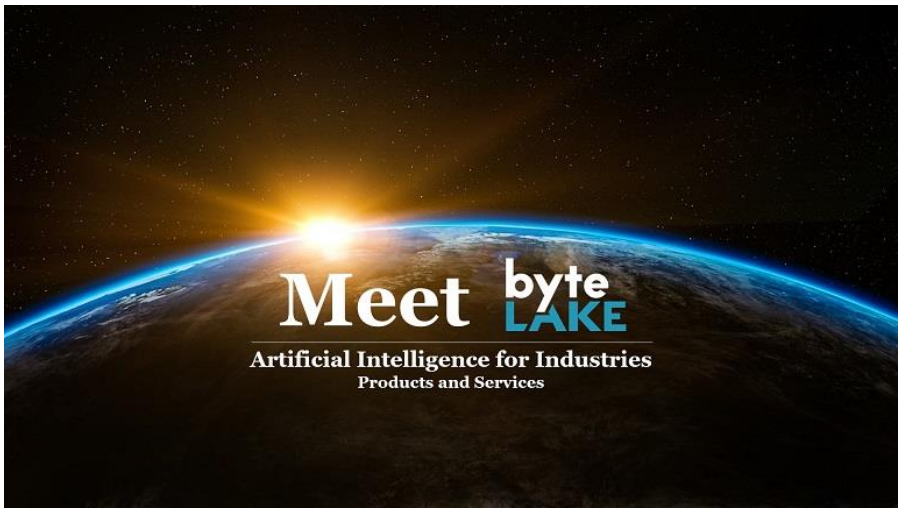

Wet Line Detector for Paper Industry

VISUAL INSPECTION

byteLAKE's Cognitive Services is a collection of AI models for Industry 4.0: Visual Inspection (products counting, recognition, quality monitoring), and Big Data analytics (finding answers in data). Wet Line Detector is the product's version customized for Paper Industry (intelligent cameras monitoring paper production and helping avoid unplanned downtimes).

Artificial Intelligence

Machine Learning

Deep Learning

Computer Vision

Edge AI

Cognitive Automation

RPA

HPC

FPGA / GPU

byte LAKE

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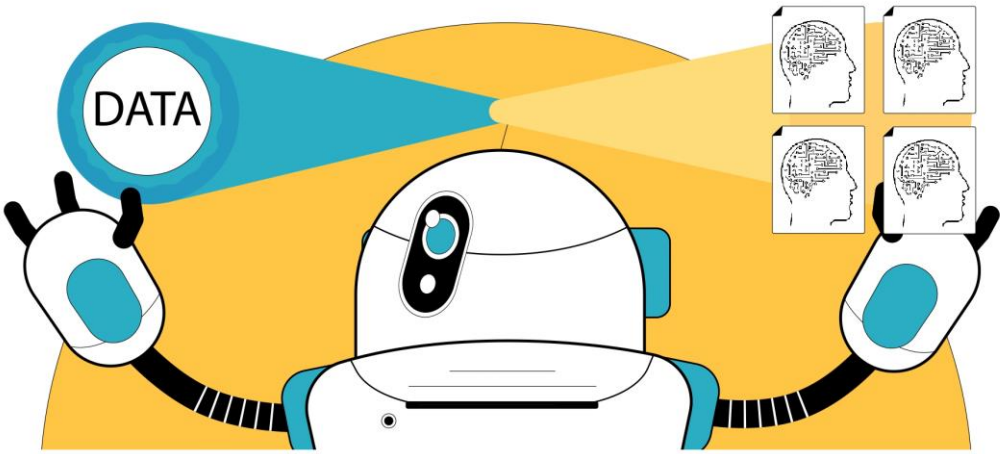
byteLAKE's Cognitive Services: Artificial Intelligence for Industry 4.0

byteLAKE's Cognitive Services is a collection of Artificial Intelligence (AI) models designed to address Industry 4.0 needs. Each AI model has been designed and trained to be razor-focused on specific industrial jobs, therefore ensuring maximum accuracy.

byteLAKE have made a strategic decision to work with various industry leaders and talented researchers in efforts to combine human knowledge, industry expertise, and know-how with the best AI algorithms and technologies. Humans and machines both make mistakes. Therefore, byteLAKE's Cognitive Services have been designed to effectively bring out the best of both worlds.

