

# **MAKING PORTS SMARTER:** THE USE OF AI FOR INTERMODAL SHIPMENT VISIBILITY AND MARITIME OBJECT DETECTION





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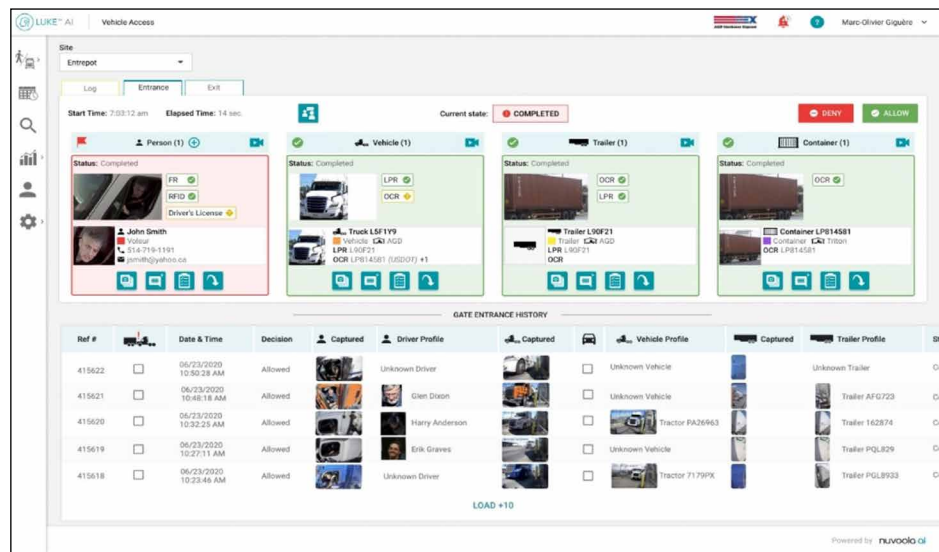
Ports stand where different modes of transportation converge. These include maritime shipping, rail transport, road transport and sometimes even air transport. More than ever, the pursuit of excellence and competitiveness requires port operators and other supply chain actors to achieve three key objectives:

1. Resiliency
2. Fluidity
3. Visibility

In this article, Nuvoola AI will focus on the visibility component as a key method for achieving greater optimization across the supply chain.

With Nuvoola AI's **LUKE Platform**, which stands for Learn, Understand, Know and Execute, the cloud-based Software-as-a-Services model not only reduces upfront infrastructure, maintenance, and upgrade investments for terminals, but it is also designed for scalability. It easily integrates other variables from third-party systems to provide AI-assisted decisions.

For yard operations and intermodal scenarios, automating asset tracking can also be challenging. Manual tracking of assets such as containers, trucks, trailers, tankers, and train compartments can be time-consuming, error-prone, and lack real-time visibility. Nuvoola AI's system automatically identifies and tracks assets through visual recognition, improving real-time visibility and accuracy while reducing human errors and labor costs. In addition, by identifying and tracking shipments in real



**FIGURE 1.** Detailed entry and exit logs and up-to-date inventory reports

time, customer communication is enhanced, and resource planning is improved, both resulting in reduced uncertainty in the supply chain.

Capable of military-grade object detection, classification and multi-object tracking, the technology relies in part on Nuvoola AI's Edge device. This was developed in partnership with Nvidia to always leverage the latest technological advancements.

Current versions of the AI Edge device successfully run several commercial applications for detecting and classifying trucks, trailers, and containers found in port operations with intermodal terminals.

AI not only allows for real-time visibility but also provides valuable analytics that can be viewed on an intuitive dashboard. With the ability to dynamically create and validate models and profiles, the system trains multi-factor AI models for

future identification requirements.

Visibility is achieved with an innovative SaaS video analytics platform that uses a combination of state-of-the-art technology and techniques such as:

- Computer vision
- Advanced motion tracking
- Multi-sensor fusion Edge computing
- Modern AI interfaces
- Flow analytics
- Scalable architecture

The "end goal" is to implement one or several systems to enable exponential operational efficiency. Improved overall performance is key to providing superior customer service, better support for employees in their day-to-day work, shorter delivery times, product traceability, and simplified processes for smarter and faster decision-making.

