

# Artificial intelligence in vision systems for fulfilment, warehousing, and postal sortation facilities

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Efficiency, accuracy, and reliability are crucial in the fast-paced world of logistics and fulfilment services. To meet growing demands and reduce operational costs, sortation facilities are increasingly turning to artificial intelligence (AI) to enhance their processing systems. These advanced technologies are revolutionising how parcels and letters are identified, sorted, and routed, offering significant improvements in speed, error reduction, and data accuracy.

*Wouter Homan, Research and Development Engineer at Prime Vision, explores the benefits of AI in the context of fulfilment, sorting and warehousing operation.*

AI is set to revolutionise accuracy and reliability in the logistics and fulfilment industry. Sortation facilities manage huge volumes of items every day so precise identification and sorting are crucial, but traditional warehouse and sorting methods are not always accurate. They rely on two-dimensional (2D) techniques like optical character recognition (OCR) and barcode scanners that can struggle to read messy handwriting or damaged labels. Even poor lighting can reduce accuracy. Failed or inaccurate scanning reduces efficiency at all stages of the logistics lifecycle and can lead to costly errors.

Prime Vision uses cutting-edge technology to solve these issues with its Vision AI platform. This versatile digital infrastructure integrates two- and three-dimensional

(3D) computer vision capabilities. 2D applications improve sorting efficiency and accuracy by reading and processing labels, barcodes, hazardous material signs, and even handwritten information. The 3D applications involve shape recognition technology that can integrate with robotic handling systems and image projection that enhances the accuracy of both human and robot operation.

Vision AI blends machine learning with deep neural networks and precision scanning techniques. This sits alongside the latest developments in edge processing for an innovative logistics solution that improves process efficiency.

### **Speeding up the sorting process**

One of the most immediate benefits of integrating AI into sorting systems is the dramatic increase in processing speed. AI models that use convolutional neural networks (CNNs) can identify and interpret information from parcels at high speeds with minimal delay. These models continuously learn from new data, allowing them to adapt to various label types, fonts, languages, and even partially obscured information.

Vision AI can process images in milliseconds, allowing for real-time decision-making as parcels move along conveyor belts. This means fewer slowdowns, less manual intervention, and a higher throughput, ultimately enabling facilities to handle greater volumes with existing infrastructure.

3D software takes it a step further. Standard 2D models can struggle when labels are not pointed at a single camera. Extended fields of view simply search for a better angle to read the data, avoiding costly and time-consuming remedial processes. The same technology can identify parcels that are on top of each other, stuck together, or at risk of causing damage during the process of sorting.

### **Reducing misreads and enhancing accuracy**

AI significantly reduces the number of misreads that plague traditional OCR systems. While older systems might struggle with smudged ink, obscured labels, or non-standard fonts, Vision AI can infer the correct data by analysing context, patterns, and historical data. For example, if an address is partially illegible, the AI system can cross-reference postcodes, common street names, and postal routes to fill in the gaps with high confidence.

These advanced recognition capabilities can enhance even fully automated warehouse systems. Many facilities have started to implement robotic picking techniques, but as with any new technology, there are bound to be errors. This could be robots picking up two items accidentally or displacing one item while picking another. Vision AI can identify logistical errors just as easily as during the sorting process for maximum efficiency at all stages.

### **Improving data accuracy, traceability and security**

Accurate data capture and analysis is essential for tracking, billing, and customer satisfaction. AI-enhanced vision systems improve data accuracy by ensuring consistent and correct interpretation of parcel information. This results in better tracking accuracy, more reliable delivery estimates, and improved customer service.

Furthermore, AI systems can integrate with other technologies, such as radio-frequency identification (RFID) and Internet of Things (IoT) sensors, to create a holistic data environment. In practice, this means ultra-fast processing and the ability to respond to changing situations instantly because data processing happens as close as possible to the source of the data. This efficient processing – known as edge computing – can be a particularly effective addition to sorting where speed and efficiency are crucial.

These systems are extremely fast and secure as data does not have to travel around multiple systems for processing, but they can struggle with complex tasks or

unexpected changes. Prime Vision offers a hybrid AI solution that enables the best of edge computing with connected cloud support for maximum accuracy as well as speed and security.

### **Levels of AI integration**

The integration of AI in warehousing, fulfilment and postal sortation systems can be categorised into three levels:

**Basic automation with AI assistance:** At this level, AI can enhance OCR performance and barcode reading. It supplements traditional systems, improving recognition rates but still requiring some human oversight for exceptions.

**Intermediate AI with predictive analytics:** This level includes AI models that not only interpret visual data but also use predictive analytics to forecast flows, detect anomalies, and suggest operational adjustments. These systems begin to operate semi-autonomously.

**Advanced AI with full autonomy:** At the highest level, AI systems perform end-to-end analysis and decision-making with minimal human input. These include adaptive learning systems that evolve with new data, support fully autonomous sorting lines, and integrate with enterprise resource planning (ERP) and logistics management systems.

### **Business benefits of AI-driven systems**

The implementation of AI in warehousing and postal sortation offers numerous benefits for businesses. Operational efficiency derived from faster processing times mean more parcels handled per hour, reducing bottlenecks and overtime labour costs. Fewer errors reduce the need for rework and the risk of lost or misrouted parcels, reducing operating costs.

At the same time, AI systems like Vision AI can easily be scaled across multiple facilities and updated via cloud-based platforms, ensuring consistent performance organisation-wide. These all lead to improved customer satisfaction, with more accurate deliveries and better tracking capabilities, which translate into higher service levels and customer trust.

In summary, artificial intelligence is rapidly transforming warehousing and fulfilment processes through intelligent 2D and 3D vision systems. By reducing misreads, improving data reliability, and enabling scalable operations, AI is not only addressing current logistical challenges but also setting the stage for the future of automated mail and package processing. As AI technology continues to advance, its integration into logistics systems will become increasingly vital in an evolving global processing and fulfilment landscape.

**Image captions:**

**Image 1:** By reducing misreads, improving data reliability, and enabling scalable operations, AI is not only addressing current logistical challenges but also setting the stage for the future of automated mail and package processing (shutterstock\_2441231863).

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**About Prime Vision**

Prime Vision is a global leader in computer vision integration and robotics for logistics and e-commerce. As an award-winning company, Prime Vision designs and integrates solutions using the latest recognition, identification, and robotics techniques to optimize the automation of sorting processes.

Headquartered in Delft, The Netherlands, more than 170 experts provide comprehensive market and domain knowledge to digital companies around the world.

For more information, visit <https://primevision.com/>

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