KPM

WE CRAFT ASSURANCE

Artificial Intelligence for Foreign Material Detection in Food Processing

WHAT IS AI?

Artificial intelligence (AI) refers to the simulation of human intelligence by machines, particularly computer systems. AI encompasses various applications, including expert systems, natural language processing, speech recognition, and machine vision.

At KPM Analytics, we leverage computer/machine vision to train AI models to identify foreign and unwanted indigenous materials, ensuring product quality, and performing grading tasks. Through our line of AI technologies, we can grant computers a level of discernment comparable to humans.

WHAT CAN AI DETECT?

If a human can perceive the difference, we can develop an AI model to perceive it, too. In essence, if an operator can be trained to identify defects and sort them on the production line, we can implement a vision system to perform the same task. With the power of AI, we can go beyond mere color detection and analyze complex systems for various attributes.
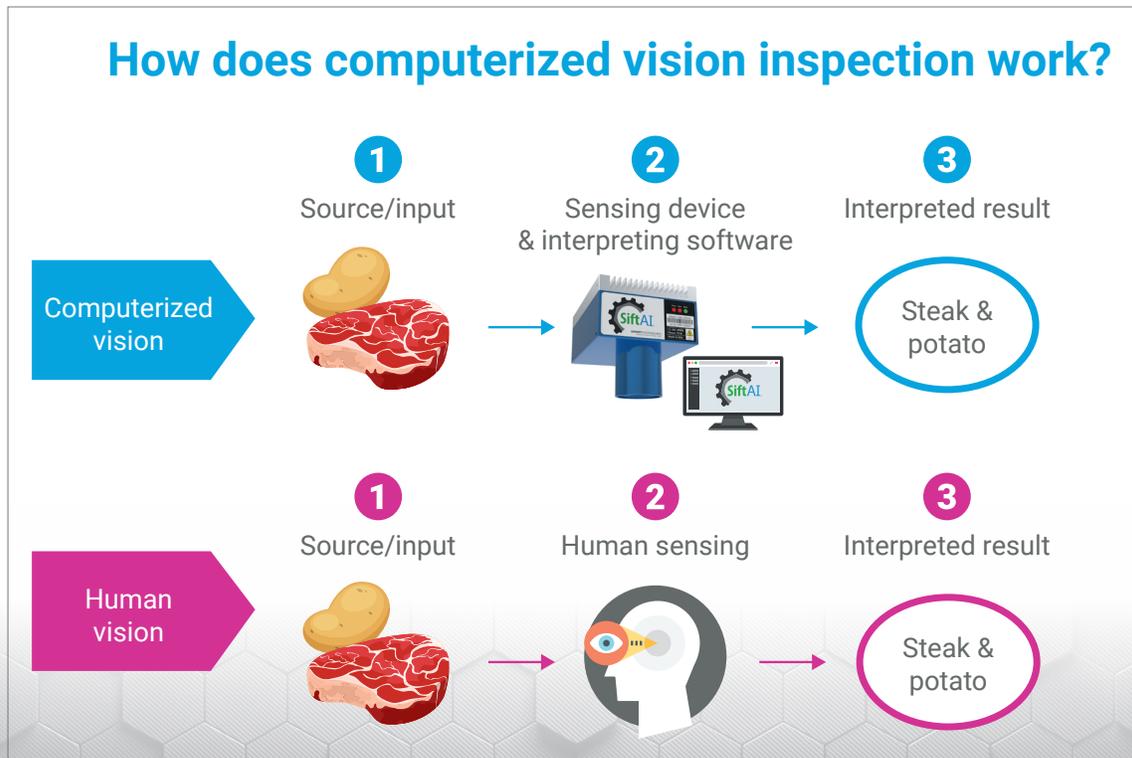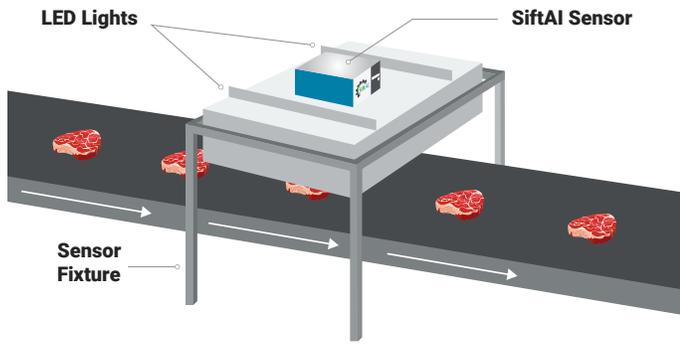
How does computerized vision inspection work?

