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Design of a Backlight Hyperspectral Imaging System for Enhancing Image Quality in Artificial Vision Food Packaging Inspections

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Abstract : Poor image acquisition is limiting the promising growth of industrial vision in food control. In recent years, the food industry has witnessed a significant increase in the implementation of automation in quality control through artificial vision, a trend that continues to grow. During the packaging process some defects may appear, compromising the proper sealing of the products and diminishing their shelf life, sanitary conditions and overall properties. While failure to detect a defective product leads to major losses, food producers also aim to minimize over-rejection to avoid unnecessary waste. Thus, accuracy in the evaluation of the products is crucial and, given the large production volumes, even small improvements have a significant impact. Recently, efforts have been focused on maximizing the performance of classification neural networks; nevertheless, their performance is limited by the quality of the input data. Monochrome linear backlight systems are most commonly used for online inspections of food packaging thermo-sealing zones. These simple acquisition systems fit the high cadence of the production lines imposed by the market demand. Nevertheless, they provide a limited amount of data which negatively impacts classification algorithm training. A desired situation would be one where data quality is maximized in terms of obtaining the key information to detect defects while maintaining a fast working pace. This work presents a backlight hyperspectral imaging system, designed and implemented replicating an industrial environment, to better understand the relationship between visual data quality and spectral illumination range for a variety of packed food products. Furthermore, results led to the identification of advantageous spectral bands that significantly enhance image quality, providing clearer detection of defects.

Keywords : artificial vision, food packaging, hyperspectral imaging, image acquisition, quality control
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