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Interpretable Property Prediction on Full Scale Paperboard Machine

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In paper & paperboard making, sampling of product properties can only be made by the end of each jumbo reel, which occurs 1-2 times per hour. Product properties can vary significantly faster and do so in both machine and cross machine directions. The low sampling may result in significant consequences such as the rejecting an entire jumbo reel, weighing about 25 tons, by classifying it as defective and resolving it into pulp if a specific property test fails.
Predictive models have the potential to inform operators about the expected value of product properties, but often black box-models are required due to the complex relationships among input variables.
While black box-models can provide robust predictions, they are not interpretable for the operator, and thus their value is limited. Therefor the field of XAI (Explainable Artificial Intelligence) has evolved, in which algorithms help users to interpret black box models.
In this paper, we investigate the possibility of using a Random Forest to predict the results from the Scott-Bond test for z-directional strength. Scott-Bond is used since it exhibits a complex and multifactorial nature, characterized by significant short-term and long-term variations, as well as significant measurement variance. Hence, a predictive model would be beneficial.
We evaluate the model's potential as operator support by utilizing the XAI algorithm LIME combined with feature engineering to provide interpretability. Our approach aims to provide valuable insights into how to achieve desired states while maintaining robust predictions, ultimately improving product quality, and minimizing the waste of resources.

Keywords

XAI Full-scale Usability

Classification

Mainly application

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