

CASE STUDY

Increase manufacturing productivity

 EDGE IMPULSE

ADVANTECH

Case Study

Increase manufacturing productivity

Can machine learning speed up manufacturing and improve throughput?

Manufacturing at full capacity means making every second count. If you can find the bottlenecks that are slowing down your assembly line, you can increase efficiency and productivity. Manufacturing managers, roaming the factory floor, can address delays, but they can't be everywhere at once. The engineers in Advantech's new AIoT division wondered if they could help, by using video analytics to find holdups faster.

Working with the Edge Impulse team, Advantech developed a monitoring system that flags even tiny delays, for more precise fine-tuning with less human oversight. The new setup, now in place on a live assembly line, can easily be re-trained to monitor other production tasks.

Results

- Faster detection of idle time raises assembly-line productivity
- Managers free up time to focus on production planning and operations
- Manufacturers can easily deploy video analytics to improve production efficiency, even if they have no AI experience

ADVANTECH

As a global leader in industrial IoT solutions, with a run rate of two billion, Taiwan-based Advantech is a key player in the transition to Factory 5.0 operation. Through their new edge software business, they have aggressively expanded into AIoT and cloud ecosystems in recent years.



Advantech AI Box AIR-020

[View Product](#)

Frame
Extraction



Object
Classification



Object
Detection

The next phase of factory automation

Over the past decade or so, as part of the fourth wave of the industrial revolution, or Industry 4.0 for short, manufacturers in every sector have embraced digitalization and created smart production facilities that use the Internet of Things (IoT). Now, as manufacturers work to refine and evolve their IoT deployments, production facilities are moving to the next level of automation, in what's being called Factory 5.0. Factory 5.0 aims to create more collaborative relationships

between humans and machines, by leveraging advanced technologies, such as edge processing and machine learning (ML), to increase efficiency and enhance throughput on assembly lines.

Even tiny delays in assembly can create significant productivity drag

One of the biggest manufacturing-related challenges that Factory 5.0 can address is productivity. Any time spent waiting for another machine in

the production line, caused by an unexpected delay somewhere upstream, lowers efficiency.



Our only goal is to “wow” the industrial world. We’ve partnered with Edge Impulse so we can do just that.

Eric Kao, Director, Advantech WISE-Edge+

Throughout interruptions that last even just a few seconds can add up quickly, creating a significant drag on overall productivity.



In a traditional factory setting, manufacturing managers walk the factory floor to make sure the production line is running smoothly. But even the most vigilant managers can miss small delays, and spending time patrolling assembly lines takes time away from other important management tasks, like planning and scheduling.

The manufacturing experts at Advantech, a global leader in industrial IoT, wanted to see if they could use Factory 5.0 techniques, based on edge-driven artificial intelligence (AI), to help offload manufacturing managers, automate assembly-line monitoring, and increase productivity.

Prompted by an internal request to reduce wait times in the manufacturing side of the company's operations, the engineers in Advantech's new AIoT division, which focuses on ways to use AI in the IoT, got to work.

The Factory 5.0 approach to increasing productivity

The development team installed an IP video camera above a workspace to capture real-time images. The camera, pointed at a conveyor belt, where a tray arrives to deliver the next item to be worked on, sends video

images to an Advantech AIR-020 box, an ultra-compact, low-power system for running neural networks on the edge.

