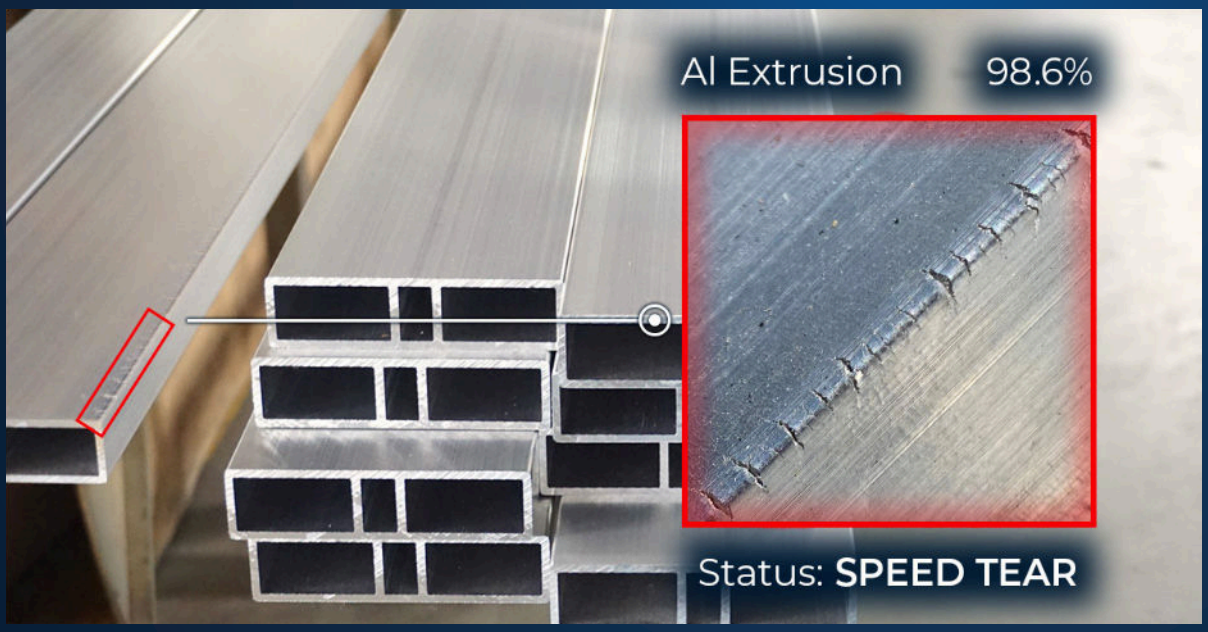
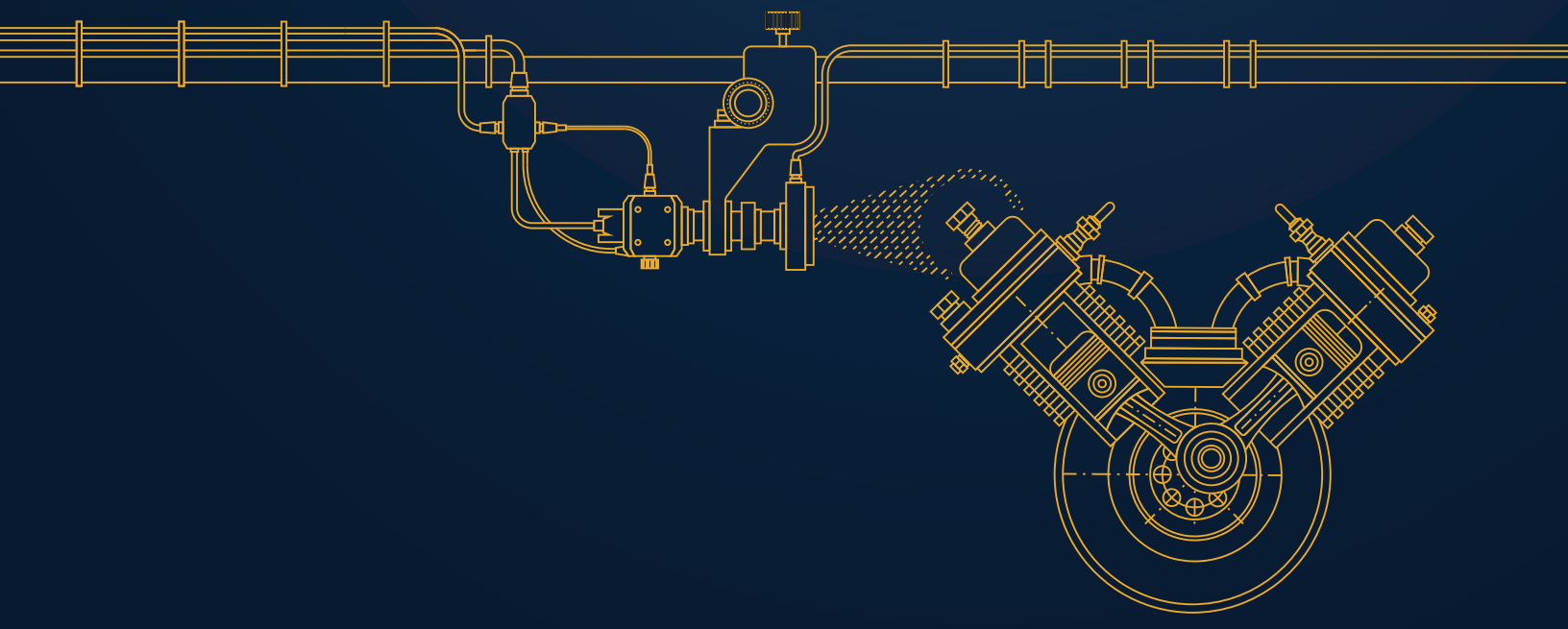
COMPUTER VISION DRIVES SUSTAINABLE, COST-SAVING INNOVATION

