ZDMP Blog

AI & Analytics in Industry 4.0

By Mircea Vasile, Technical Leader, SIMAVI

Some questions for you

- How do you take advantage of the data that exists in your organization, be it from sensors, operational or business processes?
- How do you make sense of all this data?
- How can you uncover the hidden patterns and dynamics in the data?

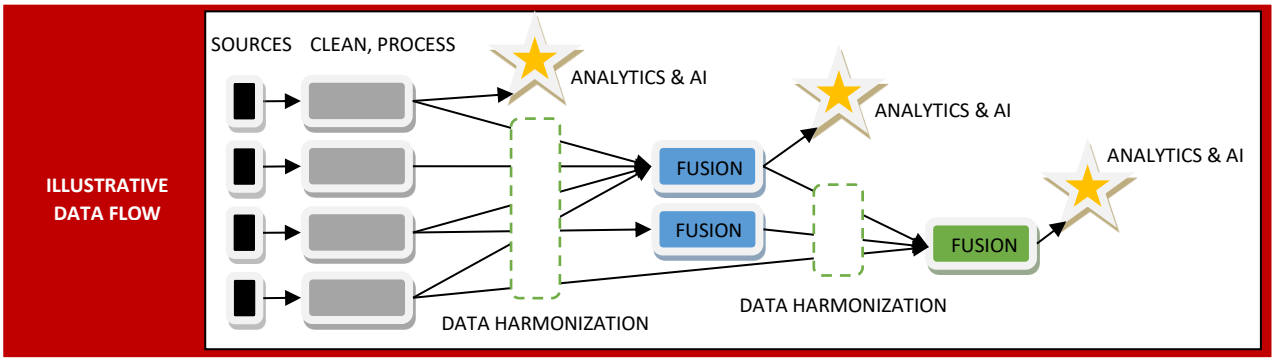
Data everywhere

The initial industrial revolutions were brought by the wide-scale availability of game-changing tools. In the case of today's 4th Industrial Revolution, Industry 4.0, it is the widespread connectivity brought by the Internet and the ever-evolving underlying communications infrastructure, together with the availability of more and more intelligent devices at all levels [1]. These tools are visible from the digitization of business processes to intelligent and connected sensors for all. However, the realization of the full potential for Industry 4.0 only comes when all these are holistically integrated into a system that can take advantage of all the wide range of data and gather insights into the way everything functions and interacts. These insights will help improve the existing processes as well as design the future of the business.

The availability of the raw data is just the first step in the process and which raises more questions: Now that we have x Terabytes of sensor data, y Terabytes of quality information, z Terabytes of business information and customer feedback, how can I help take my factory towards a Zero Defects goal? How can I turn all this data into useful business decisions? This is where analytics come in: their role is to help make sense of all the data and, with the help visualization tools and Artificial Intelligence, allow the factory to reach its full potential.

Knowledge is power

The availability of the raw data is just the first step in the process. The objective of analytics is to support decision making by extracting knowledge from that data. This can be translated into business decisions to improve the existing processes. At the factory level, the important volumes of data, as well as their variability, require design-time as well as run-time decisions. This is an iterative process where data and processes are constantly analysed to identify which are the most appropriate tools to use and on which data to apply them. Some data flows may need to be fused to gain a larger perspective of the processes, as some phenomena may not be visible when using a limited perspective. Images-based quality-assurance vision systems may help identify defects on production lines, but their data needs to be integrated with other sensors and machine data to help detect the actual cause.



The first level of analysis is the visualization part, allowing each user to evaluate the data on different dimensions and properties and build visual representations in the form of graphs, maps, etc. At this level, data can for example be filtered, aggregated, simplified to extract the part that is relevant for each analysis.

Artificial intelligence takes this one step forward, by providing various tools for better understanding and qualifying the data [2]. Machine learning can help identify correlations in events to improve areas in the manufacturing process. For example, humidity data from the production facility may help identify a previously unknown correlation between production defects and certain relatively high or low humidity values, which can lead to productivity improvements.

AI-based forecasting can help on the business side, but also on the production line itself. If certain production processes need continuous flows of raw materials, forecasting possible shortages can help adapt the manufacturing line or set up backup suppliers. Another application is the detection of anomalies [3], where historic data is analysed to identify any characteristic that is out of place. Depending on the nature of the observed processes and the needs, the analysis can be performed in real time for immediate reactions, or after the processes that are observed were finished. However, considering that the AI solutions are often computation-intensive; real-time applications are limited in scope.

What will ZDMP achieve

Given the wide range of applications of the many available AI tools, the purpose of the ZDMP is to provide a framework that allows the users to put in place the analytics and AI tools specifically tuned for their use case. This includes the necessary infrastructure for data acquisition, harmonisation, aggregation, as well as the orchestration that allows users to define their own data flows. The AI and Analytics component deals with machine learning integration into ZDMP. The aim of machine learning in ZDMP is to detect and/or predict any defects in the production process and parts that lead to delay or inconsistency in the delivery of further product

ZDMP Links

• Architecture Component(s)	AI Analytics Runtime
• Work Package	WP5 – ZDMP Platform Building
• Tasks	T5.6 – AI Analytics Runtime

References/Acknowledgements

[1] The Fourth Industrial Revolution, Klaus Schwab, 2017.

[2] Louis Columbus, 10 Ways AI Is Improving Manufacturing In 2020, https://www.forbes.com/sites/louiscolumbus/2020/05/18/10-ways-ai-is-improving-manufacturing-in-2020 [published 2020/05/18, accessed 2020/06/12].

[3] L. Stojanovic, M. Dinic, N. Stojanovic and A. Stojadinovic, "Big-data-driven anomaly detection in industry (4.0): An approach and a case study," *2016 IEEE International Conference on Big Data (Big Data)*, Washington, DC, 2016, pp. 1647-1652, doi: 10.1109/BigData.2016.7840777.