PROPRIETARY REPORT

Transform manufacturing with vision AI

Enhance quality, boost efficiency, and improve safety with Roboflow and Google Cloud

In the rapidly evolving landscape of manufacturing, artificial intelligence (AI) is no longer a futuristic concept, but a transformative force already reshaping industries. In fact, the global artificial intelligence in manufacturing market size was already valued at $4.1 billion in 2023 and is projected to grow at a compound annual growth rate (CAGR) of 44.2% from 2024 to 2030.[1] And this new technology isn't just being experimented with—it's delivering results. 72% of manufacturers surveyed by the National Association of Manufacturers reported reduced costs and improved operational efficiency after deploying AI technology.[2]

In particular, computer vision, a type of AI that enables computers to "see" and interpret images, has the potential to unlock unprecedented possibilities for manufacturers. With computer vision applications, manufacturers like you can enhance your processes, improve product quality, boost efficiency, and elevate worker safety.

In this eBook, you'll learn:

- What computer vision is

- How manufacturers are using computer vision today

- How to build and deploy vision AI applications with Roboflow and Google Cloud

1   Grandview Research, "Artificial Intelligence in Manufacturing Market Report 2030."
2   National Association of Manufacturers, "AI in Manufacturing."

What is computer vision?

First things first: what is computer vision and why is it so relevant to manufacturers in particular?

In layman's terms, computer vision becomes your eyes on the ground, from your production lines to the yard. Computer vision uses artificial intelligence to analyze visual data, so it can identify objects, detect defects, recognize patterns, and make informed decisions. The five main types of problems computer vision helps solve are:
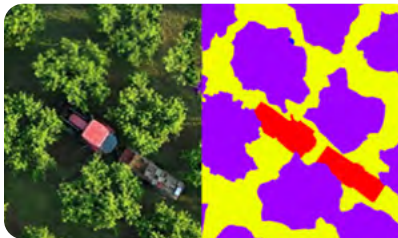

Image classification

Categorizing each image in its entirety.

Object detection

Identifying where an object of interest is, for any object of interest.

Semantic segmentation

Detecting the set of pixels belonging to each specific class of object.
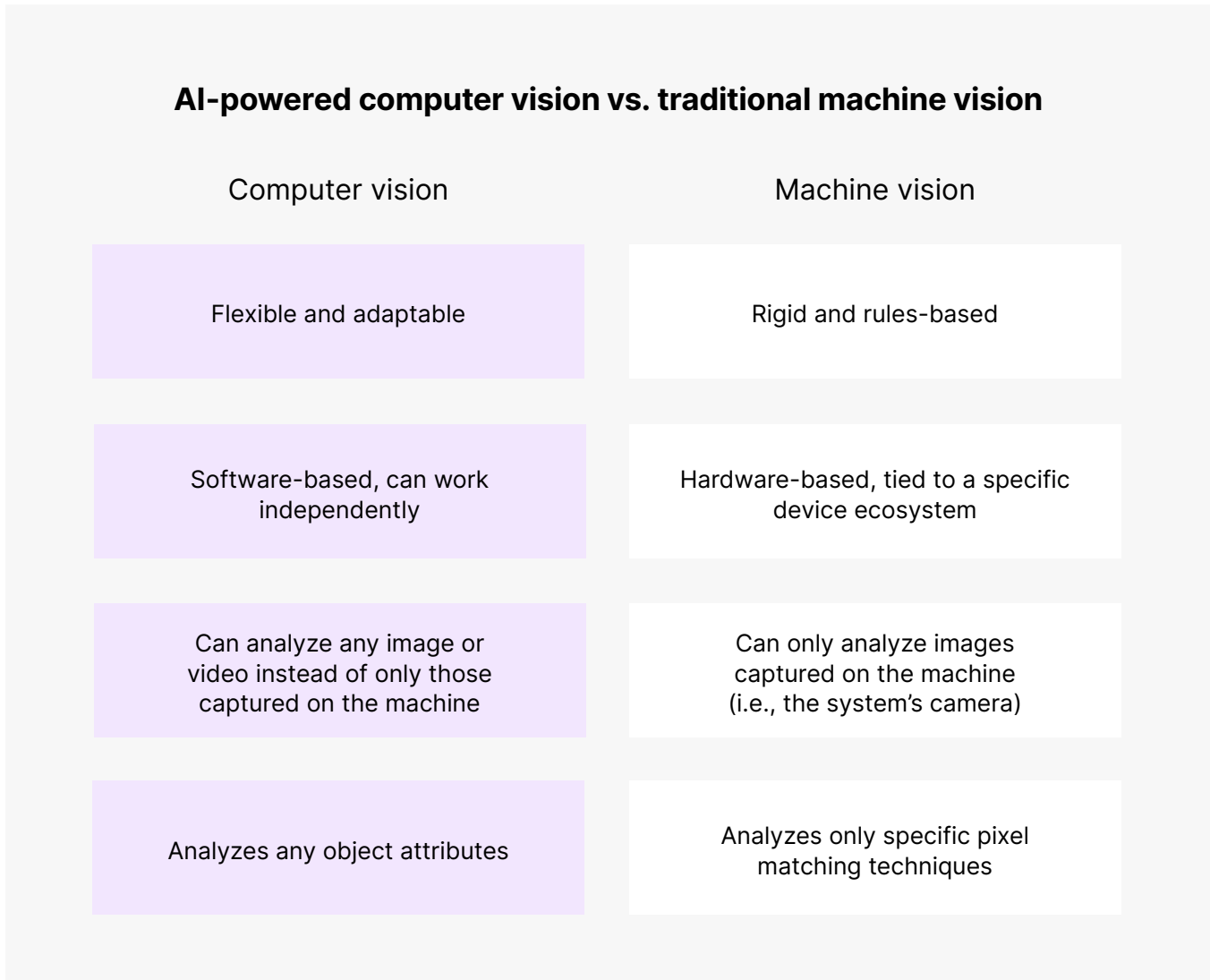

