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The Value of AI in Visual Inspection Processes - What every Industrial Kitchen executive should know

In this executive report, we will provide a comprehensive overview of AI in visual inspection processes, its significance, value, and future implications.

Artificial Intelligence (AI) is revolutionising many industries.

Artificial Intelligence (AI) is revolutionising many industries. A recent report from PwC estimates that AI will impact the global economy by over US$15 trillion by 2030.[1] While many types of AI are deployed across multiple settings in the industrial sector, AI for computer vision may be one of the most consequential. When paired with visual inspection systems, AI is a game-changer in terms of accuracy, efficiency, and safety, and it has the potential to transform the way businesses operate. In this executive report, we will provide a comprehensive overview of AI in visual inspection processes, particularly for industrial kitchen use cases, its significance, value, and future implications.

15 TRILLION US DOLLARS BY 2030

In this report we will delve in depth into these topics:

01 What is AI for Visual Inspection?

02 Benefits of AI in Visual Inspection Processes

03 Visual Inspection in Industrial Kitchen Settings

04 Challenges of AI in Visual Inspection Processes

05 Future of AI in Visual Inspection Processes

01 What is AI for Visual Inspection?

AI in visual inspection processes refers to machine learning algorithms and computer vision used to analyse images, videos, and data from various sources to perform tasks such as detecting defects and anomalies. This technology can identify defects that human inspection may miss, improving the accuracy and efficiency of the inspection process, and it is significantly different from rules-based visual inspection. Rules-based inspection relies on pre-defined rules that must be manually updated, while AI-powered inspection can learn from datasets and adapt to new situations for continuous learning.

Limitations of Traditional Video Analytics

Traditional video analytics systems may offer basic tracking capabilities, such as motion tracking, to follow moving objects within the video. However, these tracking functionalities might have limitations in handling more complex scenarios or crowded environments effectively. Additionally, the accuracy of traditional video analytics can be affected by challenging lighting conditions, varying perspectives, and occlusions, leading to more false positives or negatives in the analysis.

How AI Improves Video Analytics

AI video analytics leverages artificial intelligence (AI) technologies, including machine learning and deep learning, to analyse video streams intelligently. The key feature of AI video analytics is its ability to learn from data, adapt, and improve its performance over time. This dynamic approach enables AI video analytics systems to process vast amounts of video footage efficiently, extract valuable insights, and make data-driven decisions in real-time. AI video analytics excels in object tracking and can simultaneously monitor multiple objects. It is capable of handling challenging scenarios such as occlusions, where objects temporarily obstruct each other while maintaining consistent tracking.

Industrial kitchen AI application tracking meal count and accuracy

02 Benefits of AI in Visual Inspection Processes

AI-powered visual inspection can significantly improve the quality and safety of products, reducing the risk of recalls and product liability. It can also reduce costs associated with manual inspection and increase productivity. Additionally, AI-powered inspection, when implemented in real-time, allows for immediate detection and correction of defects, which makes it a valuable investment for many businesses. Companies are also gaining value from AI in areas such as higher customer satisfaction and improved employee engagement.

The return on investment (ROI) of AI in visual inspection processes can be significant. This is becoming increasingly evident as businesses across various industries leverage AI technology to enhance productivity, efficiency, and competitiveness.

There are several ways in which computer vision AI can deliver significant ROI for companies:

Automated Quality Control: One of the primary benefits of computer vision AI is its ability to automate quality control processes, particularly in manufacturing and production environments. By deploying computer vision systems to inspect products for defects, inconsistencies, or deviations from standards, companies can identify and rectify issues, minimising waste, rework, and product recalls. This results in cost savings, improved product quality, and enhanced customer satisfaction, ultimately leading to a positive ROI.

Enhanced Operational Efficiency: Computer vision AI can streamline various operational processes across industries, such as inventory management, supply chain logistics, and facility maintenance. For example, by using computer vision algorithms to monitor and analyse inventory levels, companies can optimise stock levels, reduce carrying costs, and minimise stockouts or overstock situations. Similarly, computer vision-enabled asset tracking systems can improve asset utilisation, prevent loss or theft, and streamline maintenance schedules, resulting in significant cost savings and efficiency gains.

Improved Safety and Compliance: Computer vision AI plays a crucial role in enhancing workplace safety and regulatory compliance across industries, particularly in hazardous environments such as construction sites, manufacturing facilities, and transportation networks. By deploying computer vision systems to monitor and analyse safety protocols, detect potential hazards, and identify non-compliant behaviour, companies can prevent accidents, mitigate risks, and ensure compliance with regulatory standards. This results in reduced insurance premiums, legal liabilities, and reputational damage, contributing to a positive ROI.

Now that we have covered the benefits of AI for visual inspection, let's dive deep into how AI can benefit industrial kitchen operators.