AI is more powerful when used across several collaborators, but one major industry challenge that remains is data sharing and data governance within an ecosystem of partners. To maintain their competitive advantage, companies are often reluctant to share their data. Nevertheless, selected solutions should allow easy integration with other systems, natively or through connectors or APIs.

In the following section, we will look at actual use cases of train and maritime operations using AI.

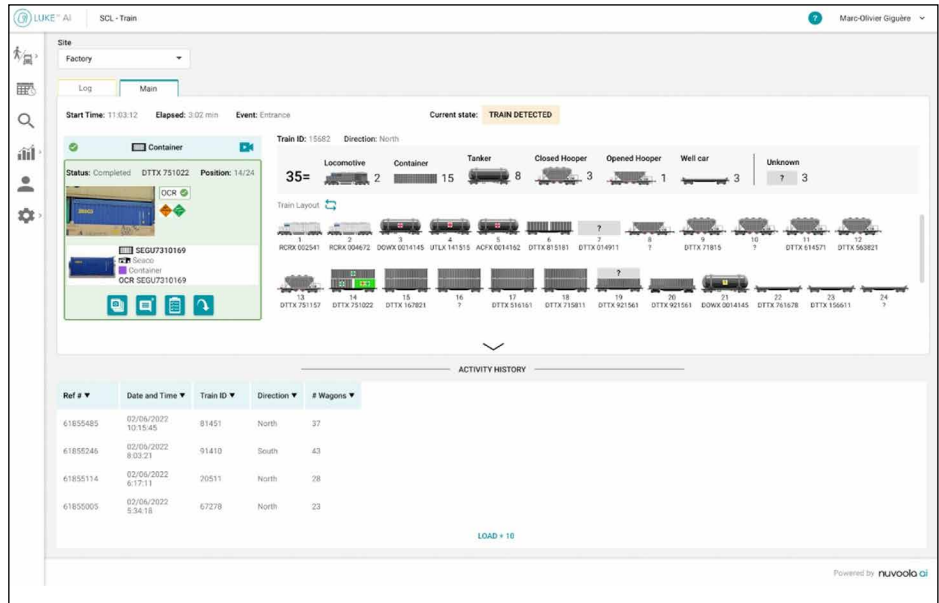
**USE CASE 1: OVERALL EFFICIENCY OF INTERMODAL EXCHANGES BETWEEN RAIL AND MARITIME TRANSPORTATION.**

**Challenge:** Optimize the use of the railway network and implement a real-time tracking tool for railway traffic.

**Solution:** An eManifest (electronic manifest) from Nuvoola's TSV solution, provides information on wagon movement in the port, specifically between loading areas and storage yards. The manifest data, acquired through artificial intelligence, enables the port to identify capacity challenges, plan for additional infrastructure needs, and simulate network improvement scenarios based on tangible data to meet the current and future needs of the port.

In this case, a Digital Twin that includes a graphical representation of the train operation is dynamically created in real time by aggregating data from cameras. The Train Visibility Solution produces an eManifest so train yards can make sure the train matches the cargo manifests from shippers.

The solution helps you ensure compliance with government regulations, such as the transport of dangerous goods, by capturing each rail car's placards using automation and artificial intelligence. Integrated with your infrastructure, the solution ensures that the train manifest is



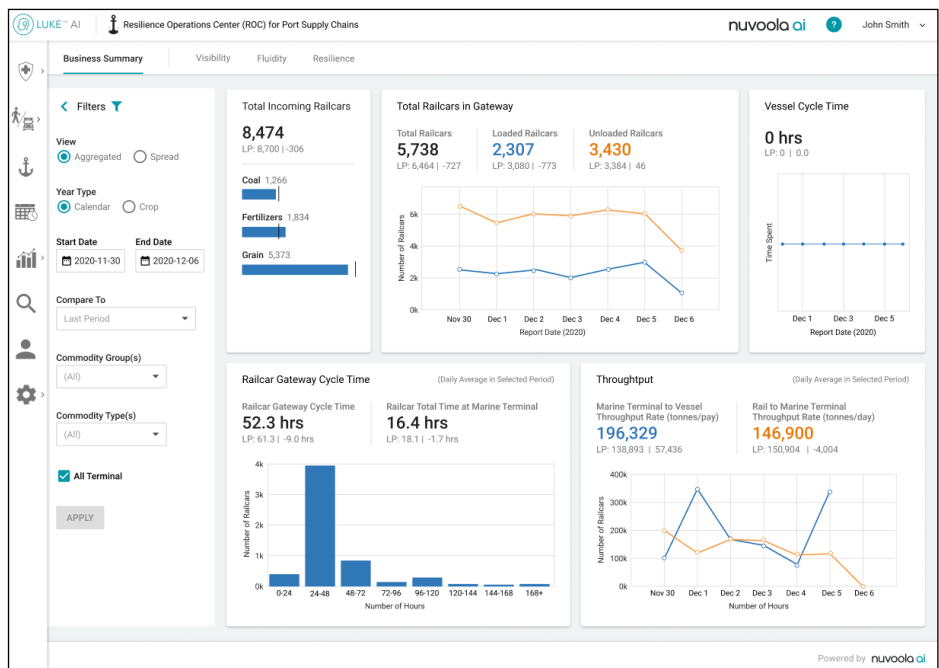
**FIGURE 2.** Graphical representation of the actual train

