Leveraging AI & ML for Line Speed Optimization

Optimizing Production Speed

In today's fast-paced and competitive manufacturing landscape, speed and efficiency are crucial.

The ability to increase daily output while ensuring optimal machine performance requires innovative, cutting-edge solutions.

By leveraging **Artificial Intelligence (AI)** and **Machine Learning (ML)** technologies, We successfully addressed speed loss issues and maximized production rates in one of the production lines.

In this white paper we will take a closer look at the methods, outcomes, and future potential of applying AI and ML to optimize line speed in a complex manufacturing setting.

Studies show that even a 5% increase in production speed can lead to a 10% rise in output without additional costs. This paper demonstrates how AI and ML can help achieve such improvements.

Capacity Utilization **OEE** **Availability** **Performance** **Quality**

Challenge : Machine performance continuous going down and push from the sales team to increase the daily output.

The Challenge of Speed Loss

The printing machine encountered a critical challenge: persistent speed losses during production. With increasing pressure from the sales team to boost daily output, it became clear that optimizing line performance was essential. However, traditional methods fell short in identifying the root causes of these speed losses, making a data-driven approach crucial.

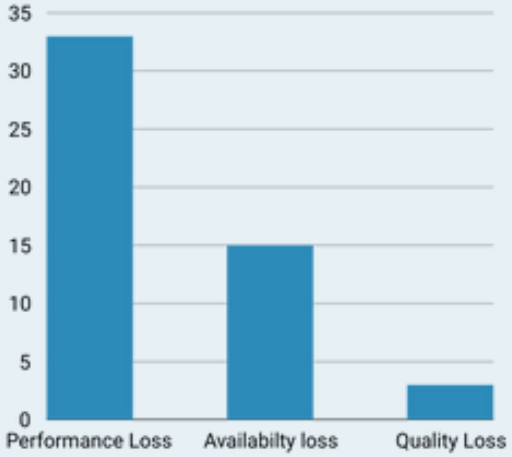
The main goals were to:

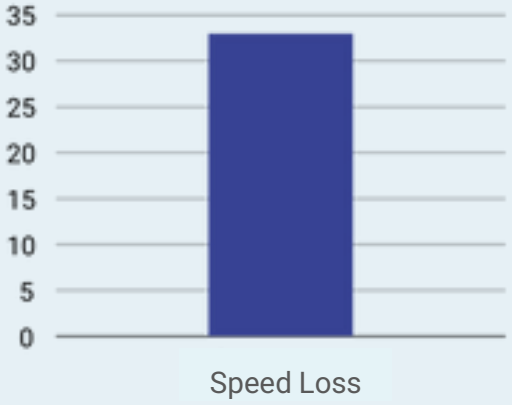
Maximize Production Volume
Achieve higher throughput without compromising quality.

Identify Critical Parameters
Determine which process parameters most significantly impacted speed loss.

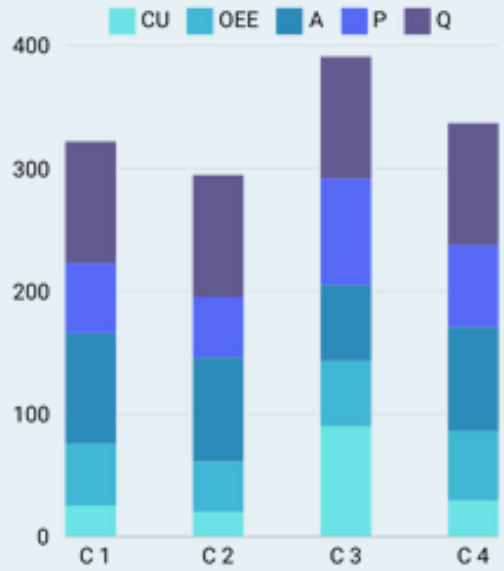
Implement AI-Driven Solutions
Utilize advanced analytics to address speed loss issues effectively.

Data-Driven Approach to Resolving Speed Loss





Speed Loss



Machine C1 – C4

Advanced Analytics

Data Collection and Preparation

The AI-driven optimization process began with gathering and preparing a comprehensive dataset. The historical database provided a wealth of information, including detailed process parameters and key production features. This stage involved three critical steps:

Data Collection

Assembled a complete dataset covering all relevant process parameters to capture a holistic view of the production line.