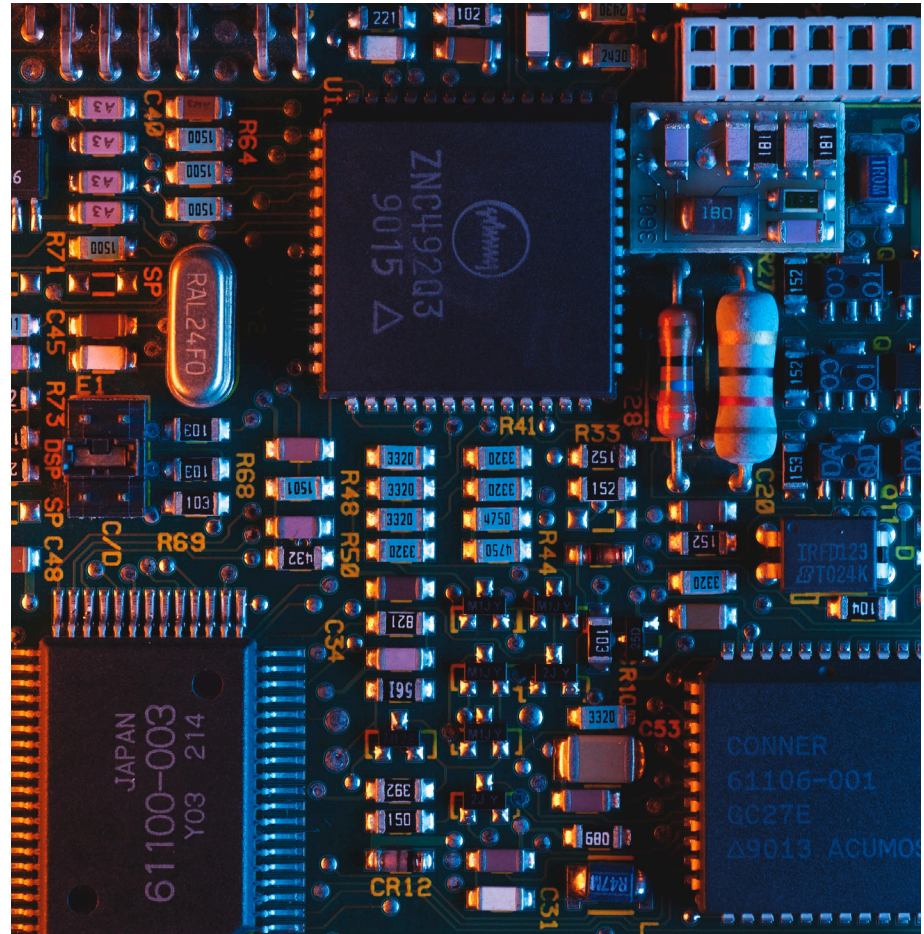
Real-time video analytics, powered by the NVIDIA Jetson family