Instance segmentation

Similar to semantic segmentation but differentiates between objects in the same class.

Keypoint detection

Identifying the location of certain keypoints on an object.

From error-proofing to fall detection, computer vision can help you keep a closer eye on your manufacturing operations without the rigid rules-based systems of traditional machine vision. Instead, computer vision is more flexible, adaptable, and can handle more complex scenarios—an ideal fit for most manufacturing businesses today.

AI-powered computer vision vs. traditional machine vision

Computer vision	Machine vision
Flexible and adaptable	Rigid and rules-based
Software-based, can work independently	Hardware-based, tied to a specific device ecosystem
Can analyze any image or video instead of only those captured on the machine	Can only analyze images captured on the machine (i.e., the system's camera)
Analyzes any object attributes	Analyzes only specific pixel matching techniques

While computers analyzing every aspect of your production line may seem like something straight out of science fiction, computer vision is now easily within your reach. Advancements in AI models, tools, and computing power have transformed computer vision into a practical solution that any manufacturer can deploy—with less effort and technical know-how than you might think you need.

Gone are the days of limited capabilities. Instead, today's computer vision systems can tackle intricate tasks, from identifying subtle defects to automating complex assembly processes, with remarkable accuracy and efficiency.

Beyond the buzz: How manufacturers are using computer vision today

You've heard the buzz about AI, but you might be wondering how it really applies to your manufacturing operations. The truth is, artificial intelligence is already making a huge impact on the factory floor. Computer vision empowers manufacturers to address a wide range of challenges, from automating quality assurance to optimizing production lines. In this section, we'll go beyond the hype and explore some real-world examples of how computer vision is being used today.

Computer vision use cases for manufacturing

Automated quality assurance

Imagine a drywall manufacturing facility, where ensuring consistent production quality is critical. Traditionally, this involves manual inspections of drywall sheets every few hours to identify microscopic defects. This process is not only time-consuming and labor-intensive but also prone to human error. Failing to catch these tiny flaws can lead to costly rework, customer complaints, and even damage to the company's reputation.

With computer vision, this process can be automated. A high-resolution camera captures images of the drywall and a computer vision model, trained on thousands of images, analyzes the images to identify any inconsistencies or flaws. This not only saves time and labor costs, but also ensures consistent and accurate quality control across all facilities.

Defect detection

In the automotive industry, ensuring the quality and integrity of every component is crucial. If vital safety features are missing or if a defect goes unnoticed, it can be disastrous for both the driver and the manufacturer. Beyond that, the competitive nature of automotive manufacturing demands a constant drive for modernization to not only keep up with competitors but stay ahead in both quality and innovation.

Computer vision can be used to automate defect detection in various stages of the manufacturing process. For instance, a vision system can identify scratches, dents, or misalignments in metal parts, ensuring that only flawless components move forward in the production line. This helps prevent costly rework, reduces waste, and improves overall product quality.

Real-time safety risk detection

In steel mills, the steel ladle, used to transport and pour molten steel, can develop thermal hotspots, posing a significant safety risk. An accident can lead to catastrophic spills and grind operations to a halt while expensive repairs are made and safety concerns are properly addressed.

Computer vision, combined with infrared cameras, can continuously monitor the ladle's surface and detect hotspots in real time. This allows for immediate action, preventing potential ladle failures and ensuring worker safety. You can also extend the life of your equipment by performing timely repairs and maintenance before severe damage occurs.

