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Multivariate Six Sigma for the Optimization of the Meat Roasting Process in the Ready-to-Eat Food Industry

This talk presents a Six Sigma project developed in a ready-to-eat food company aimed at optimizing a meat roasting process while balancing food safety, product appearance, juiciness, and production yield.

Following the DMAIC methodology, historical data analysis, Measurement System Analysis (Gage R&R), and Root Cause Analysis tools were initially applied to understand process variability and identify potential sources of performance loss. A Design of Experiments was subsequently planned and executed based on expert knowledge and process understanding.

In addition to the experimental factors, several process and contextual covariates were collected during experimentation. To overcome the limitations of traditional univariate approaches in complex industrial environments, latent variable-based multivariate techniques such as Principal Component Analysis were incorporated into the Six Sigma statistical toolkit. These techniques allowed the evaluation of hidden relationships and potential confounding structures between process covariates and experimental effects before DOE interpretation.

The proposed multivariate approach provided a more reliable understanding of process behavior and supported the identification and implementation of improved operating conditions. This work reinforces how the integration of latent variable methods into the DMAIC methodology, the so-called Multivariate Six Sigma, leads to a powerful process improvement framework for Industry 4.0 environments.

References:

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Special/ Invited session

Classification

Mainly application

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Multivariate Six Sigma, DMAIC, PCA

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