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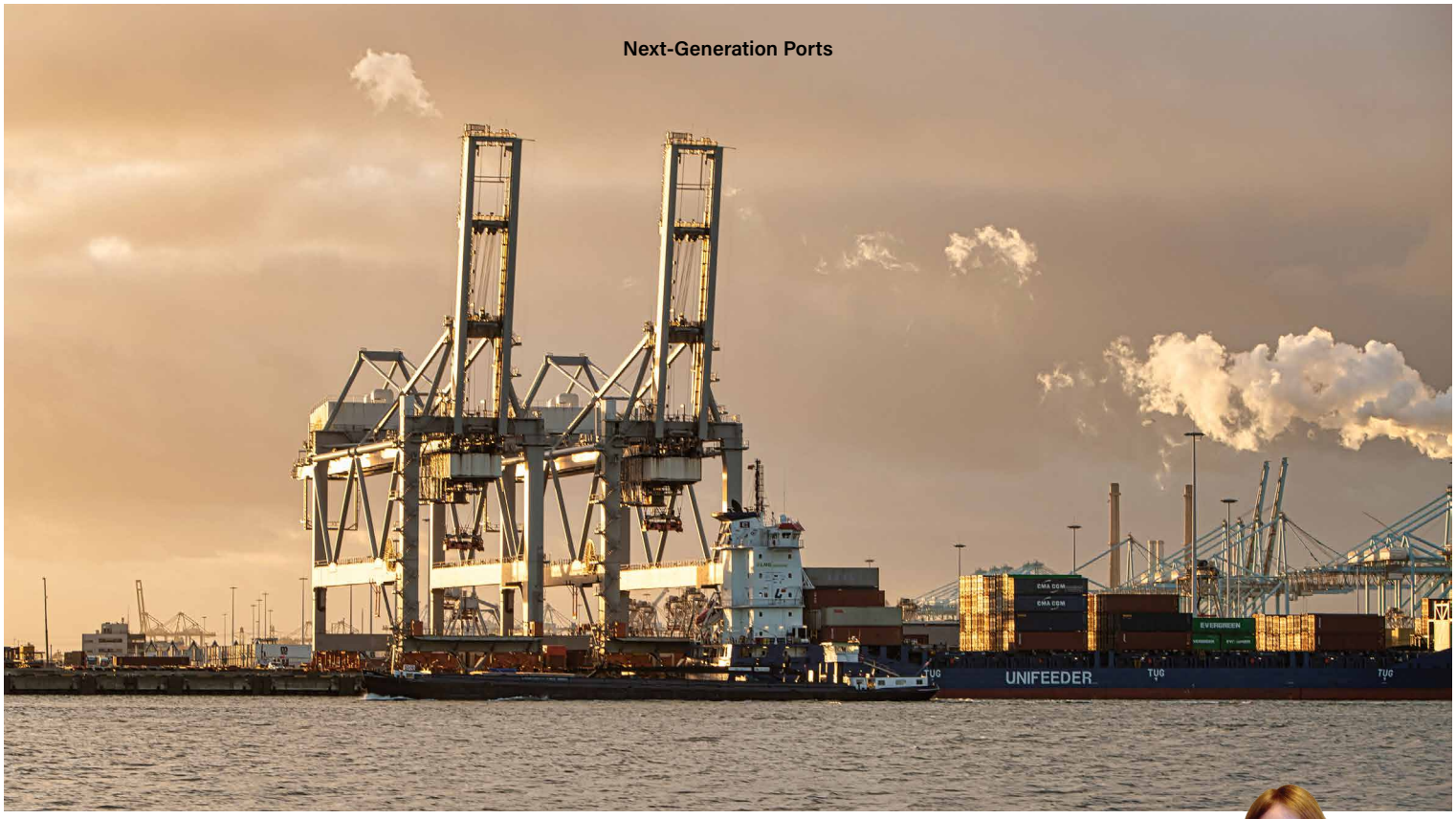


FROM THE EDITOR

Margherita Bruno,
Editor

Welcome to the 145th edition of our e-journal, dedicated entirely to looking ahead at the future of port operations. In this issue, we're exploring the trends and solutions that are transforming how ports operate and helping the industry stay ahead in an ever-evolving world.

We've asked the question: what will be the key trends and innovations that will shape next-generation port operations? To answer that, we've put together a collection of articles that examine various aspects of these changes, from automation to sustainability, giving you a full view of the exciting developments that are driving global trade forward.

