

SCCH
Software Competence Center
Hagenberg

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Centre K1

Type of project: SEBISTA (Secure Big Stream Data Processing),
 2019 - 2022, multi-firm



Huge amounts of data accumulate in the production process
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TREATING MISSING DATA

FINDING AND REPLACING MISSING DATA IN THE HOT ROLLING MILL

In many industrial companies, the production process is monitored with sensors and stored in data records. If there are errors in the sensors, they might produce "missing data" (i.e., empty values). Missing data must be considered specifically in data analytics and, if necessary, the values must be filled with suitable estimates. Such estimates can be obtained by observing the interaction of other sensors, in particular, the typical common occurrence of missing values if of interest. In the voestalpine steel mill, raw steel is casted into slabs. Those slabs are about 12 meters long and 200 millimeters thick. The slabs are heated and rolled in the hot rolling mill to receive steel coils with the desired thickness for further processing. Such a steel coil can be rolled out up to 1.5 mm thickness and an average length of 800

meters. After the hot rolling, the steel is cooled down with water and wound into coils.

In order to optimally support data analytics (using statistical methods as well as machine learning) in the applied statistics department at voestalpine Stahl GmbH, SCCH conducted research how to systematically treat missing values in this domain. In a first step, different "multiple imputation" methods have been evaluated, which targets the estimation of the missing values. Based on these findings, and experience from other projects by voestalpine, the knowledge has been gained that the estimation of these values highly depends on the context in which the values appear. Thus, an emphasis was put on the detection of patterns in the missing data. A prototype

SUCCESS STORY

for missing data pattern detection based on an ensemble biclustering method has been developed. The detected patterns are iteratively tested for robustness using genetic algorithms, in order to improve the quality of the overall result. The new method allowed to successfully detect all 18 (no false negatives) missing data patterns in a very ambitious simulation study with 1000s of process variables. In the course of a workshop, the prototype has been deployed directly at the working stations of the data scientists of the voestalpine statistics department.

Impact and effects

The aim of the cooperation with voestalpine Stahl GmbH was the systematic treatment of missing data. For this purpose, research on multiple imputation and missing data pattern detection was conducted.

In 2018, a paper about the imputation method was presented in Berlin: L. Ehrlinger, T. Grubinger, B. Varga, M. Pichler, T. Natschläger, J. Zeindl. „Treating Missing Data in Industrial Data Analytics“. In

Proceedings of the 13th International Conference on Digital Information Management (ICDIM 2018), pp. 148-155, IEEE, 09-2018.

In 2019, a prototype to detect missing data patterns by means of biclustering has been implemented and successfully deployed.



The focus of the project is the completion of "missing values" in single process steps, Copyright: voestalpine Stahl GmbH

Project coordination (Story)

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Project partner

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