amii

ATTABOTICS

ROBOTIC WAREHOUSES:
ATTABOTICS & Amii BUILD THE FUTURE OF ONLINE ORDERING

amii.ca

Efficiency is everything in the warehouse business, driven by expectations of quick ordering and one-day shipping. To meet this ever-growing need, innovative warehouse company **Attabotics Inc**. uses a high-tech solution: robotic shuttles that zip around a specially-designed facility to pull packages for orders. Their recent partnership with Amii highlights how machine learning is being used in the real world to ease logistical problems and get packages into the hands of customers faster.

A new paper presented this week by Amii scientists at the **International Conference on Autonomous Agents and Multiagent Systems** (AAMAS) details how they could use machine learning to significantly increase the efficiency of Attabotic's robotic warehouses and the promise the technology holds to transform supply chain logistics.

> The question is not whether machine learning works. It's 'how much does it work?

Matthew E. Taylor
Amii Fellow-in-Residence and Canada CIFAR AI Chair

Transforming the traditional warehouse

Traditional warehouses are usually short and long; they're built to maximize floor space to hold more products. While warehouses might have shelving or stack products vertically, someone needs to use a ladder or forklift to pull them down.

Attabotic's facilities make better use of the vertical dimension. Items are placed in bins, which are held in a 3D cube system. When an order comes in, robots (affectionately called "ants") zip along the shelves and pick out a container with the item in it. They then carry the bin to a workstation, where a human picker takes the product and ships it off. The ant then returns the container to the shelf and heads off for the next order.

Sean Murphy, Attabotics' Director of Software and Innovation, says this gets products out the door and to the customer faster. This approach can lead to warehouses that take up 85% less space, meaning they can be located in higher-density areas, closer to customers.

"That's your customer sentiment in e-commerce: you want it quick. I do it; I'm sure that you order [that way] as well. Quick is good. If it's free, all the better," he says.

"So many of our customers are looking for the best automated retrieval and storage system, and we're it."

The company's clients include large retailers, as well as some government agencies in both Canada and the United States. While their engineers have spent years refining the behaviour of their robotic ants, Attabotics approached Amii to explore whether machine learning could increase their efficiency further.

Murphy says the original goal was ambitious: increasing the throughput — how many packages leave the warehouse in a given time —by 25%. But, in the end, they far exceeded even that.

Creating a digital twin

To speed up the process, Amii's machine learning scientists focused on a couple of specific areas. Among them was the question of which bins an ant should target.

If multiple bins held the same products, the ants would need to quickly figure out which would be the fastest option to retrieve. Compounding this problem is that other robots are doing the same task, taking bins and moving them around as they work on their own orders. Given that ever-changing environment, what might seem like the most efficient next action might have unforeseen consequences down the road, causing delays. Therefore, instead of just working with the immediate state of things, the ants would need to be able to predict the situation in the near future.

The machine learning scientists used a supervised learning approach to train the robots to predict and make smarter choices in which bins to grab. However, getting the amount of data they'd need to do the training was a hurdle. Gathering the information from the real-life robots would take too long. What they needed was a "digital twin."

The researchers built several simulations to help them gather more data to aid the training. While a real-life ant might take 45 seconds to finish its task, a simulation could make thousands of trips in the same amount of time. And all that data is invaluable when trying to train the robots to make smarter decisions.

"It really, really helps to have a very good simulator where you can do all the training, which could take days or months to do," says **Payam Mousavi**, Amii's lead machine learning scientist on the project.

Simulating data like that is always a trade-off, warns Mousavi. Researchers need to find a balance between a simulation's accuracy and its speed. Making a simulation too abstract risks creating data that doesn't really apply when you try to use it in the real world. At the same time, focusing too much on accuracy slows down the speed of the simulation, which can defeat the whole purpose.

Mousavi says the Amii team ended up building a variety of simulators with different levels of accuracy to gather the data that they required. The results were very promising, with the throughput of orders significantly increased, much higher than either Attabotics or Amii initially aimed for. (Murphy is hesitant to release specific numbers, as they might change if the machine learning approach is put into full production. Still, he says Attabotics is "very happy" with the results.)

Harnessing the power of machine learning

Amii Fellow-in-Residence and Canada CIFAR AI Chair **Matthew E. Taylor** consulted on the project. While things are still in the research phase, he believes the project highlights how machine-learning solutions can have a massive impact on real-world industries. He says that much of the work being done with autonomous agents remains in laboratories and simulations — so getting such encouraging results from physical robots in a real warehouse is exciting.

It also shows the power of artificial intelligence. Taylor notes that Attabotics is a company with very talented programmers and engineers who have been working for years on optimizing the ants' behaviour. The machine learning models were able to build off that invaluable work to make further improvements that would be out of reach without AI.

"The question is not whether machine learning works. It's 'how much does it work?' And I think we showed that the gains were quite impressive and that we could make significant progress in a short time. So it shows it is a viable thing to invest in," he says.

In addition to Taylor, Mousavi and Murphy, the paper's authors include Mara Cairo, Bevin Eldaphonse, Sahir, Sheikh Jubair, Johannes Günther, Laura Petrich Talat Syed with Amii, and the Attbotics team of Graham Doerksen, Nikolai Kummer, Jordan Maretzki and Gurpreet Mohaar.

HERE TO HELP

If you're looking for some help to confidently lead with AI, the team at Amii can help.

At Amii, we guide organizations like yours with three key offerings:

- **AI Training**
- **AI Strategy**
- **AI Development**

We've designed each of our product offerings to help you advance your AI adoption journey while building internal capabilities. This ensures you're prepared not just for today's challenges but also for long-term success in the AI-driven future.

Why Work with Amii?

Amii gives you the best of both worlds—the control of building AI in-house and the confidence of partnering with globally recognized AI experts. We offer:

> **Proven Expertise:** With over 20 years of leading AI research and real-world experience, we deliver practical AI solutions that address complex challenges and achieve meaningful outcomes.
>
> **Access to Advanced Technology:** We stay ahead of AI trends, building solutions that evolve with new technologies and set your business up for long-term success.
>
> **Global Reach:** Our flexible, remote-capable model allows us to provide expert guidance to clients worldwide, wherever you are.
>
> **Deep Expertise, Board Experience:** We have decades of experience applying AI to a wide variety of problems and industries in companies of all sizes.
>
> **Focused on Your Team's Growth:** Our collaborative approach helps your team build the knowledge, skills, and confidence to lead and innovate with AI now and into the future.

Ready to take the first step?

Meet us at Hannover Messe in Hall 2 or Hall 17 of the Canadian Pavilion

Contact us

Learn more: amii.ca

amii