Machine learning - a field of artificial intelligence - also recognizes connections in production that remain hidden from human analysis. This will revolutionize production.

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AI CHANGES PRODUCTION

AI in production I Artificial intelligence (AI) and machine learning (ML) will be key technologies in many areas of life in the future. In a digitized production environment, they will enable optimized processes and new business models that are still beyond our imagination today.

Some experts regard data as the oil of the future. Only data helps us little. The art and attraction of machine learning is to generate useful information from it - even in production. Why this technology can be useful can be briefly explained using two examples: In one case from medical technology, the evaluation of data showed that defects were accumulating and that there seemed to be a connection with supplied material. Material A resulted in significantly lower scrap rates. The operator at the machine was aware of this, but the purchasing department was not - until the analysis drew attention to the correlation. In another case, types of defects and defect positions increased regardless of the product. The analysis made it possible to get to the bottom of the cause of the defect and to avoid it in the future. Over a production period of several years, 6-digit savings could be achieved here.

YOUR KEYWORD

- Data analysis leads to less scrap and defect prevention
- Computer development decisive
- Inventing new business models
- Today's commitment creates a basis

Machine Learning (ML) - in a form even more far-reaching than described here - should and will increasingly support experts in the future. ML offers added value above all when it comes to multidimensional problems and the recognition of corresponding dependencies in huge amounts of data - because in these cases the requirements go far beyond human analysis capabilities.

Virtual twin, fed with all available data

The digital twin plays a central role in the use of machine learning. The virtual copy of a product or process is presented in a simulation. All data and properties, from the time of creation to the materials and manufacturing processes used, CAX data and measured quality properties such as dimensions and surface properties over the entire product life cycle, are summarized in it.

In order for the digital twin to get enough data, measurements from the process are imported. In laser-based manufacturing processes, this data is supplied by process monitoring - an established technology that is not only used for safety-relevant components. With diode-based systems, for example, process emissions can be recorded in different wavelength ranges. Camera-based systems in turn enable the documentation and analysis of processes and influencing factors such as clamping technology and motion systems.

This data from practical experience complements the CAD/CAE and simulation data, so that the digital twin provides insight into complex production processes. One example is additive manufacturing using laser beams: Construction processes lasting several hours or even several days can be analysed and evaluated in a short time using machine learning in order to derive measures that can shorten the quality control loop.

Current computing environments give these technologies an enormous boost and provide almost unlimited storage space. Free software tools and always new approaches or pre-trained models are provided.

A rule of thumb, the 80/20 rule, states that today 80% of the time is used for data preparation and plausibility checks and 20% for the actual modelling. Modems IT environments and concepts such as schema checks to validate data sets during acquisition are already beginning to change the ratio to a 50/50 split.

The vision for the future, for example in 3D printing based on laser light - a thoroughly complex process - is that the user will be so intensively supported by IT systems that in the end he will be able to start the process according to the motto “push one button and print“. Experts believe that this will be possible in less than a decade. Work is currently underway on new cloud-based services that bring together different information from process, material and manufacturing knowledge and take into consideration real sensor data and simulation data. They should enable designers to design additively manufactured components faster.

AI in image processing shows abnormalities in 3D printing

At plasmo Industrietechnik GmbH in Vienna, for example, which specializes in quality assurance issues, a procedure was developed that finds conspicuous features in digital process twins during additive manufacturing: In several thousand shift images, the system searches for these without human assistance in less than a second and has the results currently evaluated by an expert. In the future, this data will also be available for supervised learning processes.

Deep learning, the automated evaluation of image data, is based on artificial neuronal networks and is only made possible by current computing power. It allows completely new approaches to image classification. Tasks that are mathematically difficult or even impossible to describe and that are not accessible to a dedicated algorithm can thus be solved.

This marks the beginning of an era for the industry in which technical knowledge of manufacturing processes is no longer the only thing that counts, but in which a great deal of IT know-how will be decisive for the market position. Just as the success of huge online trading groups would have been unimaginable a few years ago, new business models will develop around the familiar processes in the industrial environment. Who will offer these is not yet foreseeable. However, it is essential to look into these possibilities now as a prerequisite for participation at a later date. ■

Dr. Thomas Grünberger
Plasmo Industrietechnik, Vienna/Austria
www.plasmo.eu

Machine Learning – Artificial Intelligence

Machine learning was defined in 1959 as the learning ability of computers that had not been explicitly programmed for it.

Data Mining tries to find the cause of what happened. Machine learning is used to optimize and predict processes. It is thus an area that can be understood as part of artificial intelligence. Artificial intelligence, in turn, tries to recreate human intelligence.

Machine learning processes can be assigned to three groups:

- Reeinforcement learning requires no input/output data and learns by punishing and rewarding learning. An example is the teaching of a robot path or the optimization of material flows.
- Supervised Learning requires annotated data, i.e. for an input data set an associated output data set is necessary. Application examples are classification tasks (like 10/NIO) or regression tasks (like the prediction of the density of a component in additive manufacturing).
- Unsupervised Learning tries to find commonalities (clusters) in input data without further information. One example is the automated detection of anomalies in large image stacks – such as digital twins in additive manufacturing or CT images.