in Steel and Aluminum Manufacturing





EXECUTIVE SUMMARY

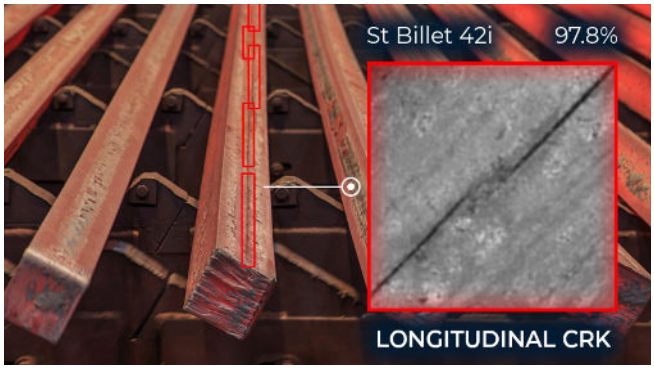
The global steel and aluminum industries are at a turning point, facing growing challenges from rising costs, labor shortages, and environmental demands. To succeed in this landscape, manufacturers must adapt with forward-thinking strategies and emerging technologies. Matroid's cutting-edge AI-powered solutions exemplify how these tools can enhance efficiency, reduce waste, and align manufacturing practices with sustainability goals. This white paper explores the role of Matroid's computer vision technology in transforming traditional operations and offers actionable insights for industry leaders ready to build a sustainable and competitive future.

INTRODUCTION

For decades, steel and aluminum manufacturing have underpinned infrastructure, transportation, and industrial applications. However, the complexities of modern global markets now demand that manufacturers rethink how they produce these essential materials. Rising raw material costs, a limited labor pool, and the need to meet stricter environmental regulations highlight the urgency of innovation.

Companies that embrace advanced tools like Matroid's AI-driven defect detection systems will lead the way, combining more innovative processes with a commitment to sustainability.

THE INDUSTRY'S CORE CHALLENGES



While steel and aluminum are essential, their production remains energy-intensive, generating substantial emissions. As many as 27 exajoules of coal, three exajoules of gas, and five exajoules of electricity are consumed producing steel each year. [1] The manufacturing process for each also accounts for approximately 10% of global CO_2 emissions annually. [2][3]

With environmental regulators' growing scrutiny and mounting pressure to meet sustainability goals, manufacturers face the dual challenge of minimizing environmental impact while maintaining profitability.

A tightening labor market and escalating material costs, which affect global supply chains, compound this issue. The rising costs have driven manufacturers to seek innovative ways to streamline operations, optimize resources, and reduce dependence on imported raw materials—all while staying competitive.

Emerging technologies, particularly Artificial Intelligence (AI) and computer vision systems, have opened up new frontiers of opportunity in sustainable production. These advanced solutions enable manufacturers to improve operational efficiency and achieve critical environmental objectives, marking the beginning of a technological transformation in the steel and aluminum industries.

SUSTAINABLE PRODUCTION IN METAL MANUFACTURING

Given the stakes, sustainability is no longer a choice but a requirement. Manufacturers worldwide are switching to cleaner and more sustainable processes. Among these are the integration of hydrogen-based steelmaking to minimize carbon dioxide output and renewable energy-powered electrolysis for aluminum processing.