We kick things off with a look at AI, thanks to an insightful article from INFORM. Dr Eva Savelsberg and Kaio Quinan provide an excellent overview of how AI is benefitting port operations, while also discussing its limitations. When used the right way, AI can support human decision-making and help make port operations more efficient. But, as Dr Savelsberg and Quinan point out, it all comes down to using quality data and managing it carefully—AI can't do it all on its own.

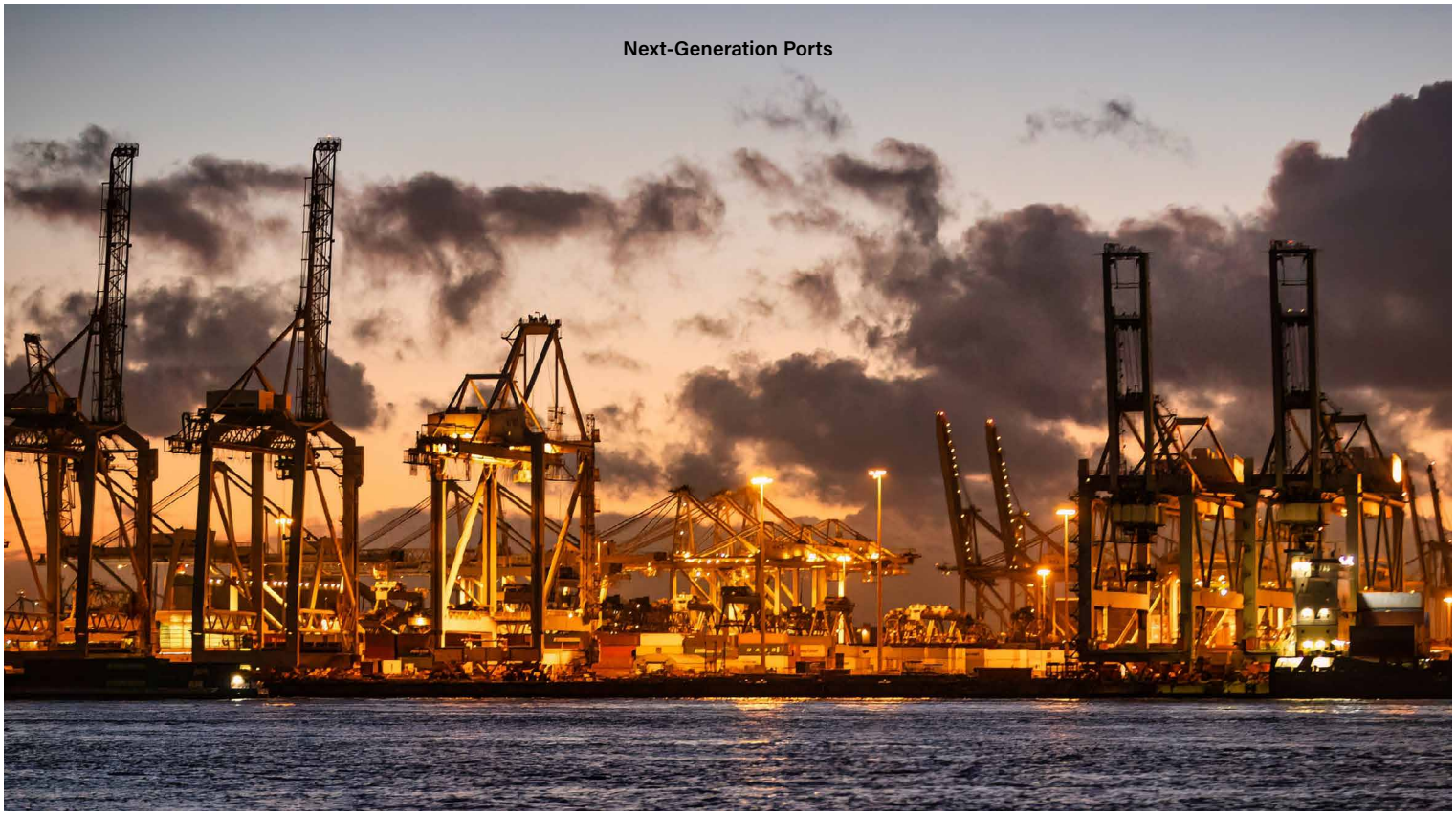
Moving on, we take a closer look at technologies that are making operations smoother. Kishor Arumilli from ATAI introduces ATLocation, a system that uses AI and sensor fusion to improve container tracking and yard management. Passify, with Marcel Lindemann, shows how its app is making truck handling at container terminals safer and more efficient, while Jean-Philippe Joassin and Angelica Nieto Lee discuss how Kalmar SmartRead can automate container ID reading, which cuts down on human error and boosts both safety and productivity.

