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# Predictive Quality for Zero Defect Manufacturing in Metals

## Avoiding Defects by Using Artificial Intelligence

**Zero defect manufacturing is still impossible in the metals industry. Defect rates of 5 % and more are no exception even in our digital world of manufacturing with highly automated and quality monitored production processes. Test procedures and quality control are very expensive and form up a significant percentage of the total production cost. Already a reduction of the defect rate by 25 % would led to significant cost reductions due to less rework and less waste of material.**

## New Opportunities Qualitative Labeling and Machine Learning

Quality prediction as early as possible in the production stage allows production management to avoid defects for the end product. The digitalization of the manufacturing process delivers a huge amount of (unlabeled) digital data from sensors, production control, quality control, material genealogy and others. By using new AI-concepts for machine learning the availability and combination of this data opens a new opportunity to reach zero defect production.

**Benefits of Defect Prediction**

- Reduce & avoid defects in advance
- Improve quality final products
- Reduce production cost
- Improve efficiency
- Self-tuning quality control business process

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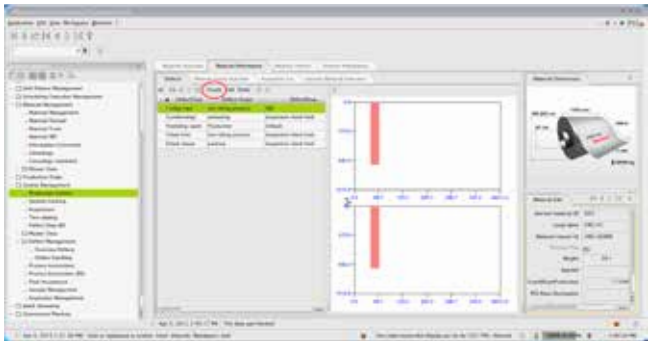
## Today's proven methods

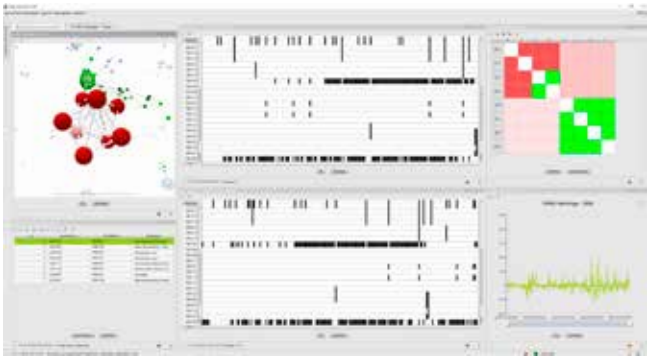
During production process a huge amount of quality measured values are collected already today. Rule management based on if-then-else-rules usually allows the software to decide which corrections are required for which defects and to guide the user. Main point: Defects are already there. Imagine if the software could automatically learn which defects could occur based on the available knowledge from previous production. And production could be adjusted before defects occur.



Predicting defects by use of existing quality measured values

## Predicting the future using AI methods

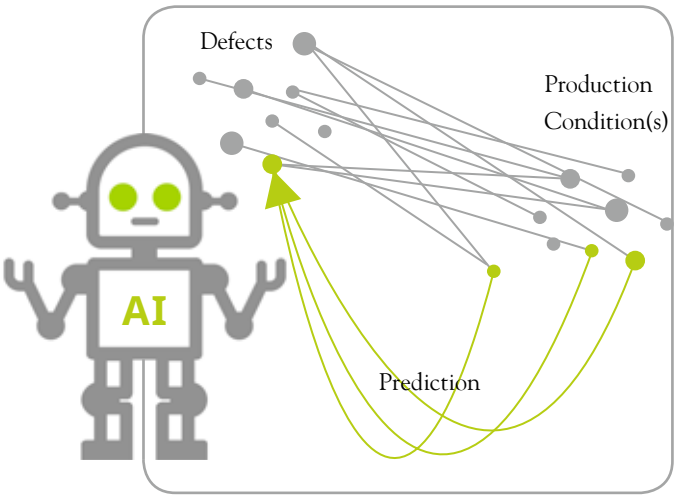
Machine learning models exhaustively explore all possible combinations of how production factors affect quality metrics and defect types. Based on historical defects and all its related process and production data the data is qualitatively labeled and defect prediction model can be extracted in order to predict future quality defects as early as possible. The reliability of such automatic prediction reaches up to 75 %. Machine learning algorithms will find correlations between data and label them in a way that experts are not even aware of. In addition to avoiding defects the solution even offers the chance for yet unknown improvements.



Deep Qualicision: Machine learning algorithms explore defects and their circumstances

## Preventing defects before they happen

For example surface defects are very often detected in the later stages of the production process (e. g. after pickling) although they originate already in the early stages of the production (e. g. slab casting or reheating). There exists no real metallurgical causal model in those early stages to detect the future surface problem based on measured process and quality parameters.
Post production though, statistically a correlation between 1000s of production data and the future defect can be found. This correlation can be used to better label historical data and use them to be trained into a prediction model. In this way a machine learning software can predict surface defects early and find production remedies to correct and avoid future surface problems.




AI methods to explore defect correlations

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