased expectations for food products of high quality and safety standards, the need for accurate, fast and objective quality determination of these characteristics in food products continues to grow. Computer vision provides one alternative for an automated, non-destructive and cost-effective technique to accomplish these requirements. This inspection approach based on image analysis and processing has found a variety of different applications in the food industry. Considerable research has highlighted its potential for the inspection and grading of fruits and vegetables. This paper presents the significant elements of a computer vision system and emphasizes the important aspects of the image processing technique.

Key words : Machine vision, Computer vision, Image processing, Image analysis

The increased awareness and sophistication of consumers have created the expectation for improved quality in consumer food products. This in turn has increased the need for enhanced quality monitoring. Quality itself is defined as the sum of all those attributes which can lead to the production of products acceptable to the consumer when they are combined. Quality has been the subject of a large number of studies (Shewfelt and Bruckner, 2000). The basis of quality assessment is often subjective with attributes such as appearance, smell, texture, and flavour, frequently examined by human inspectors. Consequently Francis (1980) found that human perception could be easily fooled. Together with the high labour costs, inconsistency and variability associated with human inspection accentuates the need for objective measurements systems. Recently automatic inspection systems, mainly based on camera—computer technology have been investigated for the sensory analysis of agricultural and food products. This system known as computer vision has proven to be successful for objective measurement of various agricultural (He *et al.*, 1998; Li and Wang, 1999) and food products (Sun, 2000; Wang and Sun, 2001).

Computer vision includes the capturing, processing and analysing images, facilitating the objective and nondestructive assessment of visual quality characteristics in food products (Timmermans, 1998). The potential of computer vision in the food industry has long been recognised (Tillett, 1990) and the food industry is now ranked among the top 10 industries using this technology (Gunasekaran, 1996). As a result, automated visual inspection is under going substantial growth in the food industry because of its cost effectiveness, consistency, superior speed and accuracy. Traditional visual quality inspection performed by human inspectors has the potential to be replaced by computer vision systems for many tasks. This paper presents the latest developments and recent advances of computer vision in the food industry.

Basics of computer vision:
Computer vision is the construction of explicit and meaningful descriptions of physical objects from images (Ballard and Brown, 1982). The term which is synonymous with machine vision embodies several processes. Images are acquired with a physical image sensor and dedicated computing hardware and software are used to analyze the images with the objective of performing a predefined visual task. Machine vision is also recognized as the integrated use of devices for non-contact optical sensing and computing and decision processes to receive and interpret an image of a real scene automatically. The technology aims to duplicate the effect of human vision by electronically perceiving and understanding an image (Sonka *et al.*, 1999). Table 1 illustrates the benefits and drawbacks associated with this technology.

A computer vision system generally consists of five basic components: illumination, a camera, an image capture board (frame grabber or digitiser), computer hardware and software as shown in Fig. 1.

As with the human eye, vision systems are affected by the level and quality of illumination. Sarkar (1991)