	① Source/input	② Sensing device & interpreting software	③ Interpreted result
Computerized vision		SiftAI	Steak & potato
Human vision	① Source/input	② Human sensing	③ Interpreted result
			Steak & potato

Figure 1: *Example of a common modular system setup (illustration not to scale).*

LED Lights

SiftAI Sensor

Sensor Fixture

MODULAR SYSTEM SPECIFICATIONS

Conveyor Belt Width	Fixture Width	SiftAI Units
1-12 in.	16 in.	1
13-24 in.	28 in.	2
25-30 in.	32 in.	3
25-36 in.	40 in.	3
37-48 in.	52 in.	4
49-65 in.	68 in.	5

WHAT DOES AN AI FOOD SORTING & FOREIGN MATERIAL DETECTION SYSTEM LOOK LIKE?

KPM Analytics' AI systems are thoughtfully designed for easy installation above existing manufacturing setups. The AI systems are modular, allowing them to be customized to fit any belt width. The camera within the SiftAI® is specifically tailored to inspect 12" of belt width, ensuring high-resolution capabilities for detecting smaller defects. In cases where the production line exceeds this size, additional cameras can be seamlessly placed in succession and interconnected to cover the entire width.

Figure 1 illustrates some of our common modular system setups for food production environments, along with a table for installation options.

HOW IS THE PRODUCT REJECTED?

Once a system is installed, there are multiple ways to reject variances from the product stream. KPM Analytics offers flexible options, providing a simple signal that can seamlessly integrate with the facility's existing rejection systems. Moreover, we can deliver a comprehensive solution, including custom rejection equipment, ranging from sweep arms to sophisticated integration with robotics (**Figure 2**). Our goal is to cater to diverse needs and offer solutions tailored to each customer's requirements.
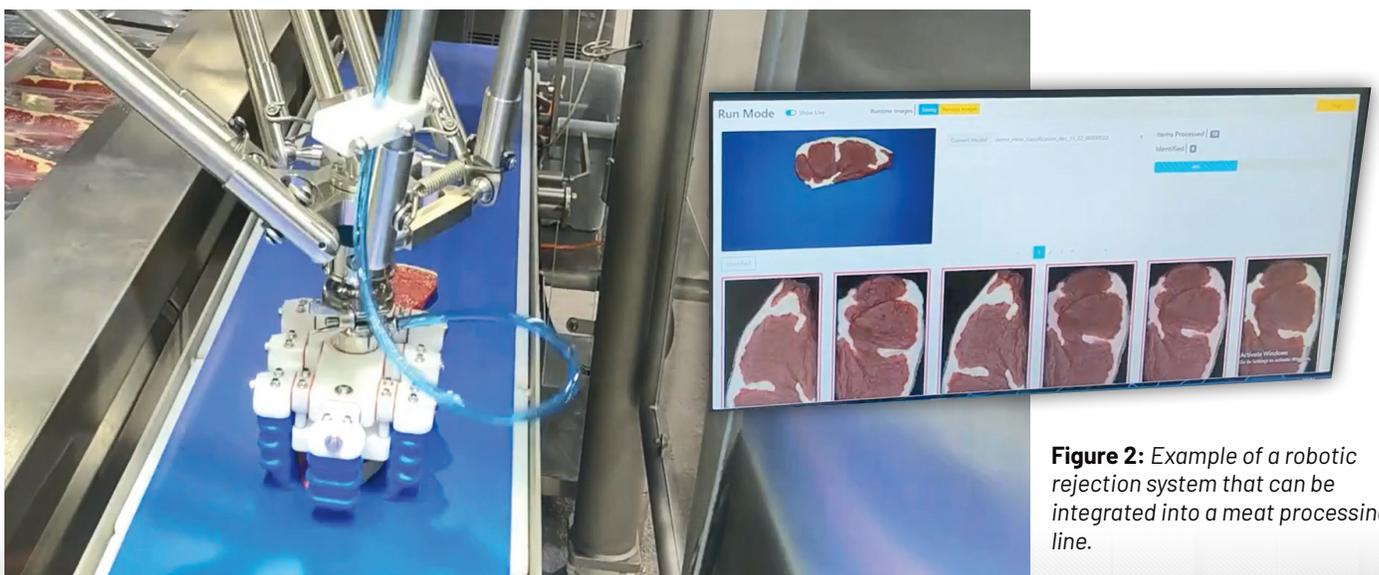