Electric arc furnaces (EAFs) offer a cleaner alternative to traditional blast furnaces. They use electricity to melt scrap metal or direct-reduced iron, significantly reducing carbon emissions. EAFs also enable efficient recycling of scrap materials, minimizing waste and conserving natural resources.

However, while such sustainable practices can reduce emissions, their implementation is still costly without additional steps to increase the return on investment. Fortunately, advancements in AI-backed computer vision offer a cost-efficient solution.

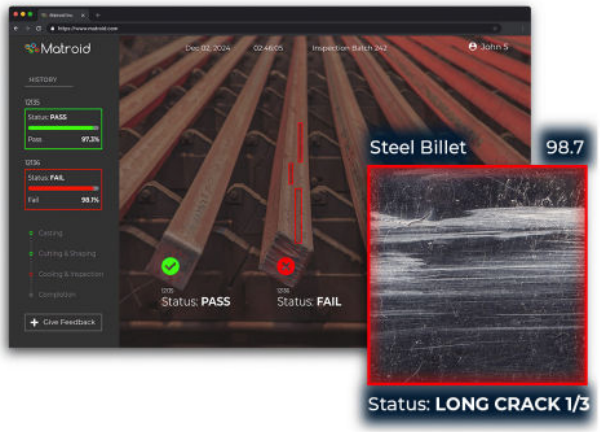
Tools like Matroid's no-code AI-powered systems allow manufacturers to automate defect detection, optimize resource use, and track operational inefficiencies cost-effectively to reduce waste and increase sustainability. Integrating these systems ensures manufacturers comply with environmental standards while lowering operational costs.

> "By automating quality control and defect detection, AI helps manufacturers catch issues before they escalate, safeguarding resources and product integrity."

MORE EFFICIENT DEFECT DETECTION

By leveraging Matroid's AI-powered computer vision, metal manufacturers can transform their defect detection processes, ensuring exceptional product quality and minimizing waste.

For surface inspections, the AI excels in detecting minute flaws like cracks, dents, or uneven coatings on metal sheets and plates, even under poor lighting or amidst the dust-filled atmosphere of production floors. Its precision, even in harsh conditions, ensures that defective materials are identified and removed early, avoiding downstream issues that could compromise the structural integrity of end products. During welding processes, the system monitors critical factors such as bead alignment, porosity, and consistency in real time, ensuring that every weld meets exacting standards and reduces the risk of joint failure and rework.



Similarly, Matroid's platform identifies issues like shrinkage, voids, or inclusions in casting processes as products are formed. Flaws that might be missed by manual inspections or require time-consuming testing are caught instantly, improving throughput and maintaining quality standards without costly delays.

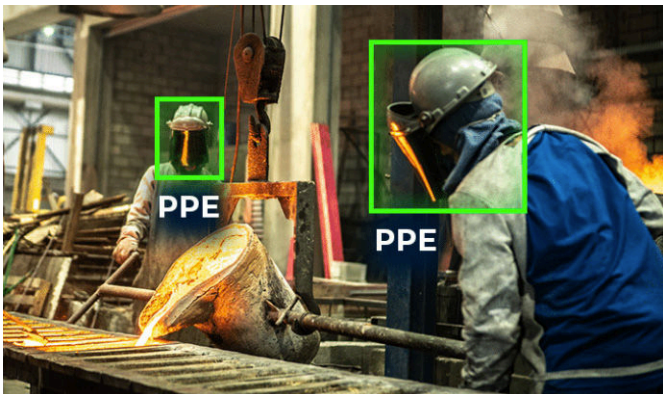
Matroid's camera-agnostic AI platform is designed to thrive in challenging environments, including the heat-intensive and fast-moving settings typical of metal production. Whether operating in high-temperature foundries or monitoring high-speed assembly lines, the technology can maintain its precision and reliability. This versatility makes it ideal for various processes across metal manufacturing, from small-scale fabrication shops to large industrial plants.

By implementing AI-driven defect detection, metal manufacturers can elevate their quality control processes to a new level. It's a proven way to keep only flawless products proceeding through the production line and driving cost efficiency across all stages of metal manufacturing.

LABOR EFFICIENCY AND WORKFORCE TRANSFORMATION

The metal production sector has long faced reduced labor pools due to an aging workforce and the global shift toward automation. Companies are integrating AI and computer vision systems to address these gaps and augment manual labor.

Matroid's technology can identify inefficiencies such as redundant steps, misaligned operations, or overcrowded work areas, enabling managers to optimize task allocation and streamline processes.