Data Cleansing

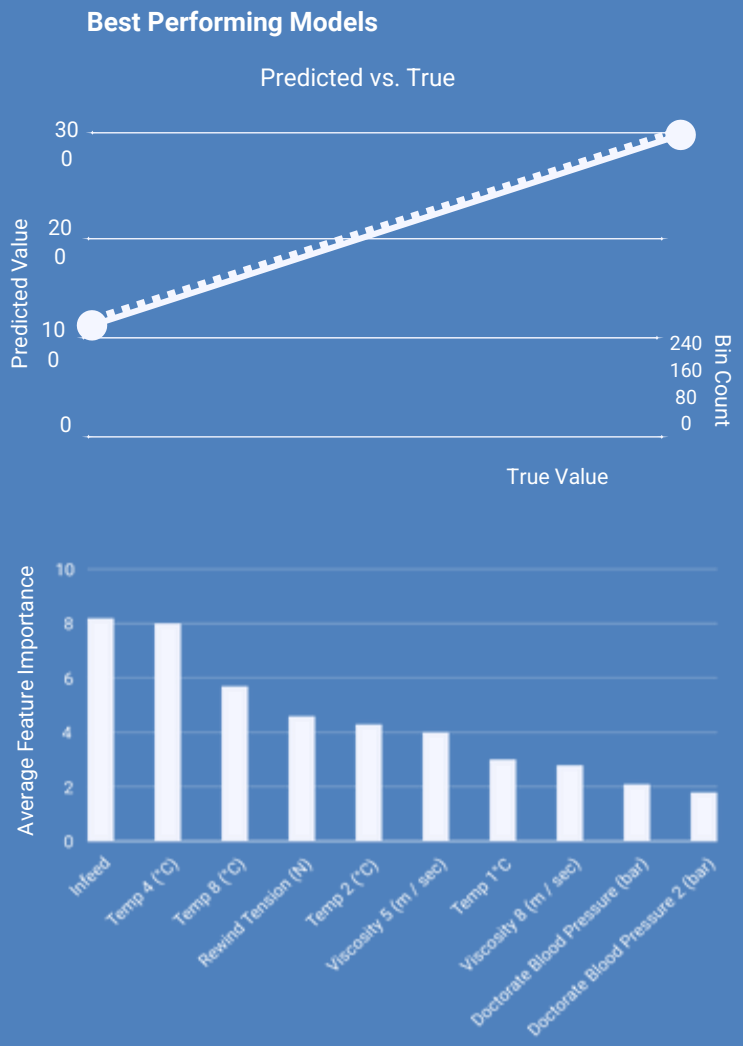
Ensured the accuracy and reliability of the dataset by addressing missing values, removing outliers, and correcting errors.

Feature Selection

Identifying the most critical features that influence line speed based on historical data.

Machine Learning Models

After preparing the data, various machine learning algorithms were employed to predict production speed and identify the most influential features. The best-performing model provided insights into the parameters that most affected speed, guiding the subsequent optimization efforts.



AI Recommendations and Optimization

The machine learning models identified the top five parameters contributing to speed loss. Based on these findings, AI-driven recommendations were made to adjust production centerlines. These adjustments focused on :

Optimizing Production Parameters

Resetting the production centerlines according to AI recommendations to effectively minimize speed loss.

Enhancing Process Stability

Implement continuous adjustments to maintain optimized parameter, ensuring stable production

Increasing Throughput

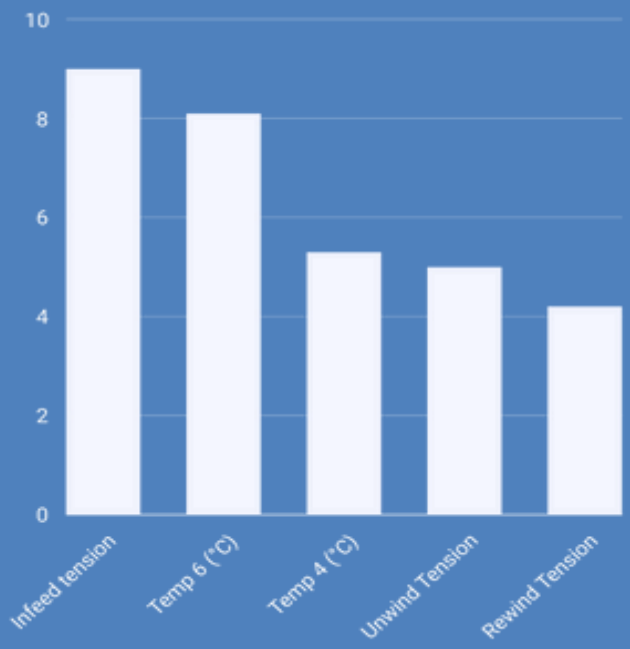
Reached optimal line speed, thereby increasing overall production volume.

