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# On-Line Prediction of Product Quality With IoT Technologies

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## ABSTRACT

Industrial Internet of Things technology significantly impacts quality management by predicting mechanical properties of steel products. A data-driven approach has been used to predict correlations between properties of final products and their chemical and process parameters, applied to long and flat rolling. A clustering algorithm has been used to highlight products out of standard. The model runs as an application interfaced with the plant automation. Achieved results show high prediction accuracy, especially reached by a high-frequency sampling rate, thus enabling high resolution along the length of the rolled product. The target is a drastic reduction of clients' rejection rate.

Keywords: Rolled products; Online; IoT; Machine Learning; Deep Learning; Quality management; Regression analysis; Processing-property linkages, Industry 4.0.

## INTRODUCTION

Product quality deviation within a product has a great impact on further processing of steel. For many years, linear models have been used in order to predict final quality of product. Improvements in processes have been made in order to reduce the deviation of product properties. In many cases the goal has been to avoid scrapping of material. The final outcome of product properties is a combination of different process parameters. By online prediction of product quality with IoT technologies, the process is monitored by acquiring data of several process parameters and analyzing direct effects as well as interactions among them. By using the online model, key personnel in rolling mills can react on data during rolling and take countermeasures to avoid scrapping. With small, measured deviations in rolled product, the further processing can be automated, overall plants throughput can be increased and resources saved.

## EXPERIMENTAL PROCEDURE

The control of process data in a rolling mill is of great importance. In this study we point out the importance to monitor all possible process values, from billet properties to furnace condition to temperatures during rolling and more. Process data are then used in artificial neural networks to predict the final product properties. The data were collected and analyzed by IOMES Group developed IoT techniques (TECH-IOMES M). The data were analyzed in 2 ways. By using data that were available before rolling and a combination of data available before rolling and process data collected during rolling process.

 