Machine learning-based predictive maintenance changes the game in the bearing industry

On 7 October 2020, SKF announced AutoML, software that uses artificial intelligence (AI) to accurately predict mechanical failures in order to optimise maintenance and production processes.

AutoML (Automated Machine Learning) applies Machine Learning algorithms to real-time process data to identify anomalies and warn technicians of evolving asset failures. AI is responsible for choosing which machine learning models are applied and maintaining these models whiles they run in production. This capability enables quicker modelling and higher accuracy.

Almost a year after it was acquired by SKF we spoke to the Co-Founder of Presenso, Eitan Vesely (now AI Offering Manager at SKF) to learn more about the latest AI technology, how it will benefit SKF's customers and how it will affect the future of the bearings industry.

Eitan Vesely,
SKF AI Offering Manager

Has AutoML already been widely applied to customers or is it still in the early stages of adoption?

The technology has been applied to several customers, including those that Presenso was working with before the acquisition — but it has not yet been widely applied. We are in the early days of scaling the project. Right now, we're at the point where we're starting to look at hundreds and thousands of machines per customers.

How will artificial intelligence affect the overall accepted manufacturing models?

First of all, the effect would be on creating a streamlined production process. So customers are able to use AI and other predictive maintenance technologies to help run a continuous production process with significantly less, or even zero, unplanned downtime.

What is AutoML and how does it work?

AutoML stands for Automated Machine Learning. One of the bottlenecks in upscaling any solution or technology is manual labour. So if machine learning is deployed by human data, with scientists working with the data and manually building AI models, they would then need to manually maintain and configure them to ensure that they perform correctly. AutoML takes around 95% of the work that human data scientists have to do and automates it. So we're pretty much unlocking the bottleneck for scaling AI models and AI solutions.

How can you create the synergy between process data and vibration data, or between Presenso and SKF?

That's a good question. First of all, there are different types of failure modes that are predicted by each set of data. For example, there is a range of failure modes that go unseen by vibration data alone and this is where the process data comes in handy.

What we have been able to prove in the last few months is that using both vibration and process data extends the scope of failures that are able to be predicted. Secondly, the value comes from contextualising one's findings.

> “We're talking about connecting and monitoring the performance of hundreds of millions of bearings.”

Let's say that an anomaly is identified in the vibration data, now we have the capability to contextualise it with the process data. Basically, we have two different models looking at the same process, which enables us to better understand the events that are seen in both sets of data, creating strong synergies between both aspects.

How do you foresee AI technology changing the bearing industry as a whole?

First of all, we're talking about connecting hundreds of millions of bearings (with millions more being added every year) to the rotating equipment performance offered. On these scales, AI acts as an enabler and plays a very important part in the process of serving our customers on these magnitudes.

What's the difference between SKF AI and Enlight AI?

SKF AI has several responsibilities, one is to develop our offers to the customers in order to support and serve their rotating equipment performance offer.

The second responsibility is to internally automate the work that is being done today on data — in order to upscale it and make internal processes more efficient.

The third responsibility of SKF AI is to find solutions that will optimise the efficiency of our operations, mostly on the manufacturing floor and increase quality assurance. Enlight AI on the other hand is one offer, or one responsibility, under SKF AI.

Could you summarise the benefits of SKF AI and Enlight AI for customers?

Through Enlight AI, we're able to predict more failures, further in advance, by using the combination of process and vibration data. Furthermore, we're able to cross-examine the data-driven conclusions with the knowledge of human SKF experts. With that, we're able to predict a much broader scope of failures for our customers.

In terms of SKF AI, there is a lot of work going on to automate manual work in order to upscale our ability to serve more customers and more machines. We're also using it to develop solutions that will optimise the efficiency of our own manufacturing.

Moreover, quality assurance will eventually shorten lead times and close the loop with the market needs in the minimum amount of time.

Are SKF's AI offerings economically applicable for small and mid-sized manufacturing companies?

First of all, there are offers within SKF that are being built and targeted to small and medium-sized companies, which are not necessarily AI.

When it comes to Enlight AI, it really depends on the level of maturity of the customer. Usually, we need these