03 Visual Inspection in Industrial Kitchen Settings

In every industry, choosing the right use case is vital to the success of an artificial intelligence program. AI for visual inspection can be highly beneficial in industrial kitchens, where quality control, efficiency, and safety are paramount. Ensuring food safety in industrial kitchens requires critical visual inspection. However, manual inspection is error-prone and time-consuming. AI-powered inspection can significantly improve food safety inspection processes. By analysing images and video, AI algorithms can detect omissions, defects, and anomalies that human inspectors may miss. This technology can reduce the risk of contamination, increase throughput, and ensure compliance with food safety regulations.

Industrial kitchen set up to use AI for visual inspection

The following are some of the ways computer vision AI can bring value to the industrial kitchen sector.

Food Quality and Count Inspection:

➤ AI-powered visual inspection systems can help assess the quality and freshness of food products in industrial kitchens. Cameras and machine learning algorithms can analyse various visual attributes such as colour, texture, shape, and size to detect defects, spoilage, or contamination in ingredients and finished dishes. For example, AI can identify bruised or discoloured fruits and vegetables, detect foreign objects or impurities in food items, and ensure uniformity in portion sizes and presentation.

➤ Computer vision AI can quickly perform repetitive tasks such as counting to ensure delivery of just the right number of meals with all required items on each tray.

Commercial airline meal quality control with computer vision AI

Commercial airline drink counting with computer vision AI

Hygiene and Sanitation Monitoring:

► AI can play a crucial role in maintaining high standards of hygiene and sanitation in industrial kitchens by automating the detection of cleanliness issues and potential health hazards. Visual inspection systems equipped with AI algorithms can analyse video feeds from cameras installed in food preparation areas, storage facilities, and equipment to identify areas that require cleaning or sanitation.

► These systems can detect accumulated debris and other sanitation-related issues in real time, enabling kitchen staff to take immediate corrective actions and prevent food contamination or safety risks.

► AI can detect PPE equipment such as hairnets, facemasks, and gloves, helping to ensure the health of customers and employees.

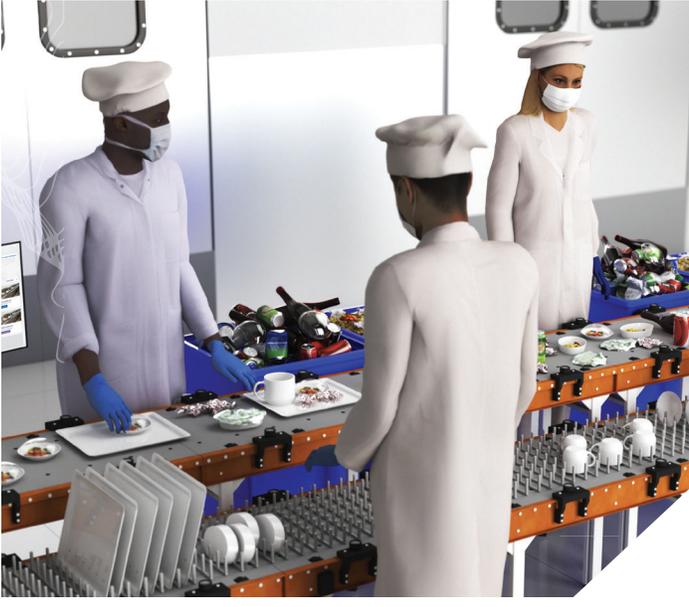Hygiene, sanitation, and equipment quality control with computer vision AI

Equipment Maintenance and Monitoring:

► AI-powered visual inspection can help optimise equipment performance and prevent breakdowns in industrial kitchens by monitoring the condition and operation of kitchen appliances, machinery, and infrastructure. Visual inspection systems can analyse images or video streams captured by cameras installed on equipment to detect signs of wear and tear, damage, or malfunction.

► By detecting potential maintenance issues early, AI can facilitate proactive maintenance scheduling, reduce downtime, and extend the lifespan of critical kitchen equipment. Additionally, AI can analyse energy consumption patterns and identify opportunities for energy efficiency improvements to reduce operational costs.

Waste Monitoring, Sorting and Classification:

The United Nations estimates that 38% of all food produced, worth as much as $2.5 trillion, goes to waste each year. Additionally, in 2019 alone, the food industry accounted for 37.3 million tons of plastic food packaging.[2] AI can help the food industry reduce this waste and positively impact environmental, social, and governance (ESG) scores.

➤ AI-powered visual inspection systems can assist in automating the sorting and classification of waste generated in industrial kitchens. By analysing images or video streams of waste materials, these systems can identify different types of waste, such as food scraps, packaging, recyclables, and non-recyclables. This helps streamline waste management operations, increase recycling rates, and reduce contamination in waste streams.

➤ AI can provide valuable insights into industrial kitchens' waste generation patterns and trends by analysing visual data collected from waste bins, containers, and disposal areas. By monitoring waste volumes, composition, and disposal frequency, AI can identify waste reduction and optimisation opportunities.

➤ AI-driven analytics can help kitchen managers track key performance metrics, such as waste diversion rates, landfill diversion rates, and waste-to-energy conversion rates. This information enables informed decision-making and the implementation of targeted waste reduction strategies to minimise environmental impact and operational costs.