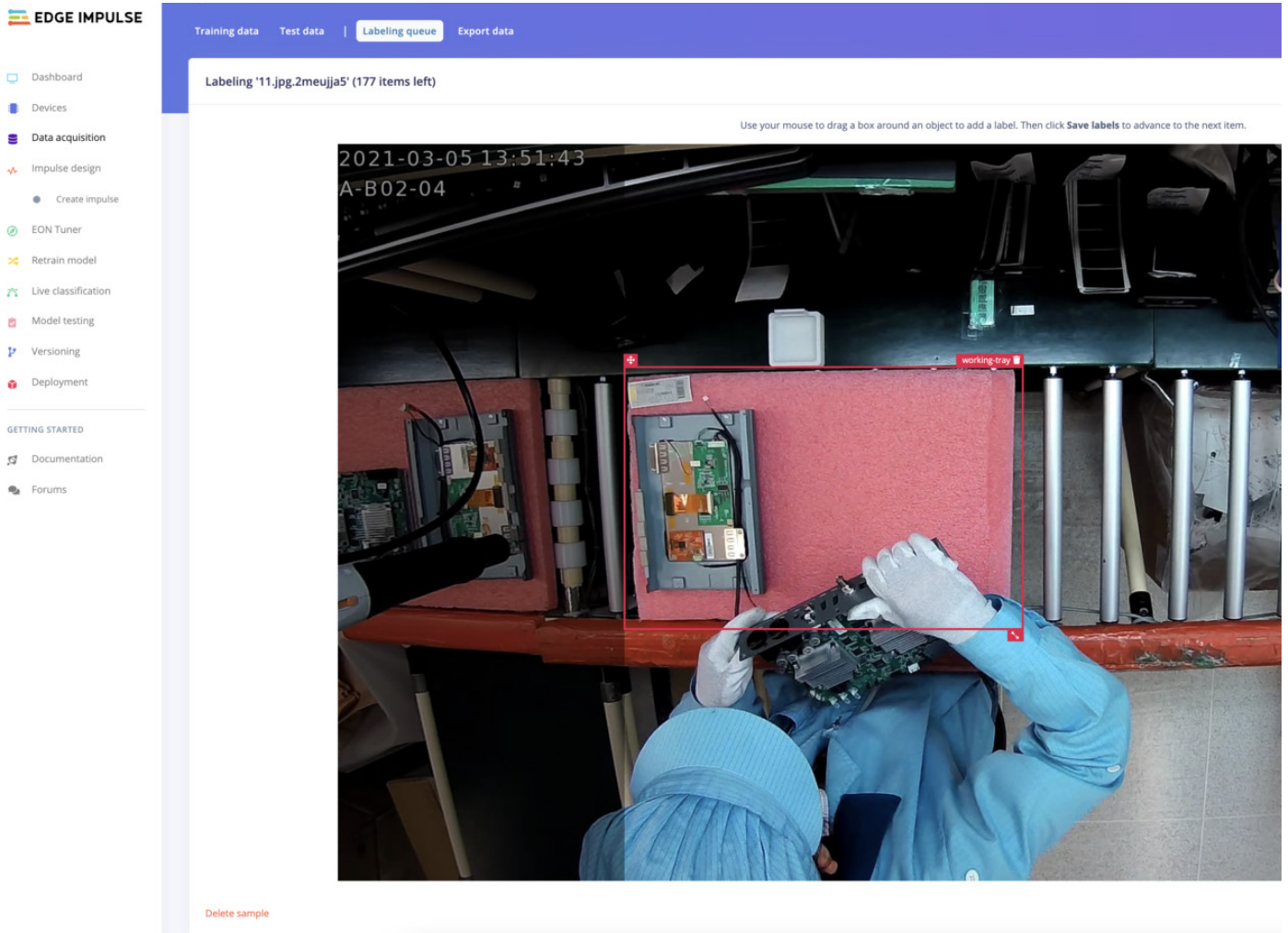
Built using the powerful NVIDIA Jetson family of embedded processors, the AIR-020 can also let you run multiple neural networks in parallel, so it's ideally suited for applications like image classification and object detection.



NVIDIA Jetson Nano Developer Kit

- AIR-020 AI box features**
- Small footprint.
 - DC inputs ranging from 12 V to 24 V.
 - Temperature range from -10 to 55°C.
 - Built-in vibration and humidity resistance.
 - Extensive I/O ports for connection with camera, Wi-Fi/LTE/5G, storage and multifunction module.





