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COMPLEX ANALYSIS OF MONITORING AND PROCESS DATA FOR EFFECTIVE MANUFACTURING

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SUMMARY

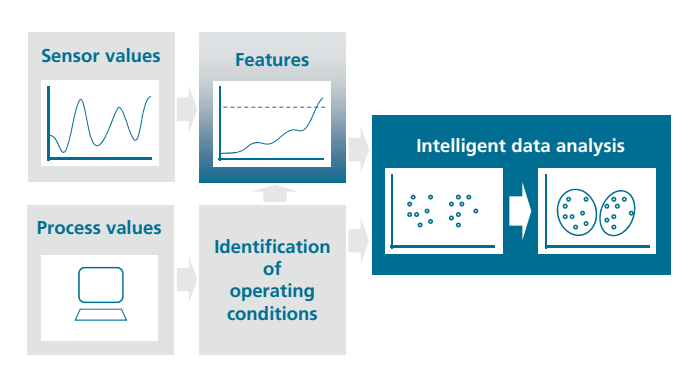
- We **optimize the manufacturing process** in terms of
  - **early detection of** possible **failures** of machinery
  - **reduction of rejects** by monitoring process deviations
  - **diagnosis** of error sources
- The method is based on the **analysis** of a broad variety of **recorded data**, i.e.
  - sensor data
  - process control data (e.g. setpoints, states)
  - other data sources (e.g. maintenance schedules)
- The data analysis is implemented as an automated process, which results in **self-learning** properties

APPROACH

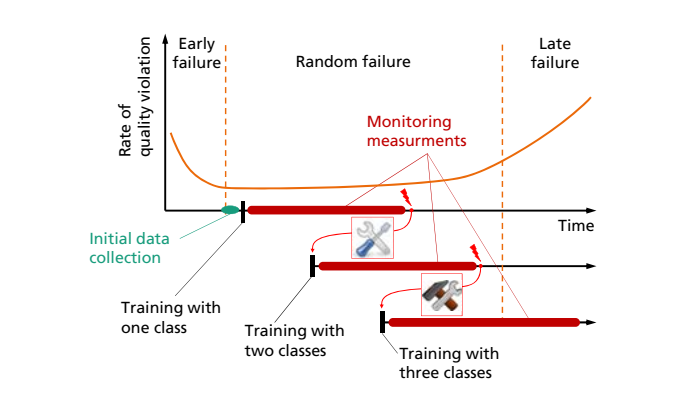
- All available **sensor data** as well as **process information** (control data) are used to extract relevant features
- Features are generated using **mathematical transformations** followed by **statistical analysis** or **knowledge-driven** approaches
- A generated **fingerprint** of **machinery or process behavior** is used for assessment

PROCEDURE

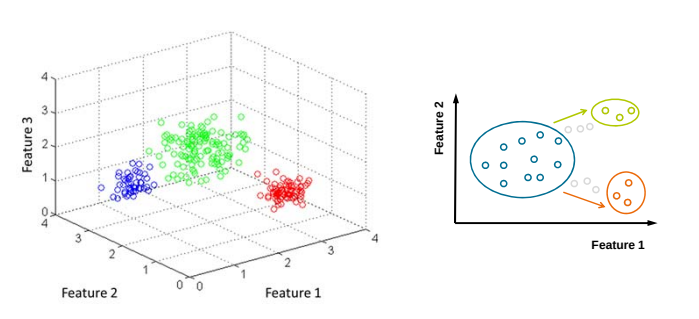
- Initial data collected under all occurring operational conditions is used as starting point for learning process
- Features are extracted automatically by reduction of feature space using appropriate transformations (PCA yields reduced feature space, LDA yields best distinction between known clusters)
- A fingerprint of machinery or process behavior is learned
- Knowledge about occurring product quality violations is increased by step-wise learning (driven by process operators)
- Standard classifiers are used for classification
- Trends are detected by evaluation of distances between data points and clusters in feature space
- Reason-impact-relationships are established step-wise using e.g. Bayesian networks



Principle flow of data processing



Step-wise learning using occurring quality violations



Three clusters in 3-dimensional space (left) and principle of trend detection (right)