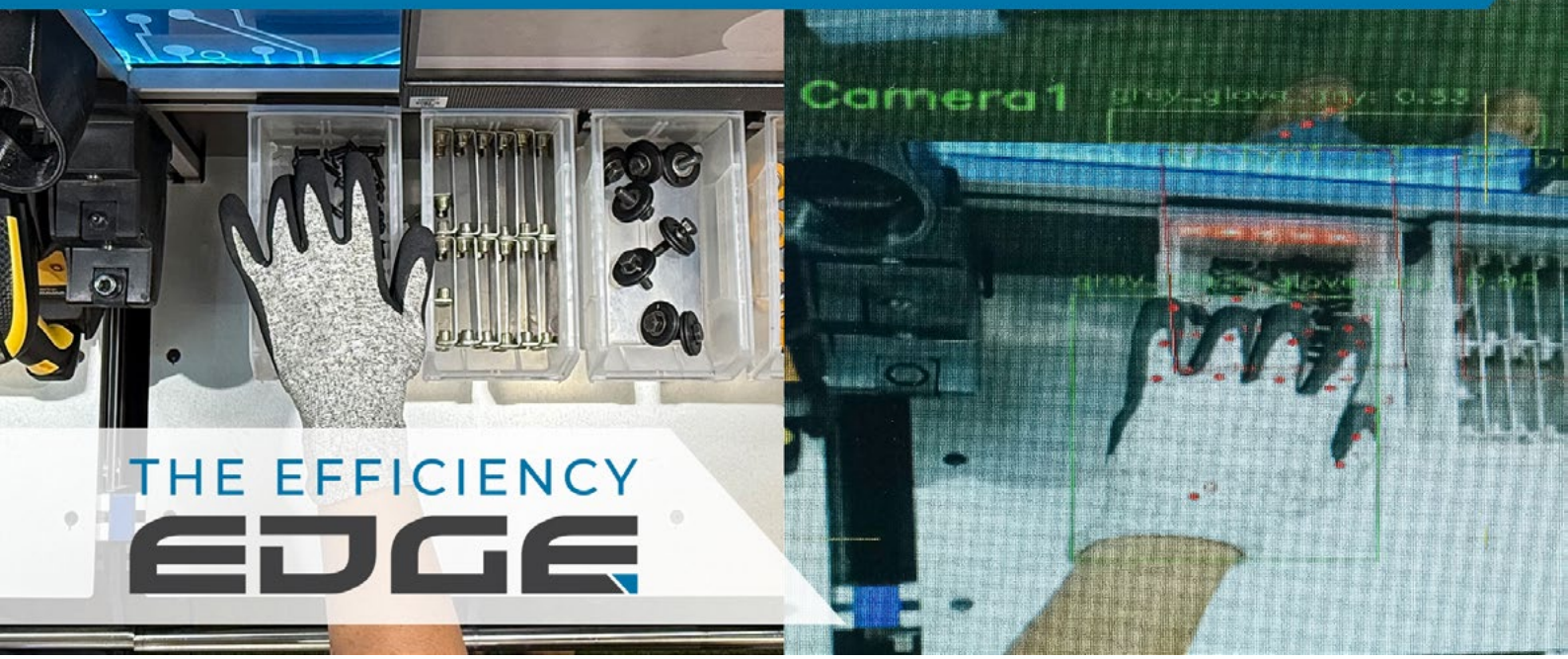
MAKE YOUR MANUFACTURING SMARTER:

AI COMPUTER VISION



THE EFFICIENCY EDGE

As we head into a new year, it's time to clean house and explore new ways of making your manufacturing processes smarter, leaner, and more efficient.

If you haven't already felt the full impact of the artificial intelligence (AI) revolution, rest assured that it will be practically inescapable in 2025. And if you want to achieve serious productivity gains, embracing AI as a tool will be a must.

Among the various AI technologies driving this transformation for manufacturers, computer vision stands out for its potential to optimise operations, improve quality control, and reduce costs.

This article delves into how AI, specifically computer vision, is reshaping manufacturing and paving the way for smarter production lines.

AI in manufacturing: A brief overview

The term 'artificial intelligence' is a little misleading because it more accurately describes an attempt to simulate human intelligence by machines, which enables them to perform tasks like decision-making and problem-solving that typically require human cognition.

A subset of AI, machine learning (ML) empowers machines to learn from large data sets and improve performance over time.

Computer vision, one of AI's most impactful applications for manufacturers, uses cameras and machine learning algorithms to analyse visual data, making it indispensable for functions like automating assembly processes and quality control.

Traditional vs computer vision systems

Both traditional and AI computer vision systems serve a common purpose – to automate the visual inspection process.

Traditional vision systems rely on fixed algorithms that are 'hard-coded' by programmers or engineers to inspect products based on factors like pixel counting and colour differentiation. While effective for repetitive tasks in stable environments, these systems have to be manually adjusted for changing environmental conditions or evolving product features.

By contrast, AI-powered computer vision systems learn from extensive data sets, made up of thousands of images, enabling them to adapt to new tasks and environments.