**FIGURE 3.** Executive Summary, reports & dashboards

correct so issues can be corrected as the train leaves the yard. Rail yards can address issues before trains arrive at checkpoints and border crossings, avoiding the risk of rail cars having to be removed from the train, the resulting loss of time and the potential of injuries to train staff.

**USE CASE 2: MARITIME AND AIR OBJECT DETECTION.**

**Challenge:** Reliability of traditional surveillance methods that are prone to errors and their ability to detect objects in all weather conditions, including low visibility.





## “NUVOOLA AI HAS DEVELOPED AUTOMATED AND INTELLIGENT SYSTEMS THAT HARNESS MULTIMODAL IMAGERY, COMBINING VISIBLE AND INFRARED SPECTRA TO ACHIEVE ROBUST OBJECT DETECTION, CLASSIFICATIONS, AND TRACKING CAPABILITIES.”

**Solution:** In response to these challenges, Nuvoola AI has developed automated and intelligent systems that harness multimodal imagery, combining visible and infrared spectra to achieve robust object detection, classifications, and tracking capabilities.

In recent years, advances in deep learning and artificial intelligence have revolutionized various fields, including object detection and tracking. Within the context of maritime surveillance, the need for efficient and accurate detection of objects on the sea and in the sky has become increasingly critical. Earlier in 2023, weather or spy balloons entering Canadian and US airspace made the headlines and captivated the public's attention.

For ports and maritime operations, solutions that are better

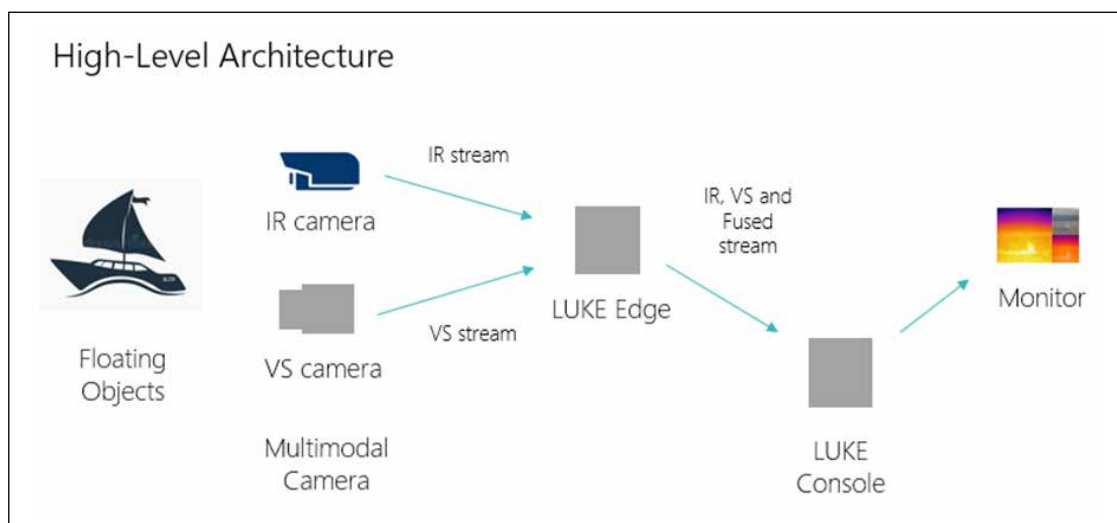
than eyesight and use tracking and super-resolution are now capable of surveillance and monitoring of objects that can range from small boats, containers, and vessels to boaters, swimmers, debris and more.