From idea to reality: Building and deploying vision AI applications

You may be thinking: this all sounds great, but I have no idea where to get started bringing AI technology like computer vision into my company. Maybe you're worried about lack of technical skills in your existing workforce, or just the sheer bandwidth required to build and deploy these new applications when you already have so many other modernization efforts underway.

The good news is, with the right tools, bringing computer vision into your manufacturing operations is easier than you think. Roboflow and Google Cloud together provide all the tools you need to build and deploy your computer vision application, regardless of your technical expertise.

With Roboflow, you can integrate your existing Google Cloud data, train and deploy custom models with unmatched speed and flexibility, and watch your manufacturing processes evolve.

## Roboflow + Google Cloud = Revolutionizing manufacturing with computer vision
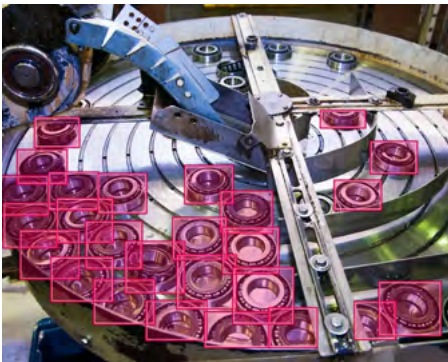
Unleash the power of AI, today

Roboflow and Google Cloud empower you to build, deploy, and scale custom computer vision models rapidly, so you can bring your AI vision to life faster than ever before.

Quality assurance, reimagined

Roboflow and Google Cloud give you the tools to identify even the most subtle anomalies in real time, safeguarding your brand reputation and customer satisfaction.
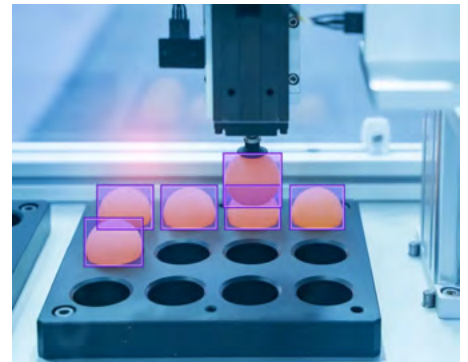
AI-powered efficiency, unleashed

Integrate Roboflow with Google Cloud services, like BigQuery and Dataflow, to collect and analyze real-time production data. Then, use these insights to identify bottlenecks, optimize workflows, and increase productivity.

A step-by-step guide to building and deploying vision AI applications

1 Start by identifying a **specific problem** in your manufacturing process that can be solved with **computer vision**. This could be anything from automating quality control to enhancing worker safety.

2 **Collect and label your data** using Roboflow's intuitive platform, ensuring your model is trained on accurate and representative information. Roboflow provides a suite of tools to streamline the labeling process, which significantly reduces the time and effort required.

3 Leverage Google Cloud's powerful infrastructure to **train your model efficiently,** whether you're using a foundation model, pre-trained model, or building a custom model from scratch. Google Cloud offers a variety of options for training, from virtual machines to pre-configured AI platforms, allowing you to scale your training process based on your needs and budget. You can also train your model directly in Roboflow if your team has the technical expertise and bandwidth.

4 **Deploy your model** in the cloud or on the edge, ensuring low latency, high security, and optimal performance for your specific needs. While cloud deployment offers scalability and ease of management, edge deployment brings several unique advantages for manufacturers, including the ability to keep sensitive data within the factory's secure network and enabling real-time response times for important issues like safety risks.

5 Continuously **track your model's performance** using key metrics like mAP and confusion matrices. Use active learning techniques to identify and address areas where your model needs improvement, ensuring it adapts to changing conditions and maintains accuracy over time.

6 **Integrate your computer vision application** with existing business systems and workflows. This could include sending alerts to production line operators when defects are detected, automatically updating inventory records, or triggering maintenance requests based on real-time insights.

Start using AI vision today

Don't get left behind in the AI revolution. Embrace the power of computer vision and unlock new levels of efficiency, quality, and safety in your manufacturing operations. With Roboflow and Google Cloud as your partners, bringing computer vision to life on your factory floor is easier than you might think.

Explore the possibilities, discover the ease of implementation, and ride the wave of AI-powered transformation with Roboflow and Google Cloud. Visit our marketplace listing, explore our resources, and embark on your computer vision journey today.

Find us on the Google Cloud Marketplace

Let's go >

Resources

- Check out our latest manufacturing blog posts and guides

- Visit our manufacturing industry page

- Watch our video on how to build computer vision applications with Roboflow and Google Cloud