Teaching the algorithm to flag holdups

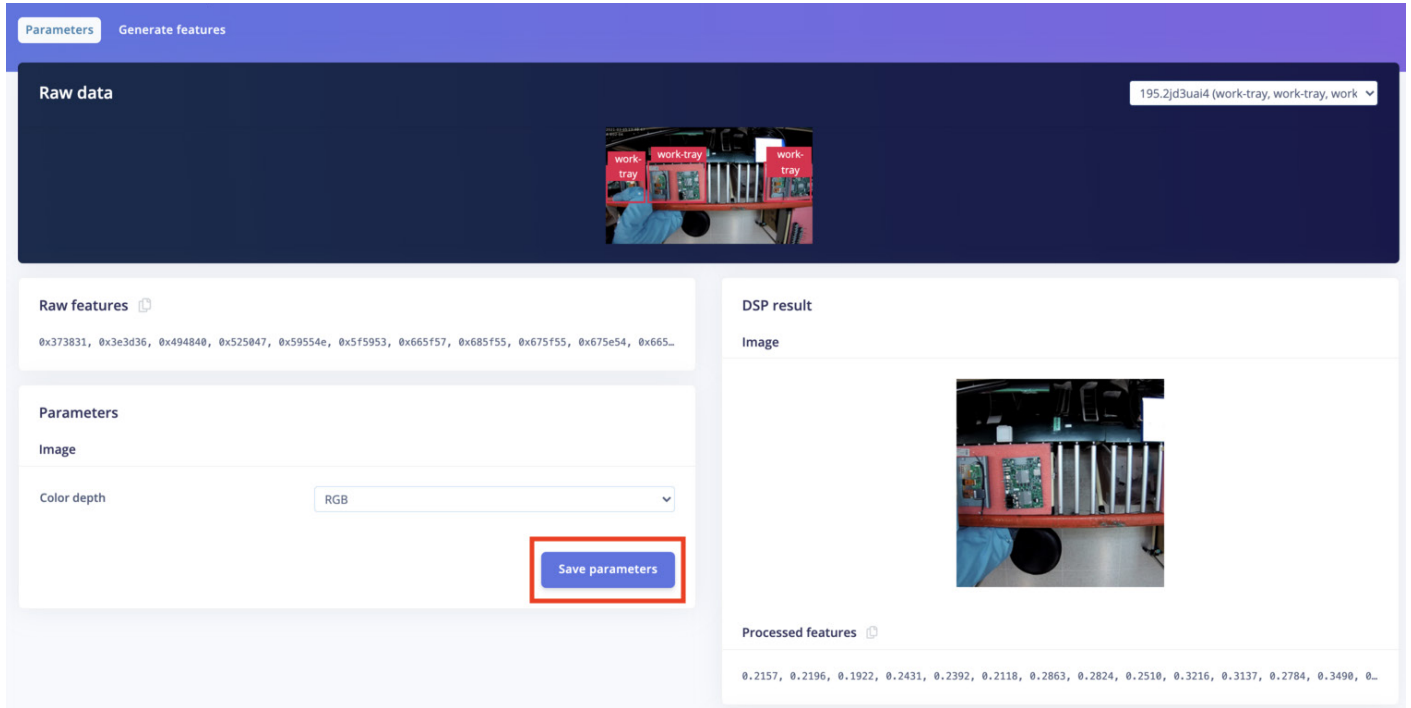
The Edge Impulse platform made it easy for Advantech to use video as a data source. The development team was able to extract different key frames from the video sequence to create their dataset. Having created a project in Edge Impulse Studio, they then used bounding boxes to highlight the part of the image they wanted to focus on – the tray present on the conveyor belt. With all



the images labeled they were able to train the model. The Edge Impulse Studio supported Advantech from start to finish, from acquiring custom data and visualizing it, to training the ML model and testing it, adapting it, and validating the inference results directly on their target device.

Impressive results

Advantech worked closely with the Edge Impulse’s Solutions Support Team to rapidly develop a smart camera with advanced video analytics capabilities, able to monitor an assembly line, and detect the presence of a slow-down in the production line. The system does this by detecting the position of the working tray and, if not detected for a few seconds, it alerts the manufacturing manager.



The new setup makes it possible to flag the kinds of small delays that can lower productivity, without forcing managers to spend time wandering around the factory floor, looking for production slow-downs. Managers can spend time doing other things and, when alerted to a slow-down, can proceed directly to the area in question, for faster response to issues and less productivity loss.

Once they had a working proof of concept, the Advantech team tested their new solution on a live assembly line in an electronic equipment factory. On a 15-minute video of work time, the setup was able to detect 131.80 seconds of idle time, representing a potential increase in production-line efficiency of 15%, over a 15-minute time frame. The factory administrators were so impressed with the results that

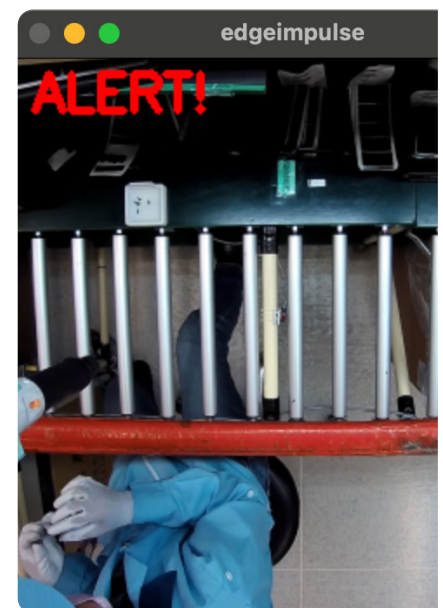
the setup is still in place, running on an actual production line.