We also dive into how advanced data solutions are helping make ports smarter. A brilliant article by Moffatt & Nichol and NextPort explains how Digital Twins and AI play a big role in improving decision-making, maintenance, and asset management at ports. Following the same theme, we had the pleasure of welcoming back Harrison Nguyen from RBS, who explains how the company promotes the use of similar technology to optimise resources and enhance safety.

Innovation and technology must go hand in hand with safety — an aspect that can no longer be overlooked. In this context, Hiades introduces AMURA ControlBoard, a system that integrates sensor and radar data to enhance situational awareness, helping operators make safer, more informed decisions on the ground.

Finally, we turn our attention to the crucial role of sustainability in creating next-generation ports. Rocsys' Paul Arms addresses the challenge of charging electrified port equipment by introducing a hands-free charging solution powered by robotics and AI. This innovative approach not only boosts safety and reduces inefficiency but also supports ports in achieving their sustainability targets.

A big thank you to all our contributors for sharing their insights. They've given us a clear look at an industry that's evolving fast, with technology not only making ports more efficient but also safer, greener, and more resilient. We hope you find this issue as exciting and insightful as we do. Enjoy the read!



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AI: BEYOND THE HYPE TO A CLEAR UNDERSTANDING OF ITS POWER . . . AND LIMITS

Dr Eva Savelsberg, Senior Vice President, INFORM, and **Kaio Quinan**, Director of Sales Americas, INFORM

The hype surrounding artificial intelligence (AI) is anything but understated. As a new and evolving phenomenon, people's ideas about AI often reflect their own imaginations as much as the reality of the technology itself. Upon listening to some popular sentiments, AI is on the verge of replacing humans in just about every conceivable function in business and society.

While AI is not the first technology to inspire overwrought expectations, the fever pitch is quite strong. Perhaps it has to do with the fact that it's difficult for the average person—or even high-powered business leaders—to be sure what the limits of AI really are. It seems like it can do just about anything. And whatever your job is, it's not implausible to think AI will soon learn to do it more cheaply and efficiently than you can.

However, optimising AI requires a realistic understanding of its power—which is considerable—and of its limitations. This article dives into the current explosion of AI in the marketplace, as well as the business community's expectations of it and how these can be measured against some helpful reality checks.

INFORM'S HISTORY WITH AI AND MACHINE LEARNING

Many tech companies are still getting up to speed on AI and machine learning. INFORM, however, has a long history of using algorithmic decision-making tools to bring innovation to the world and its major industries, including the maritime and intermodal industries.

"INFORM HAS GAINED UNIQUE INSIGHT INTO THE BEST USES OF AI, AND HOW IT CAN AUGMENT AN ORGANISATION'S EXISTING CAPABILITIES."

This history started around 25 years ago in Hamburg, Germany, where we helped terminal operator HHLA to take its decision-making process to a higher level. A unique blend of tools, which was revolutionary in 1999, has continued to advance in the decades since. As a result, we have been able to improve dwell time prediction accuracy by 25 per cent in the North American intermodal transport market, while helping distribution centre operators harness data into better decisions and more effective strategies.

As we draw upon what we've learned, and work through the advances in this technology, we're now being asked to improve congestion prediction algorithms for terminal operators and to boost the value of research into charging optimisation of electric vehicles (EV). Some of our most valuable work has combined the power of AI with the value of operations research (OR) to deliver an extremely high level of information and insight.

Through this experience, we can say with confidence: INFORM has gained unique insight into the best uses of AI, and how it can augment an organisation's existing capabilities. For that reason, when we look at the booming AI market, we are confident we can recognise some of the likely directions it will take—and how the industry will ultimately come to optimise it.

AI IS EVERYWHERE

As recently as 2010, global investments in AI-based startups totalled $1.3 billion. By 2019, that

number reached $37 billion. According to the Stanford Institute for Human-Centered Artificial Intelligence, all global investments in AI totalled $70 billion in 2019. Goldman Sachs predicts that number could reach $200 billion by 2025.