Implementation

The implementation phase involved applying AI recommendations on the shop floor through system fixes and necessary adjustments. This process included system fixing, executing changes directly on the shop floor, and following a data gathering action plan to ensure that improvements were measurable and effective.

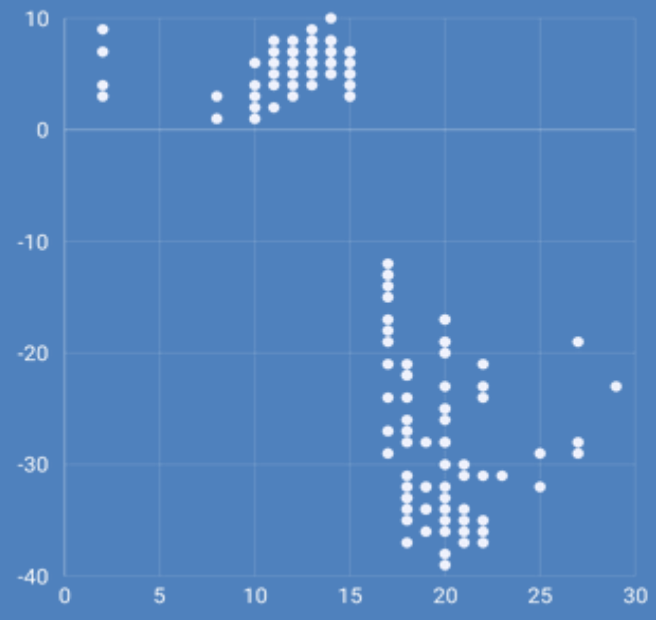
Actionable Insights

Average Feature Importance



Positive Impact Image

Feature importance of Infeed Tension (N)



Quantifiable Improvements

The AI-driven optimizations had a significant impact, leading to measurable improvements across key performance indicators (KPIs).

Increased Production Speed

The line speed increased from an average of **180 meters per minute** to optimal levels, resulting in higher daily output.

Reduction in Speed Loss

A substantial reduction in speed loss was observed, with lines operating closer to their theoretical maximum speeds.

Enhanced Efficiency

The overall efficiency of the printing lines improved, contributing to better resource utilization and reduced operational costs.

Ongoing Monitoring and Future Potential

The outcome of this project underscores the potential for continued AI and ML integration in the printing line's operations. By consistently monitoring and adjusting production parameters, the printing line can not only maintain but also further enhance these improvements over time.

AI Recommendations Impact on OEE Losses

Updating production centerlines leads to significant improvements in line speed and output, reaching optimal levels of performance.

The Future of AI in Industrial Manufacturing

The use of AI and ML to optimize the printing line's speed demonstrates how these technologies can transform industrial manufacturing. As they evolve, their ability to boost efficiency, reduce waste, and increase output will grow. This project marks the start of broader AI integration across all production lines, setting the stage for sustained operational excellence. As AI and ML advance, they will become a cornerstone of smart manufacturing, making operations faster, leaner, and more resilient.

Monitor Batches Throughout Your Factory with O3OZONE

O3OZONE integrates with your ERP system for real-time data capture and analysis.

Using GS1 standards as a benchmark, O3OZONE allows you to scan batches at any operational stage and get up-to-date info such as machine numbers, date and time of production, and supplier details.

The O3OZONE platform includes advanced analytics and reporting tools to extract meaningful insights from traceability data. You can carry out in-depth analyses, identify trends, and forecast potential issues before they escalate.

Meet Regulatory Compliance

Many industries have strict traceability requirements and regulation, especially food and beverages, pharmaceuticals, and automotive. O3OZONE makes audits easier by collecting, processing, and analyzing traceability data and producing reports.

Improve Quality Control

Identify and address quality issues early for improved consistency. Integrating O3OZONE with your ERP for full traceability helps reduce waste and meet customer quality expectations.

Optimize Supply Chains

Reduce costs by optimizing your supply chain. Track products and components back to their origin to identify bottlenecks and inefficiencies. This leads to better inventory management, reduced lead times, and improved resource allocation.

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