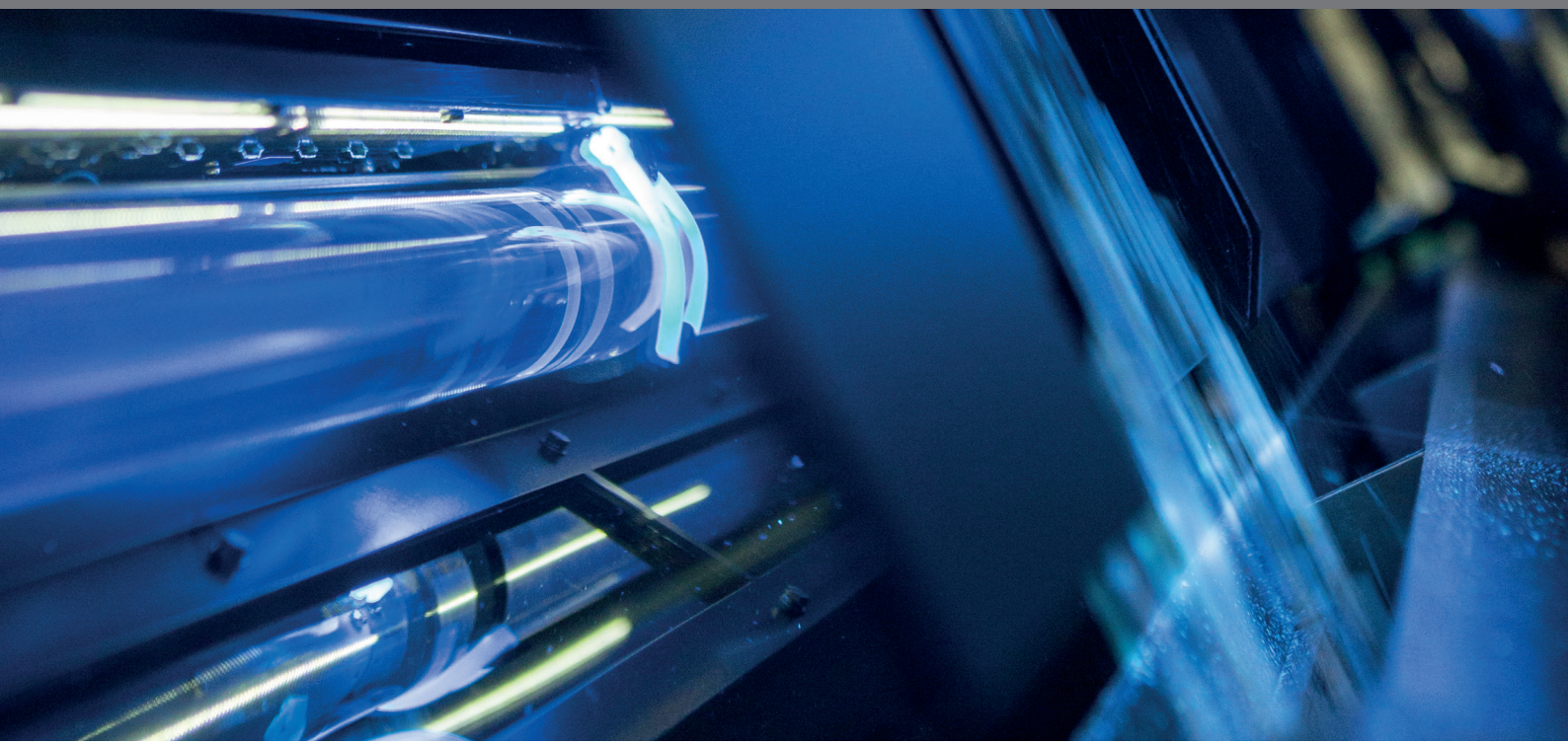

One grain at a time: How Bühler is combining advanced data analysis with machine learning to tackle a global food chain problem

You may not have heard of Bühler AG, but as one of the world's leading suppliers of food processing equipment, you've almost certainly eaten something that's passed through the Swiss firm's technology.

Likewise, there's a good chance you haven't heard of mycotoxins or aflatoxins either. And that's down to the important and innovative work of companies like Bühler.

Customer

Bühler

Website: www.buhlergroup.com
Country: Switzerland
Industry: Manufacturing
Company size: Corporate (10,000+ employees)

Customer profile

Bühler Group provides solutions in the fields of Grain Processing, Food Processing and Advanced Materials. Striving for innovations for a better world, its technologies focus on sustainability and energy efficiency.

Software and services

Microsoft Azure IoT
Microsoft Azure Machine Learning Studio

Finding the fungus among us

Mycotoxins are toxic substances that colonise crops. Left unchecked, they're capable of causing disease and death in both humans and animals.

