PreMoBAF

Data-driven methods for predicting and monitoring the behavior of Blast Furnace and Electric Arc Furnace



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MOTIVATION & GOALS

- Blast furnace (BF) and electric arc furnace (EAF) are key processes in the iron and steel production. Stability of these processes is crucial due to the complexity of processes that take place during the operation.
- Overall dynamics of these processes are difficult to model as the processes inside of the furnaces are barely accessible for direct measurements.
- **Data-driven approaches** such as Machine Learning (ML) and Deep Learning (DL) have been applied to model the complex behavior **with limited success**. Existing models could capture some of the process dynamics **but give no insight to the underlying mechanisms**.
- Goal of this research is to utilize data-driven and explainable AI (xAI) methods to better understand the inner dynamics of the blast furnace and electric arc furnace operation.

APPROACH Prepare for Implementation **Conduct Readiness Assessment** Conduct Project Kick-off **Understand Business Analyze Understand Data** Design and Validate Infrastructure Design Set up Environments Data Understanding Business Understanding Deployment Prepare Data **Build Model Evaluate Model** Config. & Define Deployment Approach Conduct Analytical Knowledge Transfer Build **Design Operational Testing Strategy** Validate and Test in QA Environment After Prediction Conduct Operational Knowledge Transfer Transparency Approach Modeling Evaluation Before Prediction Prepare for Ongoing Maintenance **Deploy** Trend analysis Causal Discovery **Deploy Solution** Additional Static Global Explainability Concept Drift Detection of spurious Operate & Feature interaction simplification **Optimize Monitor Model**

Project FactBox

Project Name PreMoBAF
Project ID MFP II 3.1
Duration 48 Months

Area 3

Cognitive Decision Making

Project LeadDI Dr. Belgin Mutlu

CONTRIBUTION

Scientific contribution

- Application of DL models in production scenarios
- Methods for knowledge discovery from ML/DL
- Factors crucial for acceptance of ML models in industry (xAI, causal AI, domain knowledge)
- Handling assumptions of causal discovery in complex industrial process

Economic contribution

- Modelling domain knowledge from data-driven methods in BF and EAF processes
- DL models in automated decision making
- Improvements in process control



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SYSTEM ARCHITECTURE