Waste monitoring quality control with computer vision AI

Overall, AI for visual inspection offers industrial kitchens a powerful tool for enhancing food quality, ensuring hygiene and sanitation compliance, and optimising equipment performance to meet the demands of modern food production and service environments.

04 Challenges of AI in Visual Inspection Processes

While AI offers numerous benefits, including increased efficiency, improved food safety, and enhanced operational performance, it also raises important considerations that require careful consideration and mitigation.

Skill gaps and worker displacement

One of the primary ethical concerns with AI revolves around job displacement and the potential impact on human labor. As AI-driven automation becomes more prevalent, there is a legitimate fear that it may lead to the displacement of kitchen workers, particularly those engaged in repetitive or manual tasks. This raises questions about the ethical responsibility of businesses to ensure that the adoption of AI technology does not result in widespread unemployment or economic inequality within the workforce.

AI governance

There are also concerns about the fairness and equity of AI algorithms used in industrial kitchens, particularly in decision-making processes related to hiring, promotion, and performance evaluation. Biases embedded within AI algorithms, whether unintentional or systemic, can perpetuate inequalities and discriminatory practices, particularly against marginalised groups. It is crucial for businesses to prioritise fairness, transparency, and accountability in the development and deployment of AI systems to mitigate these risks and ensure equitable outcomes for all employees.

Privacy and security

Privacy and security of data collected and processed by AI systems in industrial kitchens is also high on the list of concerns. As AI-driven technologies rely on vast amounts of data, including customer preferences, employee performance metrics, and operational insights, there is a need to safeguard sensitive information from unauthorised access, misuse, or exploitation. Businesses must implement robust data protection measures, such as encryption, access controls, and data anonymisation, to preserve the privacy and confidentiality of individuals' personal information.

Ethics of surveillance

Finally, there are ethical implications surrounding the use of AI for surveillance and monitoring purposes in industrial kitchens. While AI-powered surveillance systems can enhance safety and security by detecting potential hazards and preventing accidents, they also raise concerns about employee autonomy, privacy, and consent. Businesses must strike a balance between ensuring workplace safety and respecting employees' rights to privacy and autonomy, taking into account the ethical principles of transparency, accountability, and consent.

The good news is that these challenges aren't insurmountable. A growing number of AI products are designed with ease-of-use for non-technical employees. With proper policies in place around data governance, privacy, and security and with a company-wide commitment to respecting employee rights and wellbeing, visual inspection AI can benefit employees as well as the company's bottom line.

The Importance of Laying the Proper Foundation

A key element of getting value from any AI initiative is laying the proper technology foundation. A recent study by Deloitte highlights that companies that do well across important practices such as data management, tracking results, security, privacy, and ethics are far more likely to have a strong ROI than those that do not. In fact, companies who perform well across those practices average 5% ROI, while those who do not average a negative ROI on their AI initiatives.[3] These fundamentals are important to ensure legal compliance, brand integrity, scalability, and the long-term validity of your AI-based business solutions.

5
PERCENT ROI ON AI INITIATIVES

05 What does the future hold for AI in Visual Inspection?

Advancements in AI technology will continue to revolutionise visual inspection processes. Improvements in computer vision and machine learning algorithms will enable even greater accuracy and efficiency. The potential for growth and expansion of AI-powered inspection is significant, with applications across many industries. Given the fast pace of advancements, how can companies future-proof the AI programs they deploy? Choosing an AI solution with these features will go a long way towards ensuring longer-term value generation.

► **End-to-end AI applications:** AI delivered as a complete application, with an intuitive user interface and easy navigation, will minimise the expertise and training needed to deploy and operationalise while delivering faster time-to-value. Advanced features such as generative AI allow faster and easier data collection and model training, which has traditionally been a leading cause of AI program delays.

► **Traceability:** The ability to check data and models to evaluate performance is essential for creating trust in AI solutions across an organisation. Understanding how and why a model delivers certain results allows stakeholders to feel confident in deploying an enterprise-wide AI visual inspection program.

► **Continuous learning:** AI models that are enabled with continuous learning capabilities allow companies to maintain, update, and improve the models with their input. With continuous learning, AI models continue to develop over time as they are exposed to new data.

AI is a powerful tool that can significantly enhance visual inspection processes in terms of accuracy, efficiency, and safety. It has the potential to transform how industrial kitchens operate, and it is an investment that companies should consider making. As with any technology, there are challenges and ethical considerations associated with its use, but the potential benefits are numerous. Companies that invest in the proper technological foundation, choose the right use case, pay attention to ethical considerations, and deploy solutions designed for long-term success are poised to gain substantial rewards from their AI-based visual inspection programs.

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[1] https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html
[2] https://www.un.org/en/observances/end-food-waste-day
[3] https://www2.deloitte.com/xe/en/insights/industry/technology/artificial-intelligence-roi.html

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