In essence, byteLAKE's Cognitive Services focus primarily on the following two areas:

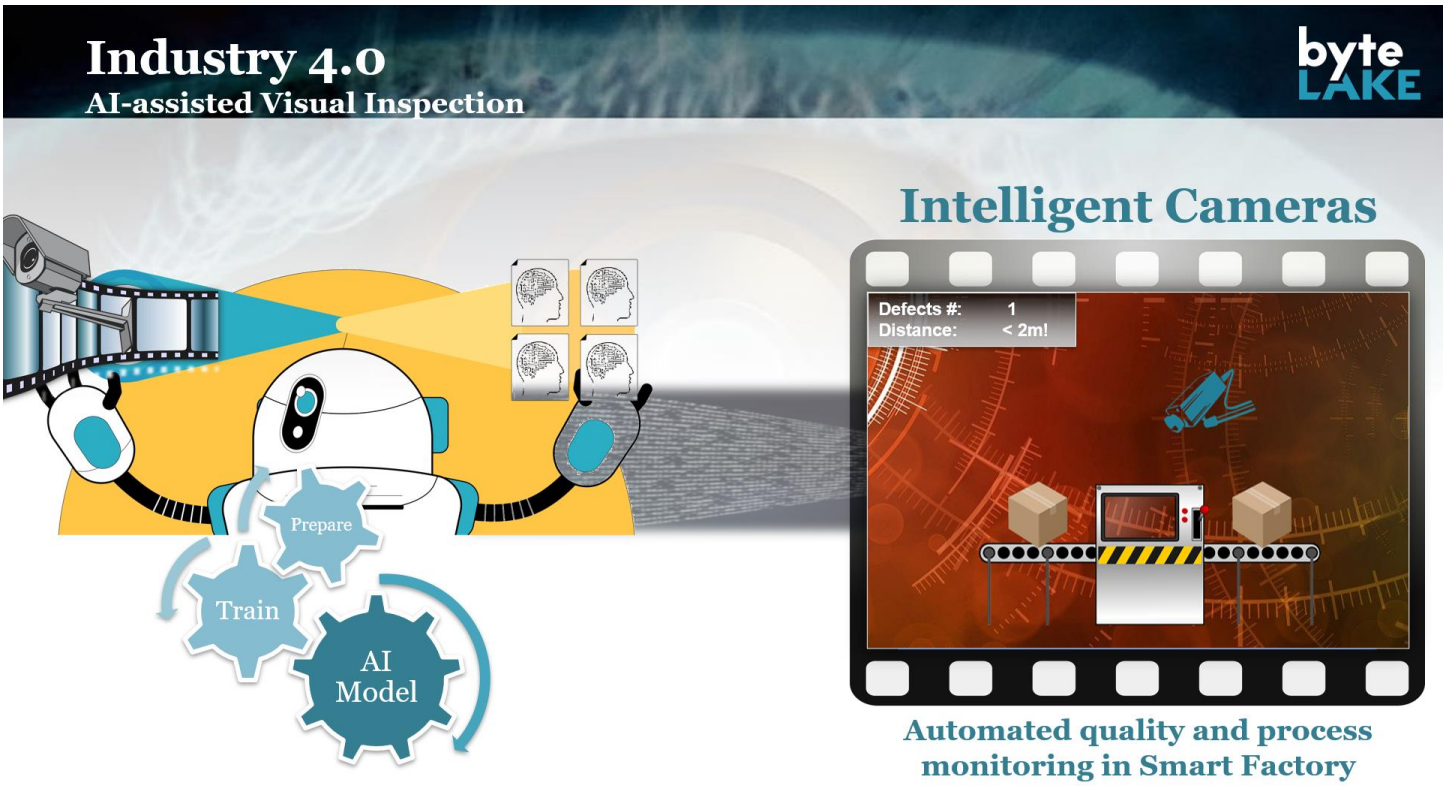
- **AI-assisted visual inspection** for efficient quality of products & process monitoring.
- **AI-powered Big Data / IoT sensors data analytics** to find trends, enable predictive maintenance, answer questions like why something happens, what will likely happen and to find the collective meaning of the data extracted from many sources.



AI-assisted visual inspection in Industry 4.0

Artificial Intelligence (AI) brings value across industries, giving machines the abilities once reserved for humans. On one hand, its fast adoption is driven by a constantly growing number of software frameworks, availability of a specialized hardware, and Big Data. On the other hand, **effective human-robot collaboration translates into increased efficiency, decreased number of defects, routine jobs automation, faster results, and numerous costs optimizations**.

AI-assisted visual inspection is a scenario where AI is leveraged to transform computers into intelligent machines to identify objects, analyze scenes and activities in real-life visual environments. For instance, a **camera is used to take pictures of products or production lines and AI algorithms provide analysis related to products quality, quantity** or even analyze and help **monitor production processes**.



