

# Artificial intelligence in industrial manufacturing

Evert Janse van Vuuren from Omron Industrial Automation in Johannesburg, South Africa, talks about the implementation of artificial intelligence (AI) on production lines and unpacks the advantages of and the differences between cloud and edge computing.

In the manufacturing arena, increasingly better machines are being introduced – most recently through the use of affordable and innovative automation solutions with more powerful hardware and software. Two technological advances playing a vital role in the improvement of machines are cloud computing and edge computing.

Cloud computing – the storage, management and analysis of data that is stored remotely on a server, either locally or on the Internet – has become commonplace in a relatively short time. Although it has proved invaluable in many circumstances, is it always the best solution for businesses and, in particular, for production lines? Recently, another promising alternative has emerged: edge computing.

Whilst there are various interpretations about what the ‘edge’ entails, data mining at the edge can be compared to a spinal reflex. Lines and devices are monitored with real-time sensors, and data at the machine level can be processed in microseconds. A machine’s condition can be monitored in real time, but the data volume is limited. Real-time data processing at the edge, however, enables an immediate response.

In introducing solutions involving artificial intelligence (AI) and machine learning (ML), industrial manufacturers need to think carefully before deciding on whether cloud or edge computing will be the most effective. Omron has demonstrated how AI can be incorporated into machines by developing FORPHEUS, the world’s first robot that can play and train people in table tennis.

FORPHEUS embodies Omron’s three-fold philosophy for innovative automation: integration, interaction and intelligence/AI. The robot uses its cameras and sensors to observe the mood and movements of the player and the ball. It can then rapidly analyse this data to anticipate how the opponent will hit the ball and its trajectory, so that it can then hit the ball back. By assessing how its opponent plays, it can determine the skill level and modify its own play so that its opponent has a challenging game.

Although AI offers some great potential benefits, care needs to be exercised before incorporating it into industrial applications. All too often, companies can be eager to start implementing and using it without being fully aware of the challenges they could face.

So, what are the key issues involved in



determining how AI can improve a production line or a process; and if cloud computing or edge computing should be implemented?

## Issue 1: What is the problem?

The biggest challenge companies face is that they often don’t know what problem they want to solve. Some of them aren’t measuring any data yet, so even though they might be keen to implement AI, this will prove difficult. The solution is to start collecting and cleaning data first, before thinking about introducing AI. The company can then try to obtain information from the data and begin using this data in smart ways to start realising a range of benefits.

One difficulty here is that much existing data isn’t suitable for analysis. It’s contaminated, duplicated, scattered or key information is missing. There is huge potential for the use of new technology, but it can only be used if the data being gathered is sufficient and correct. If starting to think about AI, the company also needs to think in a broader sense about data science – what and how much data is needed before coming to a conclusion.

The next step is to consider if implementing AI. AI can be applied at various levels, depending on the problem to be solved. For instance, if comparing the performance of two factories, data can be gathered and put into the cloud, inside or outside the enterprise, and then compared and analysed to start drawing conclusions.

At the other end of the spectrum, the performance of a machine that isn’t meeting full specifications can be analysed. This can be difficult in a mass production scenario. For example, a manufacturer providing parts for the automotive industry might need to generate 100 000 items per day, that need to be delivered ‘just in time’ to the customer. If it takes two weeks to analyse the data quality only to discover that the product isn’t meeting the specifications, the issue identified could then lead to an extensive product recall.

This is a completely different problem that needs solving. It can’t be solved in the cloud, as



A machine that needs to produce a 100 000 items per day needs to be analysed in real time so that a low-quality pattern can be identified before thousands of scrap products are delivered. This is where edge computing is very useful.

it can take hours or days to collect and analyse the data there. Instead, a solution that will run in the machine in real time is needed; one that can identify a low-quality pattern before the 100 000 items are produced. This is where edge computing is very useful.

The main challenge remains: what problem needs to be solved? A company with strong, top-level management knows the key challenges it faces and will want to use the most effective tools to optimise performance. The problems faced will determine what needs to be done. For instance, if the company wants to compare a large amount of data from 20 factories, AI in the cloud can play a key role, but if an immediate reaction on a bottling line, for example, is needed, AI at the edge should be considered.

## Issue 2: How to access and make the best use of data?

The machines within a factory are a potential source of valuable data. But how can users access and analyse the data that a machine provides? How can a manufacturing plant then make the most effective possible use of this data, especially when introducing AI? Key questions are:

- The data: Is there enough data – and if so, which data is the most relevant and how will it be used?
- The infrastructure: How much will the infrastructure cost?
- The outcomes: What problem does the company really need to solve and what increase in efficiency can be achieved by using cloud or edge computing?

Large IT companies are promoting the cloud as the solution to everything. However, it isn’t a complete panacea, as it doesn’t show or respond in real time to what is actually happening in the machines, which is why Omron decided to focus on this area. Omron has been developing tools to help the human brain cope with the challenges of what is happening

inside the machines – along with details of downwards analysis and pattern recognition.

In edge computing within an industrial manufacturing environment, it is possible to look at the actual process within the machine. Real-time data processing at the edge enables an immediate response to an abnormal situation in a process. With AI at the edge, manufacturers can control complexity and security. To translate information into action, manufacturers need efficient control and monitoring for a more natural, proactive relationship between operator and machine.

With edge computing, the data and the computing resources are located close to the machines. This enables users to gain real-time information about the efficiency of different aspects of their industrial automation system. This means that they can access intelligence within the machine, which in turn enables deep analysis to be carried out.

This information is scalable and measurable, and enables the factory to achieve a significant increase in its overall equipment effectiveness (OEE). Manufacturing companies are increasingly recognising that AI can make a major contribution to their profitability by increasing their OEE, which in turn will lead to greater productivity and lower costs.

In this way, AI can contribute to direct and immediate results, because the intelligence is incorporated within the machine rather than being located elsewhere. Users can focus on potential issues in the process, using the real-time data from the system and its components.

Omron’s AI Controller has some pre-programmed tools that can help with simple cases of preventative maintenance. Using advanced mathematics, it can detect a problem or a deterioration in part of the equipment before a machine breaks down. However, with more complicated machines and with problems that involve more detailed use of AI, specialists with advanced skills are currently



needed to extract the maximum value from the new technology.

## Issue 3: How secure is your data?

Using the cloud can cause problems of security, particularly in relation to compliance with the latest IEC 62243 cyber security standards. These are becoming increasingly important in industrial situations, and relate to the security, safety and integrity of the components and systems used within industrial automation programs.

In contrast, edge computing within the factory provides another level of security, as the data resides within the machines. The whole industrial automation process can be secured using solutions such as intruder detection, video monitoring and access control systems.

## Conclusions

In traditional machine control environments, it has been impossible to program a machine to recognise micro-second skill patterns in the local data that might be entering it. Potentially all machines have this information but until recently it has been ignored. However, the introduction of AI solutions at the edge inside the machine now provides tools that enable this data to be accessed. Advances in technology mean that machine control equipment can process the data and recognise patterns within it.

Although edge computing has some distinct differences from cloud computing in the manufacturing arena, it doesn’t have to be a complete substitution for cloud computing – the two can co-exist as they complement each other in many ways. In some situations, computing might take place in the cloud and then be transferred to edge devices.

Cloud computing and edge computing both have a valuable role to play in manufacturing, but it seems clear that in terms of using AI on production lines, edge computing really does appear to have the edge. □



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