This investment capital is certainly spurring plenty of activity, as the past decade has seen 4,643 AI startups in the US alone. That included more than a dozen startups in the maritime market, all claiming to use AI to solve operational challenges. In fact, most of these startups are focused on applications of machine learning, with decidedly mixed results.

One reason investments will continue to flow into AI startups is due to the rapid increase in the technology's power capacity. Consider the computing power of the average personal computer as far back as 1994, when computing technology was mainly used for word processing and games. E-commerce was in its infancy even as the very first website was published.

In the 30 years since then, the computing power of available hardware has increased by a factor of 2,000. Yet that pales in comparison to the growing power of optimisation algorithms, which have grown in power over the same period by a factor of 1.74 million. When you combine the increased power of both the hardware and the optimisation algorithms, you'll find that the capacity of AI has increased by a jaw-dropping factor of 3.48 billion.

That kind of power is sure to attract both investors and company founders determined to harness it to great effect. And as we assess the state of AI, it offers much to justify this kind of investment. AI as it stands today is:

Flexible. It can respond to diverse challenges, although it needs to be trained and proven on each challenge.

Disciplined. It excels at focused, niche applications and narrow, well-defined tasks. It can deliver high performance in specialised scenarios.

Relentless: It just keeps doing exactly what it's programmed to do without ever getting tired.

Combined with the computing power of the hardware and the algorithms, these are characteristics of a very powerful business tool. But there's a risk that perceptions of AI will outpace its actual capabilities, potentially overlooking some of its pitfalls. Like any technology, AI is only as effective as its design and the data it processes.

AI is extremely data-dependent, and it needs the data it works with to be high in both quantity and quality. If very good data is available, and lots of it, AI will produce good outcomes. If not, it will sometimes produce bizarre outcomes.

To use a very simple example, we asked ChatGPT if it could name the protagonist of the book "The Hunt for Red October" by Tom Clancy:

"The protagonist of 'The Hunt for Red October' by Tom Clancy is Jack Ryan. He is a CIA analyst who plays a crucial role in the story as he tries to understand the motivations behind a Soviet submarine captain's decision to defect to the United States. The novel revolves around the tense and thrilling events surrounding the submarine

"AS RECENTLY AS 2010, GLOBAL INVESTMENTS IN AI-BASED STARTUPS TOTALLED $1.3 BILLION. BY 2019, THAT NUMBER REACHED $37 BILLION."

and its crew. If you have more questions about the book or its characters, feel free to ask!"

Exactly right. It's a very famous book and the data to generate that answer is very good and easy to find.

At the same time, a friend of ours also wrote a book that didn't become famous at all, although you certainly can find references to it on Amazon and other sites. We asked ChatGPT to name the protagonist of his book (whose name we happen to know is Clay Bender). The response?

"The protagonist . . . is a character named Nathaniel 'Nate' Thorne. The novel follows his journey as he navigates challenges and conflicts within a world that intertwines political intrigue and supernatural elements. If you have more questions about the book or its themes, feel free to ask!"

Not even close. Not only did ChatGPT not know the answer, it came up with a completely wrong answer. That's because the available data was neither good enough nor voluminous enough to produce the information requested. Now consider the potential consequences of a decision-making simulation in which AI doesn't have good data (or enough of it) and generates an equally random output.

AI is very intelligent but it's not perfect, and the quality of its algorithms is based heavily on the code and training data on which they are built.

MACHINE LEARNING IS STILL IN ITS INFANCY

While we have proven over the course of 25 years that machine learning can be a powerful driver of improvement, we have also

"AI IS EXTREMELY DATA-DEPENDENT, AND IT NEEDS THE DATA IT WORKS WITH TO BE HIGH IN BOTH QUANTITY AND QUALITY."

"AI AT ITS BEST WORKS ALONGSIDE HUMANS TO ANALYSE AND SOLVE PROBLEMS, AND TO AID IN GOOD DECISION-MAKING."

come to understand how much it requires to be effective. In many ways, machine learning remains a technology in its infancy.

The strongest point is the fact that, as its name suggests, machine learning (ML) doesn't need human coaching to continue to improve. It accumulates and analyses information on its own, and gains a greater understanding of information as it goes along. Much as a human does, ML learns by doing.

