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Degradation Process Monitoring in Agro-Food Industry Using Multivariate Image Analysis

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In this talk we introduced a multivariate image analysis (MIA)-based quality monitoring system for the detection of batches of a vegetable fresh product (Iceberg type lettuce) that do not meet the established quality requirements. This tool was developed in the Control stage of the DMAIC cycle of a Six Sigma Multivariate project undertaken in a company of the agri-food sector.

An experimental design was carried out by taking RGB pictures of lettuce trays stored at two temperatures (room and fridge) every 12 hours for 5 days. By using RGB images obtained only from fresh lettuce trays, a MIA-based principal component analysis (MIA-PCA) model extracting color and textural information was built. By exploring the PCA loadings we discovered that a four-component MIA-PCA model was able to provide information about degradation in terms of loss of color intensity, dehydration and appearance of brown areas. Afterwards, the RGB data obtained from the experimental design were projected onto this model and Hotelling-T2 and SPE values obtained and plotted: the degradation process was clearly shown in the lettuce trays stored at room temperature.

Finally, a Shewhart individual control chart was built from the Hotelling-T2 values obtained from fresh lettuce trays. Applying the graph to experimental data, the lettuce trays stored at fridge temperature were under control during the five days but those stored at room temperature showed a progressive signal of out-of-control at 12 hours onwards.

The propose control chart allows the online rejection of low-quality lettuce at the reception stage from suppliers.

Keywords

Multivariate Image Analysis (MIA), SPC, Six Sigma

Classification

Both methodology and application

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