More precisely, the system's main feature can display and magnify in real time, an observed and super-resolved scene on a monitor containing the object information and metrics. It also allows for night vision and the ability to see through fog or haze in a single visualization interface without the need to toggle between different visualization modes. It allows for the continuous gathering of relevant data for further AI model training. Ongoing improvements that include the production of more diverse and higher quality images, extended 3D simulation environment, and

the incorporation of environmental factors such as cloud shapes and landscape elements, all contribute to and expanding the library of object assets, including birds, drones, airplanes, kayaks, sea-doo's and canoes.

By integrating the LUKE SaaS platform, the system can capture and process objects of interest through real-time SMTP video streams. The system's ability to generate contextual data images and metadata provides enhanced visualization, traceability, and situational awareness. Integration into maritime operations promises improved safety, effectiveness, and object classifications.

Our software can subscribe to various types of SMTP video streams. When the software captures objects of interest, it generates contextual crop images



**FIGURE 4.**  
High-Level  
Architecture for  
Object Detection

along with essential meta-data such as UTC date and time, tracking ID, crop coordinates, object labels, and confidence scores. These images and data are processed and stored in real time, accessible through various APIs and interfaces. Additionally, the software offers a web application for real-time data visualization, complete with dashboards and reports, ensuring comprehensive traceability of events.

### **THE IMPORTANCE OF BUILDING AN AI ROADMAP NOW**

Digitalization creates the pathway toward establishing your Digital Twin environment. By now, most businesses have implemented some degree of digitalization into their daily operations, but not necessarily AI. Digital innovation and AI will continue to develop rapidly over the next five to ten years, and organizations in this industry will need to start embracing AI's role to leverage the benefits and maintain a competitive edge. These benefits include faster data processing leading to more insights for safer navigation, predictive maintenance, and enhanced crew training.

To achieve a successful business process transformation, AI requires a complex mix of strategic and operational technology and change management, resulting in a business process transformation.

Along the road to transformation, common mistakes include

replicating existing business workflows versus designing new ones or trying to build everything from scratch yourself and stepping out of your core business to build an AI team.

A structured approach starts with identifying your opportunities. These can be quick wins or projects with the highest return. You want to identify real use cases with a strong return on investment.

After identifying your project(s), carefully document the actual situation and analyze the future state to compare where the gaps will be. These gains can be strategic, tactical, operational, financial, or other.

The will to become a data-centric organization is crucial to success. This requires quality data and a well-defined data governance framework. Implementing AI means using data and creating the data required for better efficiency and visibility.

After thorough analysis, the output is often an initial roadmap. At this stage, the organization must identify functional teams responsible for the success of the project, including executives and decision-makers for project support and buy-in.

Nuvoola has helped many companies transform their business processes to create a successful AI roadmap. We are confident we can provide more real-time visibility into your intermodal terminal operations so you can achieve more resiliency and fluidity.

### **ABOUT THE AUTHOR:**

Patrice Boies is currently Vice President of Strategic Growth and Partnerships at Nuvoola AI and a technology veteran with over 25 years of experience in Information Technologies.

Having worked with best-of-breed and emerging vendors, integrators, channel partners and digital transformation market leaders, Patrice has helped countless clients cross the chasm of technology choices that companies face when selecting solutions to grow their business.

### **ABOUT THE COMPANY:**

Nuvoola AI is a provider of SaaS artificial intelligence solutions that improves operational performance through automation and real-time visibility. Specialized in transport and logistic, we transform video, voice and data into actionable intelligence with innovative business solutions. Based in Canada, our company offers expertise that spans machine learning, cloud and industrial IoT.

**“ALONG THE ROAD TO TRANSFORMATION, COMMON MISTAKES INCLUDE REPLICATING EXISTING BUSINESS WORKFLOWS VERSUS DESIGNING NEW ONES OR TRYING TO BUILD EVERYTHING FROM SCRATCH YOURSELF AND STEPPING OUT OF YOUR CORE BUSINESS TO BUILD AN AI TEAM.”**