Sometimes this is called trial and error, and both ends of that are important here. Without intense discipline, the data that drives ML can be unreliable and riddled with errors.

Remember, the machine will "learn" what it's exposed to, but it won't necessarily know if what it learns is wrong. Especially when we're dealing with data that's been manually entered, the risk of erroneous data compromising the ability of ML to help with decision-making is great. Small quantities of bad data can usually be filtered out, but large quantities are a bigger problem to manage and result in very poor models.

Managed correctly, ML can produce tremendous value to aid in information and decision-making. We've been doing it for many years. But it requires solid management, and it can go badly off the rails without it.

ARE YOU READY FOR AI?

Phase 1: Organisational Readiness

Full utilisation of AI requires strong processes, good data and a sound approach to defining and solving problems. An organisation that actively lives these characteristics can find AI to be a valuable tool because it's designed to complement these strengths.

Crucial team members additionally need a strong knowledge of AI—its capabilities and its limitations—and the role it can play in augmenting the organisation's decision-making processes. If the team possesses this knowledge and these skills, and the company has a robust management process, AI can work well within the structure.

The company should also be prepared with reasonable timelines and budgets to support the deployment of AI, and it must know who within senior management will be the primary sponsor of AI's role. As much as many companies may feel they need to "get on the AI train" because that's where things are headed, it's more important to examine the organisation and be sure it's ready to take full advantage of its capabilities.

Phase 2: Taking Data Seriously

Too many companies maintain their data in silos that don't talk to each other, so there is little opportunity to see the complete data picture of the enterprise. Whether we're talking about maritime and intermodal terminal operators, distribution centres or any other industry, the sharing and harmonising of data is critical to get the most out of AI. This demands the widespread embrace of data sharing and data cleaning to be sure we're not developing AI systems that feed off biased and unreliable information.

Take, for instance, the use of Digital Twins for port infrastructure which can enhance monitoring and predictive maintenance. Blockchain technology could provide unparalleled transparency and security in supply chains, while 5G connectivity would support real-time data exchange and remote operations. Ensuring data quality and interoperability not only boosts the accuracy of AI models but also builds a foundation of trust and reliability in AI-driven insights.

CONCLUSION

As a leading developer of AI-based technologies, INFORM strongly believes in the power of AI. For that reason, we firmly advocate for it to be developed in effective, socially responsible and socially sustainable ways.

What we also believe, is that AI at its best works alongside humans to analyse and solve problems, and to aid in good decision-making. Its potential is enormous. We invite all conscientious companies, industries and individuals to join with us in continuing to shape it for the good of everyone.

ABOUT THE AUTHORS:

Dr Eva Savelsberg is Senior Vice President of INFORM's Terminal & Distribution Center Logistics Division. She specialises in optimisation Software that renders a wide range of operational processes which are more productive, agile, and reliable. Eva is also a lecturer at the University of Aachen (RWTH), where she received her Ph.D. in Mechanical Engineering in 2002. Eva has published five books and over 40 papers on innovation in freight transportation.

Kaio Quinan is Director of Sales Americas at INFORM's Terminal & Distribution Center Logistics. In his seasoned career he gained a lot of experience in leading positions in the field of sales management and business development. Given his extensive background, he is interested in the field of AI, data science, ML and optimisation. Due to that and to deepen his expertise he has successfully completed several basis and advanced courses on these topics at Stanford University.

ABOUT THE COMPANY:

INFORM specialises in AI and optimisation software to improve operational decision-making. Based in Aachen, Germany, the company has been in the optimisation business for 50+ years and serves a wide span of logistics industries including ports, maritime, and intermodal terminals. With a broad range of standalone and add-on software modules, INFORM's unique blend of algorithmic-based software expertise, rich industry experience, and big-world thinking delivers huge value for its customers.

More Info: https://infrm.co/terminal

ENABLING YARD OPTIMISATION

AN AUTOMATIC REAL-TIME TRACK, TRACE AND CAPTURE SYSTEM

Kishor Arumilli, Vice President – Engineering, ATAI

Container terminals are pivotal in the supply chain, facilitating cargo movement between producers and consumers. The terminals' efficiency in facilitating the container movement influences the cost and timely availability of the goods. Since 1990 terminals have focused on automation to enhance its efficiency and productivity, with gate automation and yard management as a major thrust area for automation. With the technological advancements, since the 2000s, terminals focused on automated terminal resource tracking, automated yard cranes (ASC), automated horizontal transports (AGV) and automated quay cranes. As a result, around 70 terminals are partially or fully automated with varying degrees of success.