Performance of such systems is critical. AI-assisted visual inspection is as useful as its timely and accurate responses. Therefore, the underlying software, or the AI algorithms to be precise, need to be optimized and generate results without latencies or even in real-time. Therefore, byteLAKE has been working with industry leaders to ensure that the Cognitive Services offer maximum performance across various hardware configurations.

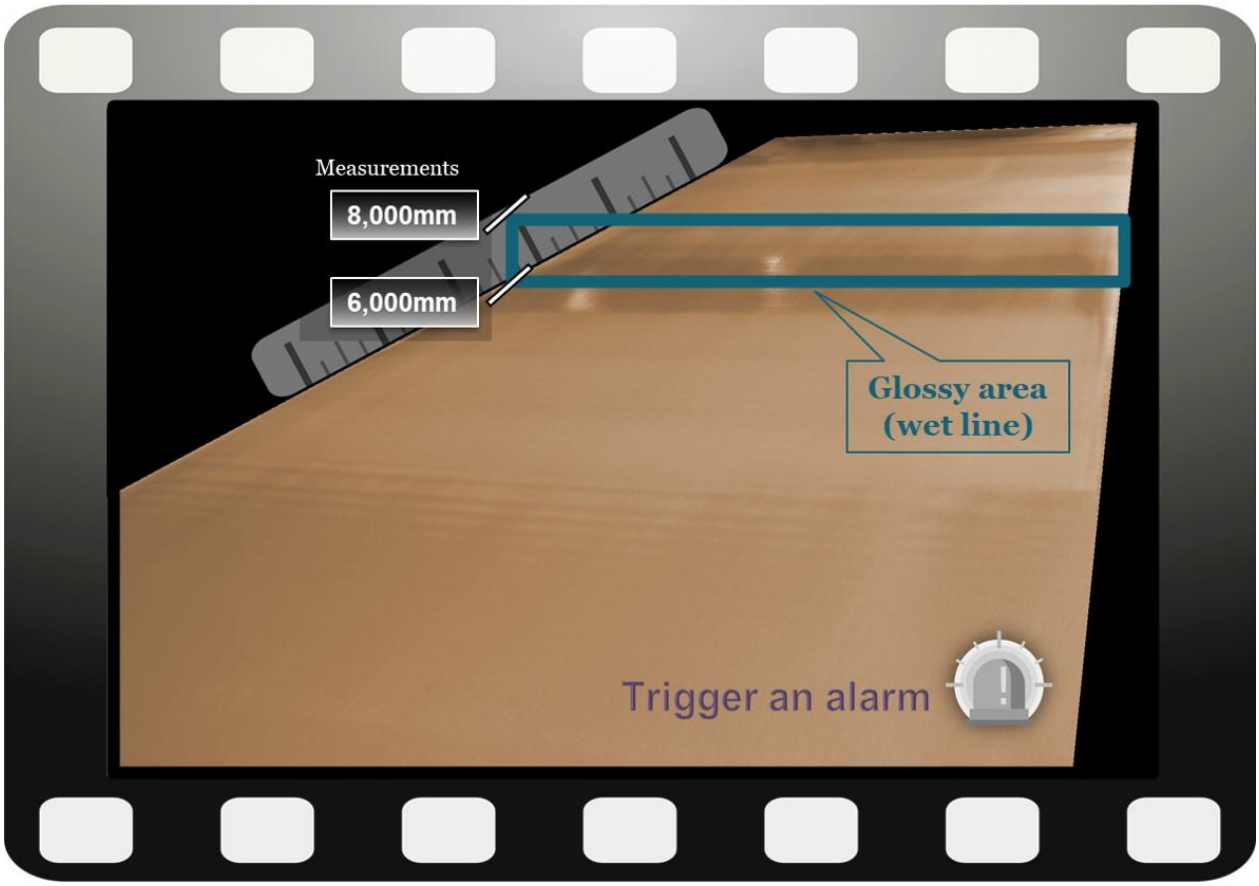
AI for Paper Industry

Paper production is a multi-phase process during which a natural phenomenon called Wet Line (sometimes Dry Line or Water Line) is observed. AI-assisted visual inspection of the process can help efficiently detect and monitor that phenomenon.