Figure 2: *Example of a robotic rejection system that can be integrated into a meat processing line.*

WHAT ARE SOME EXAMPLES OF AI USED IN FOREIGN MATERIAL DETECTION?

KPM Analytics' AI systems are trusted by customers worldwide for identifying defects in free-flowing materials. These materials can be presented under the camera in diverse ways, such as on shaker tables and on high-speed belts, which help spread out the material for efficient and accurate inspection. Our versatile system ensures precise defect detection regardless of the presentation method, offering reliable solutions to customers across the globe.

Figures 3-6 show examples of different materials and defects found by the SiftAI modular system in various food processes.

Figure 3: *Paper in IQF onions.*

Figure 4: *Cardboard in almonds.*

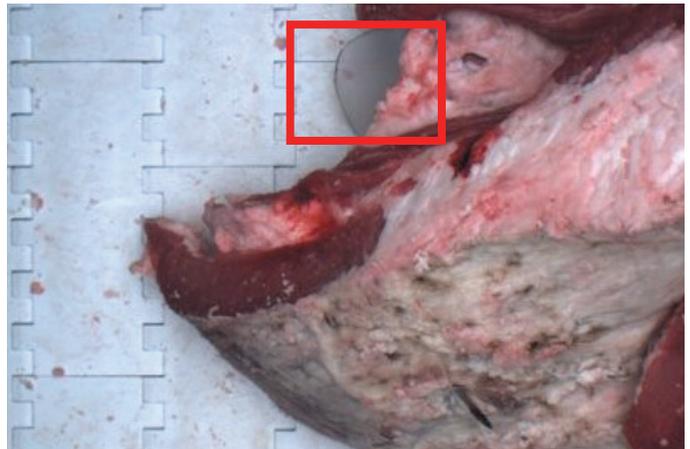**Figure 5:** *Wood in diced potatoes.*

Figure 6: *Clear hard plastic in beef.*

WHAT DOES AN INSTALLATION LOOK LIKE?

SiftAI systems are seamlessly installed over existing production lines and come with internet connectivity that is highly secure. The advantage of this setup is that KPM Analytics experts can securely access the system remotely to send updates without requiring an on-site visit. Our camera systems are shipped fully assembled for easy installation.

To complete the installation, the factory only needs to provide four things:

1. A bracket to hold the modular SiftAI system securely over the production line.
2. Ethernet connectivity
3. 110V or 220V power supply
4. A suitable location to mount the control panel within 10 feet of the modular system

Figure 7 shows an example of a modular two camera system bracket.

WHAT DOES THE MODEL CREATION PROCESS LOOK LIKE?

In AI, there are two different ways AI models can be trained: Supervised and Unsupervised learning. KPM Analytics leverages supervised machine learning to create detection models, as it offers more reliable and consistent models compared to unsupervised models..

The process of creating a supervised machine learning model at KPM Analytics involves the following steps:

1. Install the modular SiftAI system on the production line.

2. Collect images of "good" products, representing defect-free items.

3. Collect images of defects by intentionally running faulty products under the camera.

4. Utilize the gathered good and bad images to train the AI model.

5. Create the AI model and upload it to the facility's device.

6. Continuously improve the model to enhance its accuracy over time, ensuring optimal defect detection performance.

WHAT DOES ONGOING SERVICE/SUPPORT LOOK LIKE? (SAAS)

KPM Analytics offers secure connectivity to the devices installed at the facility, facilitating continuous model updates and device security enhancements. With a strong commitment to customer support, KPM Analytics takes pride in being readily available to assist their customers whenever they need help.