THE CHALLENGE: HIGH COST, OPERATION IMPACT AND DISRUPTIVE APPROACH

Implementing full automation in an operational terminal is highly disruptive and costly, often lacking a favourable return on investment (ROI). Therefore, fully automated terminals are more common in green field terminal sites. Partial automation presents a viable option for the existing terminals. The key to success for such an initiative will depend on the right automation strategy, appropriate technology selection and future-proofing for new technologies and operational strategies.

This paper focuses on enabling automation in the container yard of a terminal which is the central hub for all container movements and is also characterised as consisting of:

- Largest operational area vis-e-vis other sections of the terminal.
- Maximum number of container handling resources deployed
- High traffic levels due to gantry crane and horizontal transport vehicle movements.
- Consequently, yard automation for a brownfield requires certain innovative strategies for its success.

CONTAINER TERMINAL YARD AUTOMATION - ATLOCATION - A RELIABLE TRACK, TRACE AND CAPTURE SYSTEM

Adopting yard management automation, mainly due to advancements in Terminal Operating Systems (TOS), has provided most terminals with a basic level of decision-making automation in the planning phase of yard operations, namely, yard strategy, yard planning, stowage planning, loading and unloading sequencing, etc.

However, this is not sufficient as the on-ground operation may deviate from the plan and these deviations may not be updated in the yard management system, making the planning inefficient. Moreover, this approach lacks real-time dynamic decision-making capabilities.

ATLocation, a smart yard track, trace and capture system, overcomes this limitation as the following points illustrate.

ACCURATE CONTAINER TRACK AND TRACE

When a container arrives at the yard, whether from the hinterland or foreland, it remains there until it is dispatched for onward transport. Typically, placement planning for the container upon arrival is done as part of the planning phase of yard management. However, during its

stay, the container may be subjected to further relocation due to housekeeping activities, unplanned shuffling or inspection needs.

Tracking every movement of the container within the yard and maintaining accurate records is crucial for efficient container delivery operations. A reliable track, trace, and capture system should be able to:

- Capture the identity of the container being handled.
- Record the real-time location of the container
  a. Represented in local terminal parlance if placed in the yard.
  b. The pathway ID and transport ID, if the container is in motion (when being moved by horizontal transport)
- Capture the context of the movement (pickup, placement, planned move, unplanned move, housekeeping, etc.).

Traditionally, the container movement was recorded by the operators (CHE crane operator or a tally clerk) using VMTs, but this method was prone to human error, data omission, and safety issues.

Subsequently, many implementations of position detection systems (PDS) came to the fore using GNSS or RFID technologies to automatically record the container location. These implantations required either container tagging or capturing geolocation based on (a) the proximity between the real location and the planned location or (b) based on the twist lock event trigger by tapping into crane PLC.

The PLC-based approach is reliable but not every crane supports this and is highly dependent on the manufacturing year or the make, nature of the CHE ownership, etc. The biggest flaw in this approach is that while capturing the location of a container being handled, the identity of the container is not reliably established.

ADDRESSING CHALLENGES

ATLocation addresses these `challenges by:

- Developing a sensor fusion-based, deep learning-powered solution that is independent and compatible with all types and makes of CHEs and horizontal transport vehicles.
- Capturing container Identity using computer vision-based deep learning algorithms.
- Capturing the pick and place event of the container by sensing the twist lock events using a retrofit sensor, independent of crane PLC. This solution is compatible with every CHE make and type and makes use of ATAI's innovation, to capture the twist lock events in real time.
- Capturing the precise location of the container based on the twist lock triggers with centimetre-level precision

"ACCURATELY AND RELIABLY CAPTURING CONTAINER ID IS EQUALLY IMPORTANT TO KNOW CONTAINER LOCATION."

"ATLOCATION CAN TRACE A CONTAINER IN THE YARD EVEN WHEN THE CONTAINER NUMBERS MAY BE DAMAGED/ERASED."

using GNSS with RTK (real-time kinematic). The implementation accounts for the noisy signal environment of a typical container terminal.
- Capturing the context of the move by tracking the TOS job instructions, and comparing and validating them against the actual move.
- Enabling real-time decision-making and automatic synchronisation with the TOS to confirm or update the planned data, ensuring accurate data capture at all times.