As per Wikipedia, *modern papermaking began in the early 19th century in Europe with the development of the Fourdrinier machine (aka paper machine). This machine produces a continuous roll of paper*. As it is further described on Wikipedia, *a modern paper mill (=factory making paper) is divided into several sections […]. Pulp is refined and mixed in water with other additives to make a pulp slurry. The head-box of the paper machine distributes the slurry onto a moving continuous screen, water drains from the slurry (by gravity or under vacuum), the wet paper sheet goes through presses and dries, and finally rolls into large rolls*. One of the most energy- and capital-intensive phases is dewatering. **Water removal on the paper machine is accomplished in consecutive stages** i.e. press section, dryer section etc. **During that phase, a natural phenomenon called "wet line", sometimes "dry line" or generally "water line" is observed.**

"Wet Line" needs to be carefully monitored to avoid losses and expensive breaks in production. Typically, it shall be kept within a certain area on the paper machine. Once it goes out of control, it can cause damages translating into tangible loses and delays in production. Therefore, actions need to be triggered before it gets too close to certain areas. Its presence, though, is useful to the operator for optimizing the paper machine settings. However, the operator needs to constantly inspect the machine visually, monitor the wet line manually and adjust the settings accordingly to avoid a disaster.

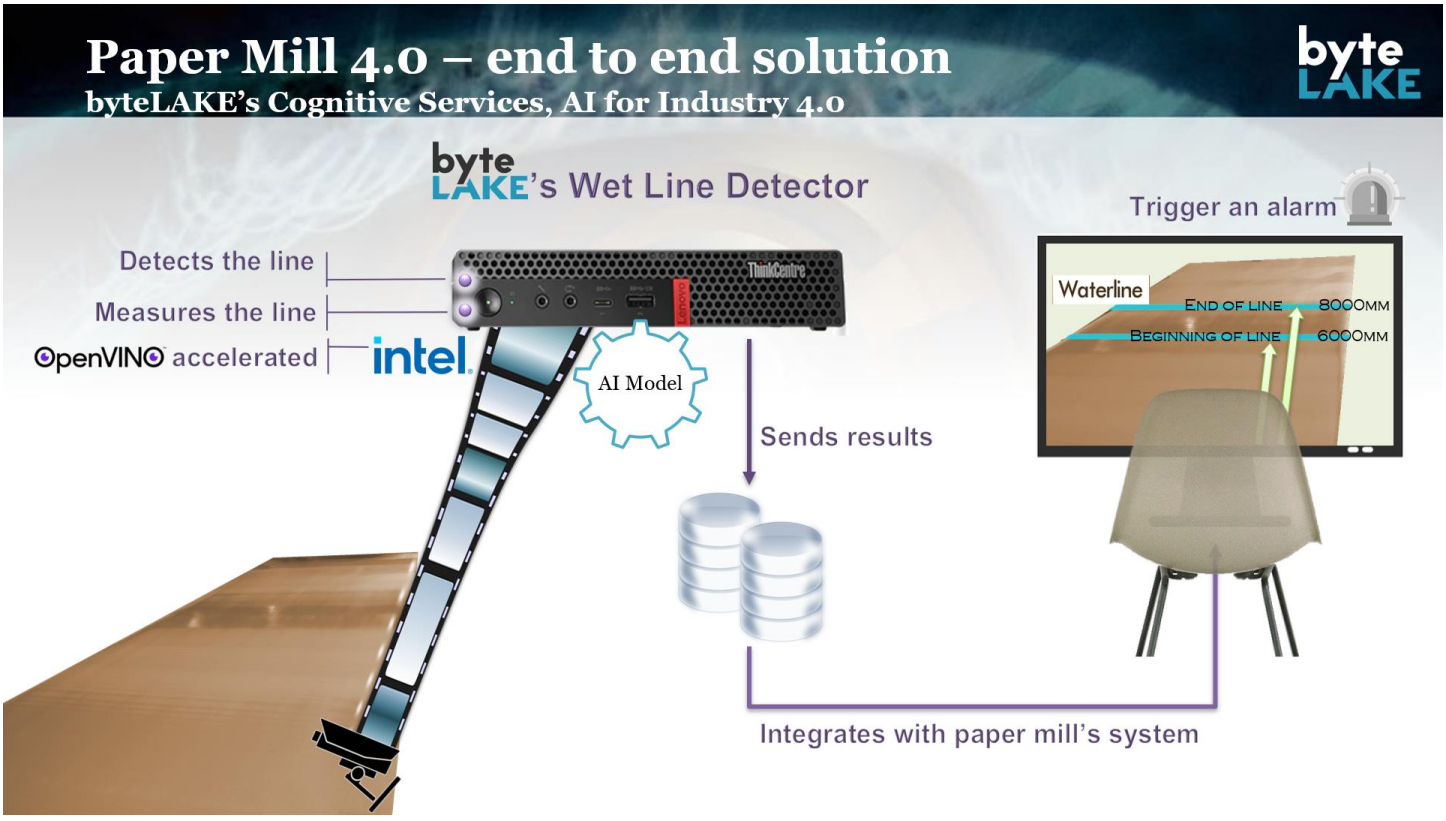
The average cost of an unplanned downtime is USD $220,000 a day for a paper or pulp plant.
International Journal of Strategic Engineering Asset Management



byteLAKE's Wet Line Detector

Wet Line Detector for Paper Mills automates detection and measurements of the so-called wet line. This module helps reduce costs, expedite visual inspection and avoid unplanned downtime in paper production. Available as a complete end-to-end solution, including edge components (hardware computing units, cameras), software license, integration services or guidelines, and post-deployment customer care.

