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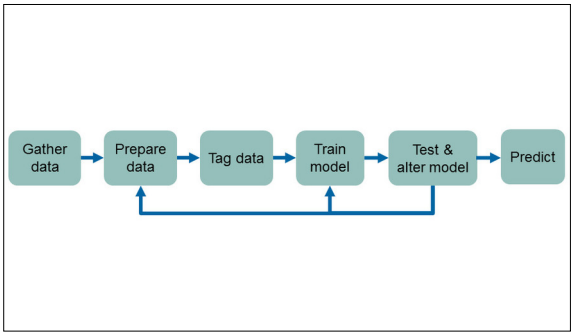
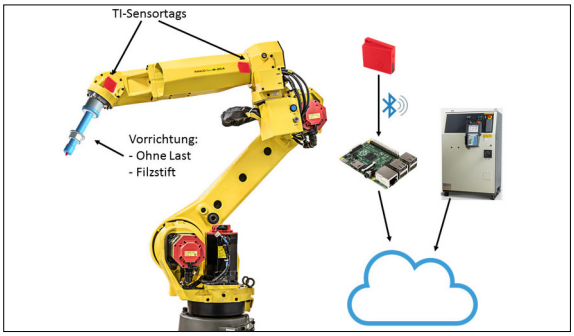
Subject Area	Information Technology for Mechanical Engineering

Predictive maintenance on an installed base

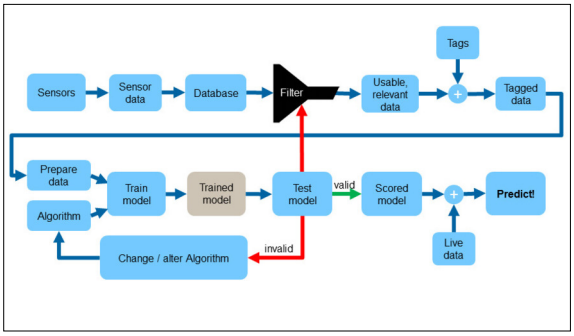
Machine Learning



Overview: Machine Learning



Setup: From the sensors to the cloud



From start to finisch: Machine Learning and Predictive Maintenance

Introduction: Industry trends indicate that in the future, more systems will be rented then sold. The customer rents production capacity and naturally demands a very high operational readiness.
With conventional maintenance, it is very time-consuming to guarantee a high operational readiness. Downtimes can never be completely ruled out.
In order to solve this problem and guarantee high operational reliability, the Predictive Maintenance approach is used. This means that a problem should be identified by means of indicators before it occurs so that countermeasures can be taken at an early stage.
The possibilities of predictive maintenance are to be demonstrated by means of an installed base, which consists of a jointed-arm robot with six axes including a control unit. The robot's motions should be retraced in order to determine the state and position of the robot. The practices of Machine Learning serve as a tool here.

Procedure / Result: The theoretical basics of predictive maintenance, industry 4.0 and machine learning must be worked out. Two use cases have been defined. With the first use case, the motions of the robot arm are to be traced and with the second use case, deviations are to be predicted in case the robot has to transport loads. This means that sensors must be attached to the robot arm and measurement data must be generated.
The measurement data is transferred to a cloud database and stored there for further processing. The industrial communication standard OPC UA will also be evaluated for these interfaces.
The measurement data and the machine learning tools are used to identify interrelationships. Based on the interrelationships and with suitable machine learning algorithms, predictions should be made as to which motion is currently active at the installed base.
The machine learning tools to be used should come from the Microsoft Azure Machine Learning Suite.

Result: According to the problem definition, the real machine, called installed base, was made IoT-capable by making the attached sensors communicate directly to a cloud database. A trained machine learning model can be used to draw conclusions about the active motion. The conclusions are displayed graphically to the operator at the machine.
The goal was thus achieved according to the given objectives as far as the first use case is concerned. The second use case was not handled due to time limitations.