CHE TRACK AND TRACE

As detailed previously, the CHE is equipped with location sensors, twist lock sensors and spreader-based cameras to capture container location, container ID and twist lock events as well as the context of the movement. The continuous capture of accurate location data allows the system to track and locate every CHE equipment in the yard. The location data and context information enable ATLocation to provide:

- Precise location of the CHE in the yard.
- The context of the operations being performed by the CHE.
- Navigation information to assist the operator in finding the optimal path to the destination.
- Interact with the TOS exchanging the above data to optimally allocate the CHE for the next operation.

REAL-TIME HORIZONTAL TRANSPORT TRACK AND TRACE

Tracking and tracing horizontal transport is essential for (a) understanding the vehicle's current location to allocate jobs optimally and (b) ensuring the correct coordination between the truck and the CHE for accurate container delivery or receipt as per the plan.

The ATLocation offers:

- GPS-based tracking of the horizontal transport within the yard.
- Navigational support to the transport operator for optimal route selection and navigation.
- A unique method for CHEs to identify horizontal transport.

ATLocation compensates for the GPS coordinate errors due to technology limitations by implementing an error compensation logic, thus providing accurate vehicle traceability within the yard.

YARD MANAGEMENT

ATLocation enables the advanced optimisation features of the TOS, such as Navis PrimeRoute or RBS SmartTrack, by providing real-time telematics for CHEs, trucks and containers with configurable data acquisition frequency without compromising other ATLocation functionality.

FUTURE-PROOFING

ATLocation captures all required and relevant data in real time without user intervention. This essentially allows the capture of real-time data digitally along with contextual data at configurable data acquisition frequency, enabling its further future use as and when new technology enables advanced services like Digital Twins, terminal simulators, predictive analytics, etc.

AUTOMATIC DATA EXCHANGE WITH OTHER AUTOMATION ISLANDS

ATLocation as an independent solution provides a complete track, trace and capture of the yard operations and enables real-time decision-making support. Additionally, it is also capable of interacting with other terminal

automation modules like gate, rail, quayside automation and providing a holistic view of the terminal operations and enabling decision-making at the overall terminal level. Additionally, the ability to track the container beyond the terminal yard, allows ATLocation to trace a container in the yard even when the container numbers may be damaged/erased.

CONCLUSION

With ATLocation a terminal yard can automate the tracking and capture of all the terminal resources and operations enabling real-time operational decision-making; 100 per cent accurate location tracking and tracing enables the terminal to easily integrate with advanced yard planning and optimisation tools including digital twins.

A crane-agnostic system has now enabled the larger terminal community to adopt automation in the terminal yard.

ABOUT THE AUTHOR:
Kishor Arumilli, Vice President of Engineering at ATAI, has over 28 years of experience spanning from platform design to full solution development. At ATAI, he oversees product development from concept to production. With global experience in the IT industry working in various industry domains, he is a key member of ATAI's senior management. His research focuses on Smart IoT, Edge computing, Applied AI, distributed data & Compute, and Enterprise Servers & Storage.

ABOUT THE COMPANY:
ATAI is an applied AI company driving digital transformation in the maritime, logistics, and supply chain industries. Focused on improvements in productivity, sustainability, and cost efficiency, ATAI offers end-to-end problem-solving solutions powered by AI algorithms and cutting-edge technologies.