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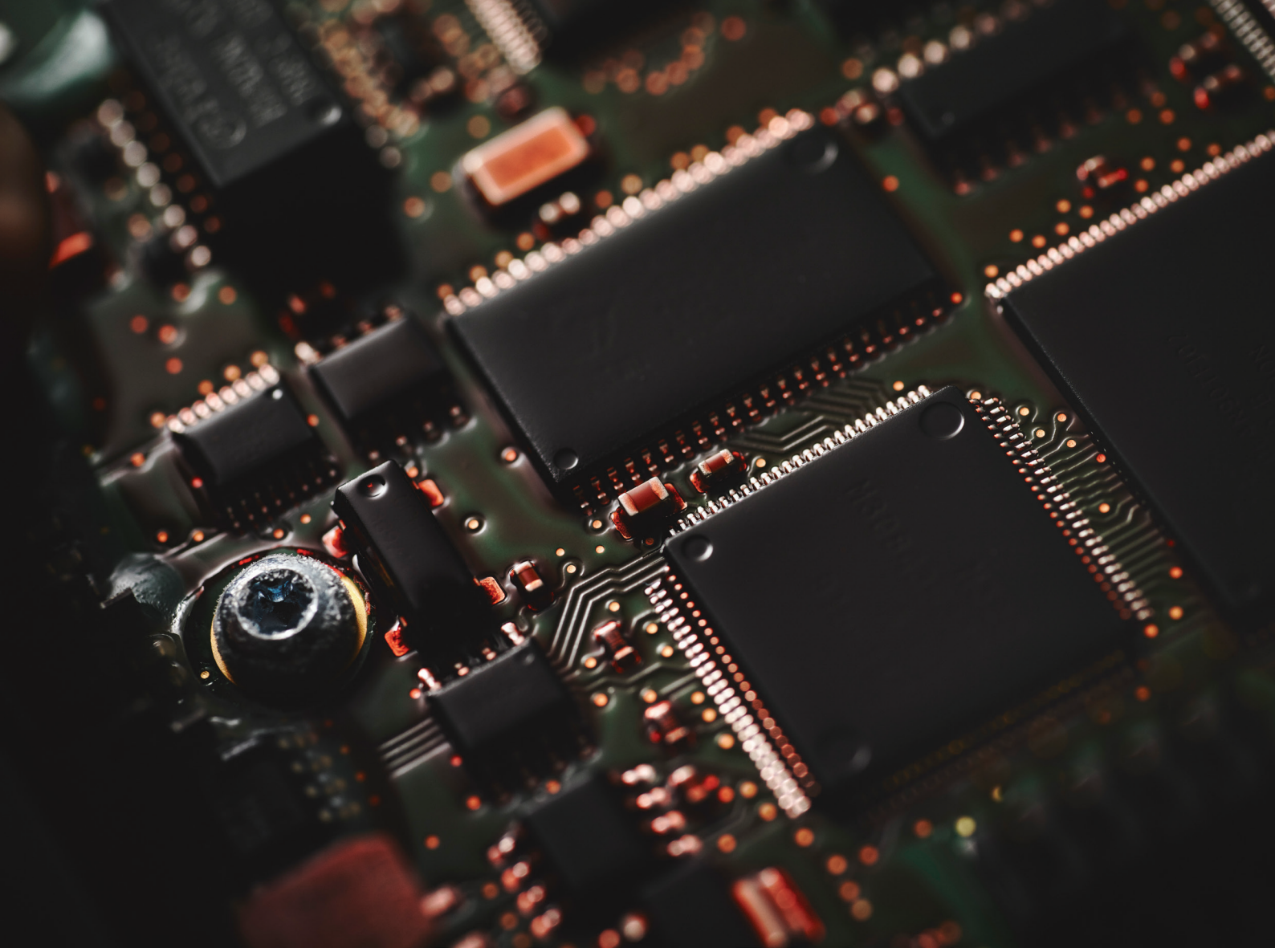

customers that have DCS systems and data acquisition systems, which most medium to large size enterprises do, but when we look at small businesses, it really depends on their maturity.

However, Enlight AI is focused mainly on the process industry. So the manufacturing of pulp, paper, steel, cement, chemicals, oil and gas etc. Usually, these are industries of the medium to large corporates that we're working with.

Are there any additional costs when implementing SKF or Enlight AI?

The implementation is quite straightforward. Enlight AI only needs data, so customers would need to hire IT staff in order to provide the interfaces required to retrieve the data.

With that in mind, I would say the additional investment is slim when it comes to AI. Usually, Enlight AI is installed as part of a larger REP (Retaining Equipment Performance) contract, so there are other efforts from the customer's side.

But with the division or guidance of scalability that comes as a result of Enlight AI, the implementation effort is relatively small by comparison.

How does the algorithm for machine learning work for bearing applications?

Simply put, for the first phase of AutoML, the software needs to select the best performing modelling tool because there is a set of AI algorithms, each with its own advantages and disadvantages. The software starts by selecting which AI tool it wants to work with on the data. Then there's the model generation phase, where the tool selected will be used to generate a model that represents the data being analysed.

Once we have the model in place, there is the part of the software which takes the models generated and extrapolates them to predict upcoming behaviours. When a difference is detected between the predicted model and the actual data, this is flagged as an anomaly.

These anomalies are then used for the prediction algorithms, the algorithms that make the less layer where they take the anomalies detected. They then extract patterns from these anomalies, so multivariate across sensor patterns — these are all indicative features that are then fed into the failure prediction algorithms in order for them to alert whenever they detect an evolving failure.

An interview by Thomas Johnson, editor at Bearing News magazine