Opinion

The Role of Artificial Intelligence (AI) in Quality Control of Industrial Products

Mohammad Taleghani*

Associate Professor, Department of Industrial Management, Rasht Branch, Islamic Azad University (IAU), Rasht, Iran

Corresponding author: Mohammad Taleghani, Associate Professor, Department of Industrial Management, Rasht Branch, Islamic Azad University (IAU), Rasht, Iran.

Abstract

AI systems, equipped with advanced machine vision capabilities, can analyze vast amounts of visual data in real-time, identifying defects and deviations from the desired standards. This not only enhances the speed of inspection but also improves accuracy and consistency, reducing the likelihood of human error. Overall, AI can exceed human capabilities in quality control by providing faster, more accurate, and more consistent decision-making based on vast amounts of complex data. Leveraging AI can ultimately lead to better product quality and patient safety. AI solutions in manufacturing increase the overall effectiveness of order management systems, speed up decision-making, and guarantee a more responsive and customer-centric approach to order fulfillment for companies across various industries by automating repetitive operations and delivering data-driven insights.

Keywords: Artificial Intelligence (AI); Quality Control; Industrial Products

Introduction

Once the AI model is trained, it can be deployed to analyze images in real-time as products move along the production line. The model identifies defects and anomalies, triggering alerts or automated actions if necessary. Feedback Loop: Continuous improvement is essential in AI-based quality control. AI in quality assurance refers to applying artificial intelligence technologies, such as machine learning, natural language processing, and computer vision, to enhance and automate various aspects of the QA process. By automating mundane activities, AI can free up staff time to work on more engaging tasks. Smart algorithms can also help companies identify patterns and trends that traditional methods may have missed.

Equipped with high-resolution cameras and advanced sensors, robots conduct meticulous inspections of products. They can detect defects, contamination, and inconsistencies in texture, size, or color, ensuring each product meets quality standards. It identifies flaws with precision and speed. Moreover, AI assists in packaging inspection, ensuring its integrity and accuracy. Material sorting and product counting are other areas where AI can help. It sorts materials based on quality using visual inspection and automates counting for inventory management. Generative AI can also help with predictive maintenance. Based on historical data, it can predict when a system or equipment is likely to fail or impact safety, offer warnings and, in some cases, take the steps needed to correct it.

In summary, the goal of AI is to provide software that can reason on input and explain on output. AI will provide human-like interactions with software and offer decision support for specific tasks, but it's not a replacement for humans and won't be anytime soon. For analysts, automation and AI can take away some

of the manual tasks that make a proper evaluation take so long. Automated workloads can queue up interactions for the analyst so they spend less time searching. Quality control (QC) ensures that products meet the required standards, and an AI-powered system can help identify defects and reduce waste. However, using AI for QC comes with challenges as well. AI can predict the quality of a product based on data collected during the manufacturing process. By using predictive analytics, AI algorithms can anticipate potential defects and prevent them from occurring, which can help to improve overall product quality and reduce waste.

AI systems can detect and analyze defects precisely, leading to consistent and reliable quality outcomes. AI-driven automation and data processing capabilities significantly increase efficiency and productivity in quality management. AI helps quality management in customer service by automating repetitive tasks, enhancing efficiency, and allowing human QA inspectors to focus on complex issues. It ensures consistent and reliable quality checks, predicts potential issues, and accurately detects gaps in the customer experience. Automated quality control improves inspection measurement reliability. Accurate measurements on complex parts and high throughput production lines are assured with automated inspections. These systems can capture more data for large quantities of parts faster. Robots ensure consistency in production, increase production speed, and provide companies with flexibility in setting up new production lines. This leads to fast delivery of high-quality products to satisfied customers, which in turn increases revenue and provides financial stability for your organization. Automation can optimize schedules to minimize defects and inefficiencies, leading to better-quality products. Manufacturing technology expedites production, allowing more batches to be made in less time with consistent results.

AI improves product quality and efficiency through data analysis, design optimization, supply chain management, and process automation. Autodesk Fusion exemplifies this integration, offering AI-driven generative design, CAM automation, and future automated drawing capabilities, ushering in a new era in manufacturing.

Conclusion and Summary of the Discussion

In today's fast-paced manufacturing industry, ensuring the quality of products is of paramount importance. Product defects not only lead to financial losses but also tarnish a company's reputation and erode customer trust. Traditional methods of quality control can be time-consuming, labor-intensive, and prone to human errors. This is where the marriage of Artificial Intelligence (AI) and Machine Vision steps in, revolutionizing quality control processes and propelling manufacturing towards greater efficiency and accuracy. Quality control has been a cornerstone of manufacturing since the Industrial Revolution. Traditionally, inspectors would visually examine products for defects and inconsistencies. However, human-based inspection has limitations, such as fatigue, inconsistency, and the inability to process vast amounts of data in real-time. This is where AI and machine vision shine. AI brings the capability of cognitive functions to machines, enabling them to learn, reason, and make decisions based on data. In the context of quality control, Manufacturing AI can analyze vast amounts of visual data from the manufacturing process, identify patterns, and make real-time decisions regarding product quality. This is especially valuable for tasks that require high precision and speed, such as inspecting parts for defects on high-speed production lines.

The integration of AI and machine vision into manufacturing processes falls under the umbrella of Industrial Artificial Intelligence. This involves the application of AI technologies to optimize various aspects of industrial operations, including production, quality control, supply chain management, and predictive maintenance. In the context of quality control, Manufacturing AI enables manufacturers to achieve consistent and reliable product quality while minimizing human error and variability.

Acknowledgement

Conflict of Interest

There is no conflict of interest in the present research.