For example, these systems can identify components even when partially obscured or presented in different orientations, making them ideal for industries and assembly processes involving multiple variants or frequent product changes.

Object classification and detection

Here are two of the main ways that computer vision is applied in a manufacturing environment.

1. Object classification

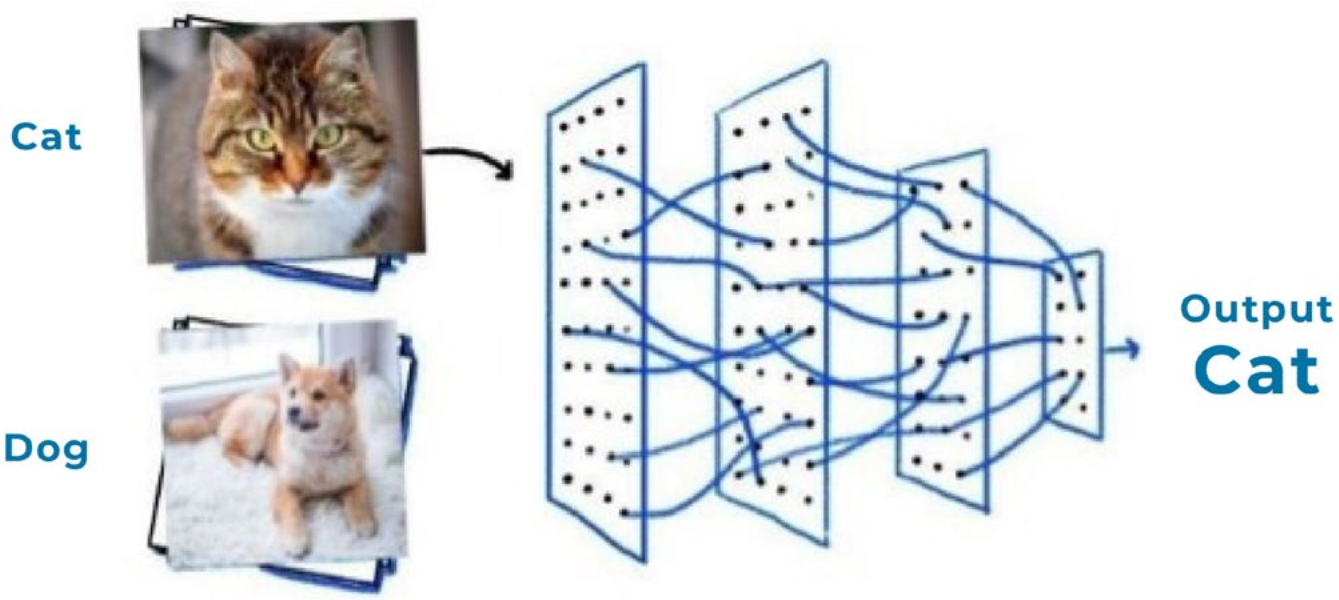
Object classification involves identifying and categorising what is present in a camera image.

A practical use case could, for example, be to train a vision system to determine the type of beverage in a bottle on a production line.

When a bottle passes under the camera, the computer vision system captures an image and processes it to classify the beverage as either water, soda, or juice. By analysing visual features like liquid colour, cap design, or label patterns, AI systems can classify products in real-time, ensuring accurate labelling and packaging of the product down the line.

In the automotive sector, consider a factory where three different types of rims need to be fitted. The assembly facility includes a robot picking solution that must be able to pick rims from multiple conveyor systems and organise them in different dunnages. In this instance, you could use the camera to tell the robot which rim is being picked.

In order to train the model or algorithm to distinguish between rims, you would take thousands of images of each of the rim types in different lighting conditions and from different angles and label them as RIM type 1, 2 or 3. By learning to identify the rim type, the model will ultimately be able to tell the robot which rim is being presented to it for faster, accurate sorting.