Additionally, it can be designed to detect unsafe worker practices, such as improper lifting techniques or employees entering restricted zones. Flagging these problems in real-time with Matroid's computer vision helps reduce the most common workplace injuries, such as falls and repetitive motion strains, to foster safety, reduce accident rates, and contribute to workplace compliance.

Matroid recently worked with a client to proactively detect specific safety hazards using existing video security infrastructure, such as improperly deployed airbags and fall risks. Within hours, the AI identified critical safety issues, significantly improving compliance rates from below 25% to over 90% daily. [4] The technology addressed immediate safety concerns and provided actionable insights for broader safety improvements, reducing incidents to zero over a year.

OPTIMIZING RESOURCE USE AND MINIMIZING WASTE

Efficient use of materials remains a core challenge for industries striving to achieve profitability and environmental sustainability. Manufacturing processes often have inefficiencies, leading to excess material waste, increased costs, and heightened ecological impact. Traditional inspection and quality control methods can fall short, failing to catch defects early enough and optimize resource allocation effectively.

Not surprisingly, the challenge has made reducing waste and improving precision critical priorities for manufacturers worldwide.

AI technologies transform these processes by enabling real-time monitoring, precision analysis, and proactive decision-making. These tools allow businesses to analyze production data at scale, identify inefficiencies, and make adjustments to reduce variability and optimize material usage. By automating quality control and defect detection, AI helps manufacturers catch issues before they escalate, safeguarding resources and product integrity.

A prime example is Matroid's collaboration with one of the USA's largest steel producers. The company utilized AI-powered computer vision to revolutionize its defect detection process, boosting accuracy from 60-70% to over 98% and setting a new standard for operational efficiency and resource utilization. Implementing computer vision automation reduced reliance on manual inspections, saving over $2 million annually in labor costs and allowing metallurgists to focus on innovation. [5] It also minimized rework and material waste, ensuring higher quality control and operational efficiency.

REDUCING DEPENDENCY ON RAW MATERIAL IMPORTS

The volatility of raw material markets has pushed manufacturers to explore local alternatives or reduce overall dependence through advanced material recovery. Circular economy practices emphasizing recycling, reusing, and refurbishing products are becoming more prominent in production strategies, with manufacturers incorporating scrap metals into their supply chains.

In 2023, Steel Dynamics recycled 13.4 million tons of ferrous scrap and 1.1 billion pounds of nonferrous scrap using electric arc furnace (EAF) technology to source 82% of the raw materials used in their steel production.[6]

AI and computer vision integrations help optimize this practice by tracking recycled materials' quality, volume, and source in real time. Matroid's computer vision systems can categorize metal scraps automatically, ensuring that high-quality recycled materials are utilized where necessary while minimizing the risk of contamination. Implementing an AI-backed selective approach extends supply chain flexibility and reduces costs associated with international material imports.

MATROID IS REVOLUTIONIZING METAL MANUFACTURING

Amid this shifting landscape of emerging priorities, Matroid's no-code computer vision technology is a game-changer for the metal manufacturing industry. With features ranging from real-time video analytics to defect detection capabilities, Matroid supports manufacturers in overcoming core challenges. Its camera-agnostic platform, with deployment options across cloud, edge, and on-premise environments, equips businesses with a highly scalable, adaptable solution.

Smart manufacturing use cases include safety compliance monitoring, SOP adherence, and automated quality inspections, all of which make Matroid an essential partner for future-ready facilities.

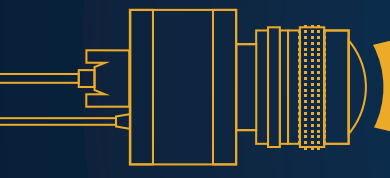
The software's plug-and-play design also ensures it can integrate seamlessly with existing production equipment, eliminating extensive setup barriers traditionally associated with new technologies.

GAIN A COMPETITIVE EDGE IN A DYNAMIC LANDSCAPE

The steel and aluminum industries are undergoing a necessary transformation, and the forward-looking manufacturers will leverage innovative technology to achieve sustainability goals while maintaining profitability.

AI-powered systems and smart production technologies are pivotal tools that will continue to drive this industry-wide change. They allow businesses to reduce operational costs, lower their environmental footprint, and improve workforce safety—essential for thriving in today's competitive landscape.

At Matroid, fostering sustainable, intelligent manufacturing is part of the mission. Whether addressing defects, optimizing labor, or decreasing material costs, our AI systems help companies achieve ambitious goals while improving profitability and remaining compliant with stringent industry standards.



Explore how Matroid's solutions can support your sustainability and efficiency targets.

REQUEST A DEMO

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