One such toxin is called aflatoxin. Just two grains in 10,000, infected with this highly carcinogenic fungus, can be all it takes to write off an entire lot. And that's a huge problem, because detection is notoriously difficult. Aflatoxin often can't be seen, smelled or tasted, and it's not destroyed by heat – so cooking contaminated food doesn't make it safe.

In humans, exposure to aflatoxin doesn't usually cause acute contamination – where you eat infected food and feel ill. The potentially fatal effects more often come from chronic exposure and steady consumption.

A growing problem for food producers

Grain is the cornerstone of global nutrition, and corn – or maize – is the most grown grain on the planet. It's a staple in African and Central American diets and the main source for livestock feed around the world.

For countries and regions with strong food safety regulators, aflatoxin is more of an economic problem – because contaminated food can't be sold. But in other areas, where there's no choice but to eat tainted food or go hungry, it has become a severe health problem.

Since consumers can't tell if their food is infected, the onus is entirely on growers, harvesters and processors – more of whom are having to fight the mould as it expands north amid climate change that stresses crops and makes them more susceptible.

Using the cloud to safely navigate the maize

Ideas for keeping aflatoxin out of food have been floated for as long as its risks have been known, but the technology to implement them has been limited and costly.

That all changed when Bühler engineers combined over 70 years of grain sorting expertise with the power of the Microsoft cloud, data analytics software, and advances in camera and UV lighting technology.

"Aflatoxin isn't exactly a household name, but it's one of the biggest global pains. And it's a silent threat – you don't even know you're being poisoned.

Beatrice Conde-Petit,
food safety officer, Bühler AG

The end result is LumoVision: an optical sorting machine that takes pictures of individual kernels and effectively removes contaminated maize grains to ensure safe food and feed. And while that sounds simple enough, it's a solution that's only been made possible through Bühler's commitment to digital transformation.

In the initial research project, images of good and contaminated maize kernels were collected with a hyperspectral camera – which adds spectral information to each pixel of an image – creating so-called 3D 'hypercubes'. But the integration of such cameras in optical sorters with a massive throughput of some 20,000 kernels per second wasn't financially viable. At least, not until the Microsoft cloud made it possible.

Through an exploratory analysis of the hyperspectral data in Azure Machine Learning Studio, the most important optical parameters/ wavelengths for classifying contaminated grains were identified. And these insights enabled the development team to design an effective and cost-efficient camera for industrial high-throughput grain sorting that's capable of detecting mould-contaminated maize grains. After being identified, contaminated grains are then removed from the product stream with high precision air ejectors. No grain, no pain.

Saving time, money and lives

LumoVision's real-time identification and elimination keeps toxins from spreading and infecting even more kernels. And it's so fast that if you were to turn an open bag of corn upside down, its entire contents would be analysed and sorted by the time a single kernel hit the ground.

To put this into numbers: the system can process up to 15 tons of maize per hour. That's 15 tons – or, an entire truckload – of maize that might otherwise have to be burned or thrown away if just two aflatoxin-affected grains were detected.

So, not only are there huge cost savings to be made, there are also huge implications for the global food supply chain – especially when you consider the amount of food that gets wasted each day due to inefficient processing in underdeveloped regions.

"We are very excited by Bühler's new development. The new machine should allow us to sort all our incoming product, reducing losses and most importantly improving food safety."

Damiano Destro, Capa Cologna

KEY STATISTICS

The system can process 10 to 15 tons of maize – or an entire truckload – in just one hour.

LumoVision reduces healthy grain wastage in the process to less than 5 percent – down from as much as 25 percent with existing machines.

"We're not only going to get economic results, but hopefully we can transform and save lives at the same time. It's the most exciting and valuable project I've worked on in my 40 years with the company. It's a really big thing."

Ben Deefholts, Senior Research Engineer, Bühler AG

A LumoVision of the future

While the technology only works with maize right now, Bühler hopes to roll it out to other foods at high risk of aflatoxin infection, such as peanuts, rice and dried fruit.

Senior Research Engineer, Ben Deefholts, says that there's huge potential throughout the food value chain, in terms of the value Bühler can offer its customers.

"Now we can have a subscription model and charge at different rates, depending on whether we are sorting or monitoring. And without that connection [to the cloud], we wouldn't really be able to do that.

"It's a new revenue stream for Bühler," says Deefholts. "But it also offers our customers the opportunity to get this technology at a much lower initial cost, and then they can pay for it from the profits they're making over time, rather than buying machinery outright. I think that could give us access to a much wider customer base in the future."

Whatever happens from here, LumoVision is already an important step towards an integrated mycotoxin management solution that will result in safer food and feed chains globally. And that's good news for everyone.

"I see us being at the very, very beginning of a very interesting journey, which should take us to quite amazing things in the future."

Ben Deefholts, Senior Research Engineer, Bühler AG