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Intelligent robots offer service with a smile

Clever algorithms are allowing robots to navigate accurately and work safely in challenging environments, all the while displaying a smile across their screens.

Produced by



The latest staff at McDonald's outlets across Slovenia stand at just 1.3 metres. They have aviation-grade aluminium alloy bodies, a screen for a face, and pointy, cat-like ears. The brainchild of commercial-service-robot firm, Pudu Robotics, these 'BellaBots' started working the floor here in late 2021. They deliver not only food to customers, but also a smile or wink whenever they receive a pat on the head.

PUDU's robots have learned to navigate complex, unpredictable environments such as fast-food outlets, says Felix Zhang, founder of Pudu Robotics, which is based in Shenzhen, China.

Like humans, the BellaBot and others — such as the SwiftBot and PUDU A1 — can dodge obstacles and swiftly stop when a child crosses their path.



Service robots — such as the PUDU A1— developed by Pudu Robotics in Shenzhen, China, are becoming increasingly sophisticated thanks to AI algorithms. *Credit: Pudu Robotics*

These are not simple tasks for a machine. To navigate in a dynamic environment, a robot navigation algorithm usually requires three steps: positioning, perception and route planning. In these three steps, positioning is a key issue.

Expert navigators

Most mobile robots currently rely on ‘markers’ that need to be placed around their working space as reference points to position themselves, but modifying every working environment isn’t feasible.

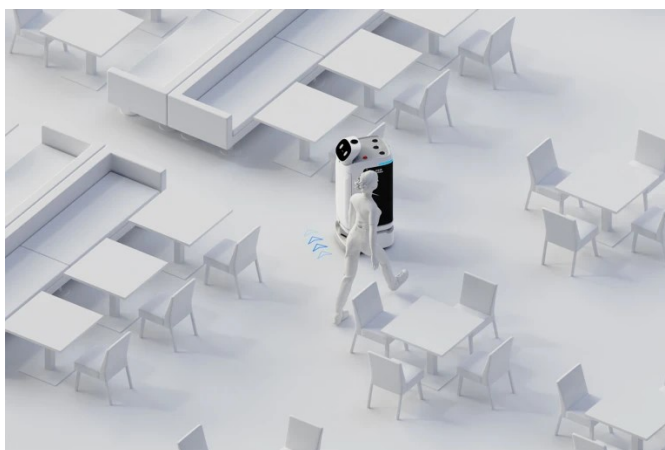
In order to scale the application of service robots in uncharted environments, PUDU’s team developed ‘VSLAM+’ technology consisting of AI algorithms that extract features from images, then match the images to build a map.



“The biggest strain on computational power and memory came from image



Service robot — the PuduBot 2. *Credit: Pudu Robotics*



Service robot — the SwiftBot. *Credit: Pudu Robotics*

processing,” says Zhang. To fix this, the neural network of AI algorithms had to be optimized. The team designed a network compression technique, which uses less computing power, and offers better performance.

This reduced the initial navigation time to understand an environment from two hours to far less than one. Powered by the PUDU VSLAM+ algorithm, PUDU’s latest robot, PuduBot 2, launched in July, can familiarize itself with a 1000 square metre workspace within an hour.

Shortly after PUDU started to test their robots in real-world environments, they observed a potential safety issue: many children like to play with the

cute robots and tend to block their way or gather around them.

“We thought that the robots should distance themselves, ahead of time, whenever they encounter certain groups of people, such as young children or the elderly,” Zhang says.

Deep learning

The team thus adopted deep-learning algorithms to accurately identify these groups, so that the robots would be extra careful, slowing down and maintaining distance.

The company’s SwiftBot specifically recognizes elderly people, enabling it to work

safely in nursing homes in addition to environments such as restaurants, hospitals and hotels.

One of their latest robots, the PUDU A1, has an arm with which it can deliver food, and collect used dishes, without the need for staff or customers to load and unload it.

To train it for these tasks, PUDUs team compiled images of 2000 food items, 500 utensils, and 100 common table settings, and then built a custom-image database for it to refer to. The PUDU A1 robot can now differentiate between food items and utensils, and identify with 92% accuracy which food items it should pick up. It can also tell where there is room on a table to set down plates.

With a strong suite of AI techniques to build on, Pudu Robotics continues to innovate and come up with new designs, Zhang says.

His team hopes that their robots will be versatile and pleasant workers, ready for the tasks that await them.

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