ARE YOU INTERESTED IN DISCUSSING AN AI-ENABLED FOREIGN MATERIAL DETECTION APPLICATION FOR YOUR PROCESS?

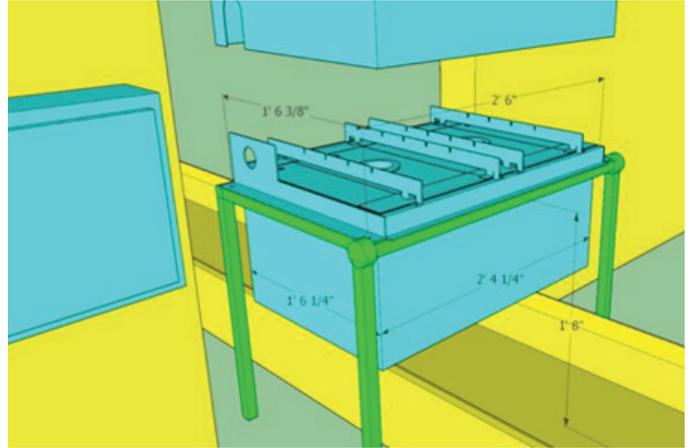**Contact us today at sales@kpmanalytics.com.**

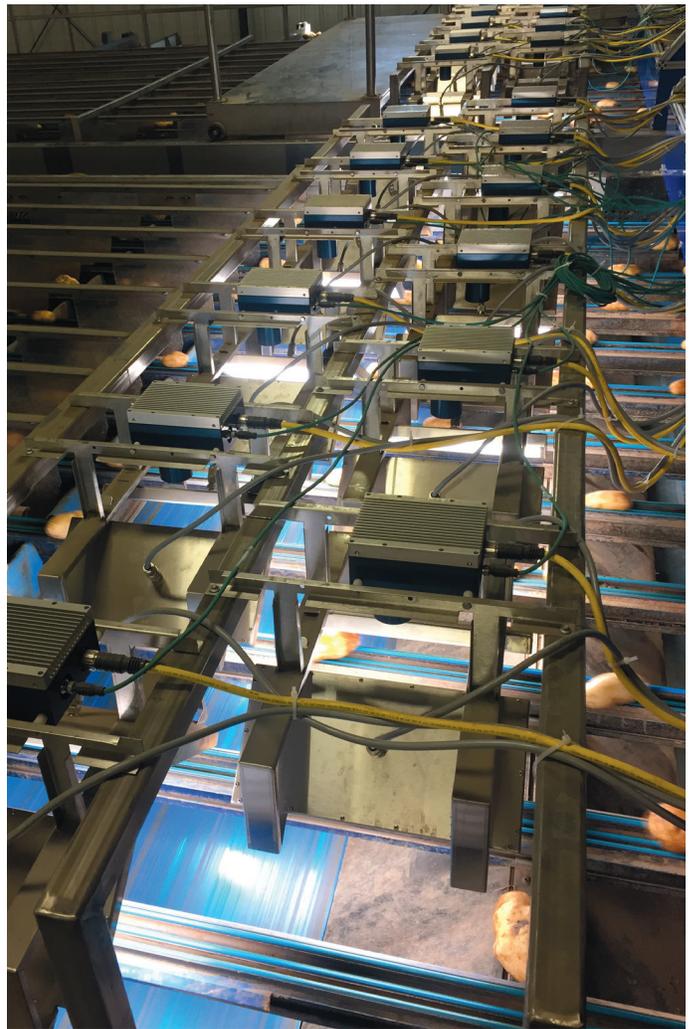**Figure 7:** *Example of a modular two-SiftAI system bracket (in green).*

Figure 8: *A series of SiftAI installations across a potato packing plant.*

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