2. Object detection

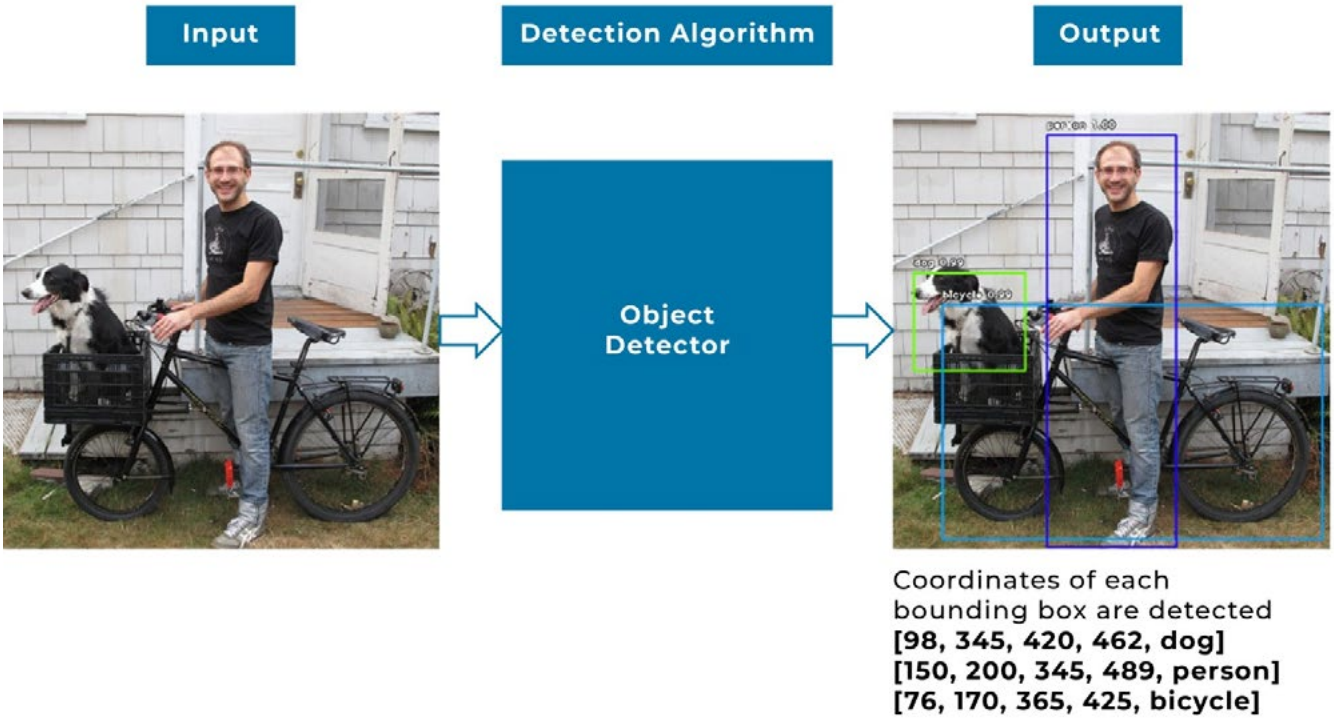
Object detection is perhaps the biggest opportunity for computer vision on the shop floor. It takes classification further by identifying and labelling multiple objects within a single image and pinpointing their locations.

For automotive component manufacturers, object detection is useful, for instance, in the critical process of tightening the dust cover onto an axle, where each bolt must be tightened accurately in a specific sequence.

Here, cameras, coupled with machine-learning based object detection, can continuously monitor the position of a bolting tool in three-dimensional space. This space is mapped with predefined 'hotspots' corresponding to each critical bolting position.

As the tool navigates within these hotspots, the station's control system, aided by object detection, can decide whether to activate the tool - or deactivate it if it's in the wrong position. This ensures that precise tightening sequences are followed. If a bolt fails, it is easy to identify which one, switch the tool to reverse and redo the tightening action, reducing rework time.

In addition to tool tracking, object detection can be integrated with an operator guidance system to enhance the assembly process by confirming correct part selection from the right bin through tracking the operator's hand movements – and only then allowing the assembly sequence to continue. It can also be used to ensure compliance with organisational standards like 5S by confirming that tools have been returned to their designated positions after use.



Benefits of AI-driven computer vision

- **Improved quality control:** By identifying defects or deviations in real-time, manufacturers can save rework time, reduce waste and enhance product quality.
- **Cost efficiency:** Automated inspection eliminates the need for labour-intensive manual checks and reduces downtime.
- **Flexibility:** AI systems can be retrained to accommodate new products or changes in production processes, making them future proof.
- **Data-driven insights:** Beyond visual inspection, these systems collect valuable operational data, such as cycle times and device utilisation, which can be used to optimise processes.

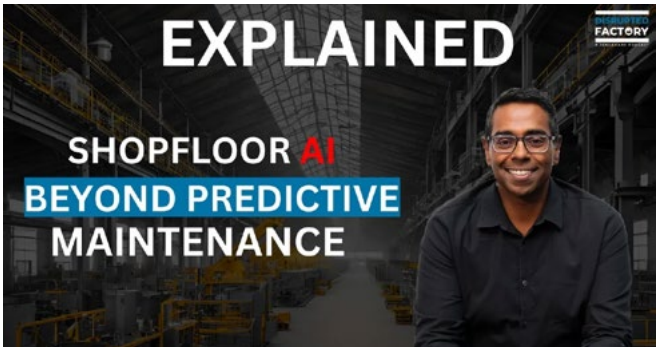
Embrace the evolution

AI is leading the transformation of all industries at an unprecedented rate, and manufacturing is no exception. Implementing computer vision systems can enable smarter, more efficient production lines. By automating visual tasks, these systems offer never-before-seen precision, adaptability, and cost savings.

But successful implementation requires careful planning, high-quality data, and ongoing refinement.

As AI continues to evolve, the potential for computer vision in manufacturing will only expand, driving innovation and competitiveness in the industry.

Watch this video to see how AI vision saves money and time on your shop floor.



For more on Shopfloor AI, watch this video.

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