To further automate the process of paper production, byteLAKE has worked with the leaders in the industry to optimize byteLAKE's Cognitive Services for the purpose of automated wet line detection and measurements. The solution can work in real-time and continuously analyze frames received from industrial cameras. AI algorithms inspect the surface where the fabric is formed and detect the so-called Wet Line. In addition, the algorithms measure and estimate the position of the Wet Line as well as its width. This information is then presented to the paper machine operator who can react accordingly and i.e., apply required settings. More about the solution can be found at: https://www.bytelake.com/en/ai-for-paper-industry/. The solution is visualized in the picture below.



Wet Line Detector – integration into Paper Mill

byteLAKE's Wet Line Detector has been designed to work with the majority of the available hardware components incl. cameras and hardware computing units (i.e. desktop PCs). However, it is also available as a complete, end-to-end solution, ready for integration with the paper mill's manufacturing software components. Typical deployment is shown in the picture below.

A camera is used to take pictures of the production line. Note that the software has been optimized to work with acute angles so that the camera can be placed on a side of the production table and does not need to hand over it. The picture is then processed by byteLAKE's Cognitive Services module dedicated to Paper Industry (Wet Line Detector). The results can be sent either to the cloud or any server / local hardware infrastructure where manufacturing software resides. As a final step, the results of the analysis can be visualized to inform an operator about the Wet Line's presence and its measurements.

Wet Line Detector – licensing

Typically, the overall cost of deploying Wet Line Detector in a paper mill consists of 2 components.

1. Cost of hardware and integration (one time).
2. Annual license giving access to the product incl. upgrades, customer care/support for 12 months.

Key takeaways

- **byteLAKE's Wet Line Detector** automates detection and measurements of the so-called wet line. This module helps reduce costs, expedite visual inspection and avoid unplanned downtime in paper production. Available as a complete end-to-end solution, including edge components (hardware computing units, cameras), software license, integration services or guidelines as well as post-deployment customer care.
- **Wet Line Detector can be easily integrated** into existing components (cameras, PCs, servers, manufacturing software) or can be delivered by byteLAKE as a complete, end-to-end solution.

- **Wet Line Detector is part of byteLAKE's Cognitive Services. They automate visual inspection and Big Data processing across industries.** Each AI model has been designed and trained to be razor-focused on specific industrial jobs, therefore ensuring maximum accuracy.
- **Can be re-trained to handle a variety of scenarios** related to visual inspection/quality monitoring automation, products counting, objects recognition and historic data analysis to find hidden answers in the data (i.e. trends, information about why something happened or what will likely happen and when).

- **New AI models are constantly added by byteLAKE** which gradually increases the number of scenarios that can be handled off-the-shelf. To do so byteLAKE collaborates with a growing number of industry/manufacturing leaders.
- **Cognitive Services is an add-on to existing tools/software in factories and its integration is a straightforward process (compatibility).**
- **byteLAKE as single source for all components** of the solution (sensors/cameras, edge devices, servers, data acquisition/processing, deployment, post-delivery customer care etc.)

- **Globally available through growing network of integrators.**
- **Optimized for Intel technologies** (OpenVINO) ensuring compatibility and maximum performance across various hardware configurations.

Panel discussion: Cognitive Services (AI for Industry 4 0)
Listen to the recording on YouTube: youtu.be/skM77hdPCjw

- Link to recording: https://youtu.be/skM77hdPCjw
- Learn more: www.byteLAKE.com/en/CognitiveServices
- Contact us: CognitiveServices@byteLAKE.com

byteLAKE

Artificial Intelligence for Industries. Products and Services.

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About byteLAKE

byteLAKE is a bespoke AI & HPC software company developing AI-powered solutions for enterprises. The company offers both products and services, enabling innovative, AI-powered automation and data-driven, proactive operations across various industries i.e. AI-assisted Visual Inspection and Big Data analytics for manufacturing, AI-accelerated Computational Fluid Dynamics, AI for Industry 4.0, workflow and document processing automation etc. To learn more about byteLAKE's innovations, go to byteLAKE.com.