Fast, smooth development without AI experts

Before starting their project, the Advantech team had evaluated a number of AI/ML platforms and solutions. They chose Edge Impulse because it lets industrial engineers - who aren't trained as data scientists - develop and deploy ML models on their own, in all kinds of verticals and on a wide spectrum of edge devices.

Edge Impulse, which is designed specifically for use by non-experts in data science, makes what has been a complex and time consuming process

much more manageable and accessible. Advantech likes the fact that Edge Impulse offers an end-to-end edge ML platform to solve customer problems, with easy-to use MLOps and optimized inference at the edge, regardless of the hardware (Arm or x86).



CREATE IMPULSE (ADVANTECH - BOTTLENECK ON CONVEYOR BELT)

An impulse takes raw data, uses signal processing to extract features, and then uses a learning block to classify new data.

Image data

Image

Object Detection (Images)

Output features

1 (work-tray)

Save Impulse

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Cutting-edge portfolio

The new solution will become part of the AIoT team's Advantech Wide-Edge+ portfolio, offered as a way to help manufacturers deploy Factory 5.0 capabilities. Advantech's customers are industrial builders, not data scientists, so delivering a tailored, high performance AIoT solution that is easy to retrain will be of high value.

Advantech is certain that the new widely released product, based on the company's AIR-020 box and Edge Impulse platform, will lower development costs and increase ease of deployment in smart factory applications. And they believe much of that cost/effort benefit can be attributed to the use of Edge Impulse.



Advantech AI Box AIR-020

In every industrial sector that Advantech supports, there are uses cases that can benefit from the productivity improvements that high-performance, real-time video analytics make possible. The AIoT team is also confident that, because their new offering is easily scalable and can be deployed quickly in other production sites, it will become a benchmark for other manufacturers.

Ongoing development

Advantech is already looking at other ways to use their new, visual-AI solution on the factory

floor. To help maintain production quality and ensure operational safety, for example, they're using the same videoanalytics approach to confirm that anyone attempting to operate specialized machinery is wearing the blue hat and vest that indicates they are qualified to do so.

The stated mission of Advantech's AIoT division is to enable development of apps that facilitate the deployment of Factory 5.0 solutions for intelligent management and data-driven digital transformation.

The partnership with Edge Impulse plays directly into that strategy, by making it easy to bring AI and ML capabilities to IoT use cases. Advantech and Edge Impulse are now working together on an integrated edge ML platform. Stay tuned!



Learn more:

Edge Impulse for data-driven engineering

Edge Impulse is the fastest growing development platform for edge machine learning, used by thousands of enterprises across 55,000+ ML projects worldwide. We are on a mission to enable the ultimate development experience for machine learning on edge devices for sensors, audio, and computer vision, at scale. From getting started in under five minutes to MLOps in production, we enable the development of highly optimized ML models deployable to a wide range of hardware from MCUs to GPUs.

To learn more visit www.edgeimpulse.com

Advantech enabling an intelligent planet

Founded in 1983, Advantech is a leader in providing trusted, innovative products, services, and solutions. Advantech offers comprehensive system integration, hardware, software, customer-centric design services, embedded systems, automation products, and global logistics support. We cooperate closely with our partners to help provide complete solutions for a wide array of applications across a diverse range of industries. Our mission is to enable an intelligent planet with Automation and Embedded Computing products and solutions that empower the development of smarter working and living. With Advantech, there is no limit to the applications and innovations our products make possible.

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