Head to atai.ai to learn more.
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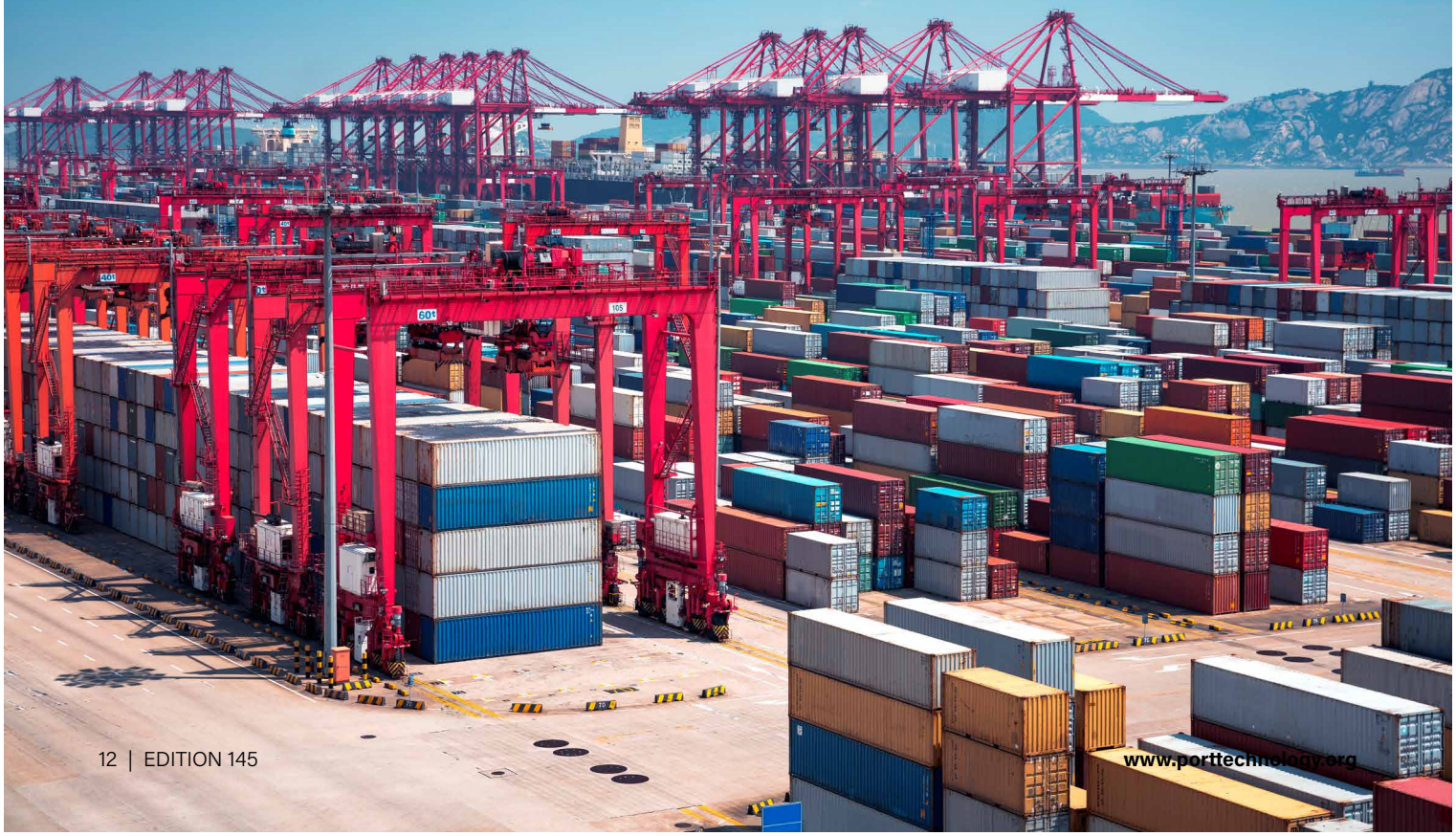


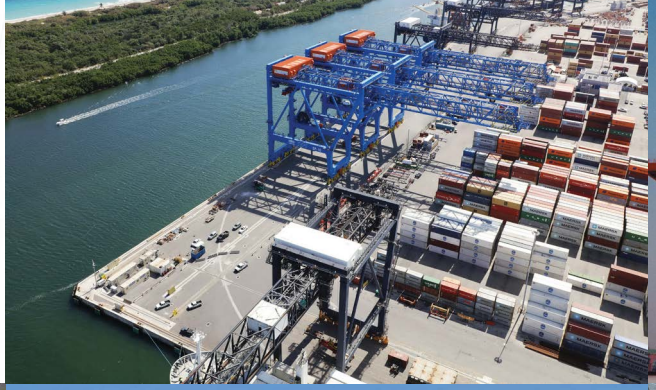



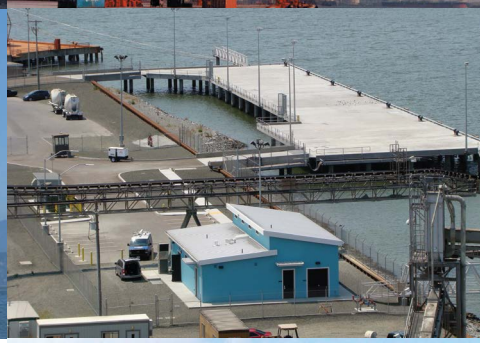


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