TU/e
iNNOVATION SPACE

Challenge name	Classification of robot pickable products in logistics
Challenge owner	Vanderlande Industries B.V.
	X Company Ƴ Research Ƴ Student team
	Stijn de Looijer
Brief summary	Every day, Bol.com alone delivers more than one million packages to people in The Netherlands. These packages all need to be picked from warehouses. Vanderlande's Smart Item Robot can typically pick around 60-90% of all the different types of packages, and for the other items a human worker is informed at the moment this picking is impossible. In order to make this process more efficient, a classification of pickable items is needed. In this challenge, students will explore ways of automatically classifying an item set (of typically > 50.000 items) of our customers.

About the challenge owner

Vanderlande is a market-leading, global partner for future-proof logistic process automation in the warehousing, airports and parcel sectors. Its extensive portfolio of integrated solutions – innovative systems, intelligent software and life-cycle services – results in the realization of fast, reliable and efficient automation technology. Established in 1949, Vanderlande has more than 9,000 employees. Vanderlande's 'Innovate' department identifies and explores new ideas in a global ecosystem and determines the value of individual technologies. By working closely with knowledge institutions and start-up companies, Vanderlande is able to create innovative and sustainable solutions that improve the competitive positions of its customers.
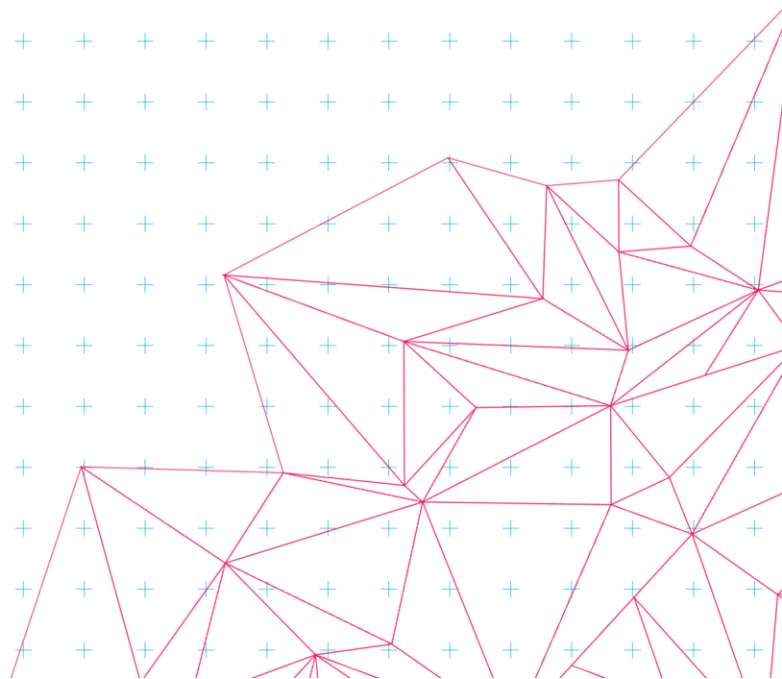
Challenge description

FASTPICK is Vanderlande's Market Leading Solutions for e-commerce customers that are looking for a high level of automation. FASTPICK uses the advanced ADAPTO shuttles for product storage and retrieval and both manual and robotic goods-to-person workstations for order fulfilment.

The robots use a vacuum gripper to pick items from a product tote into an order carton. While humans can pick all the items in the customer's portfolio with their advanced grippers (hands) and vision (eyes), robots still have their limitations. Depending on the customer, the robots can pick around 60-90% of the items. When the robot cannot pick an item, a human intervention is needed to complete the order.

Orders typically consist of 2-3 items in General Merchandise and Fashion and 30-40 items in Food. When orders are sent randomly to either a robot station or manual station, there will be a lot of human interventions and the productivity of the robot will be very low. For that reason, Vanderlande classifies items as "pickable" and "non-pickable". Based on those item classifications, we create robot pickable orders and schedule those on the robot stations. At the moment, this classification is a manual and labor-intensive process.

In this challenge we are looking for automated pick ability classification. Whether an item is pickable by the robot depends on many factors, such as item properties like weight, texture, and material, but also environmental circumstances like the orientation of the items in the order tote play a role. Lastly, the capabilities of the robot play a role. The quality of the gripper, vision system and motion planning all play a role in whether the robot is able to successfully execute a pick.

The goal of the project is to design and prototype an automated classification module that is applicable in Vanderlande's FASTPICK concept.

Challenge Picture
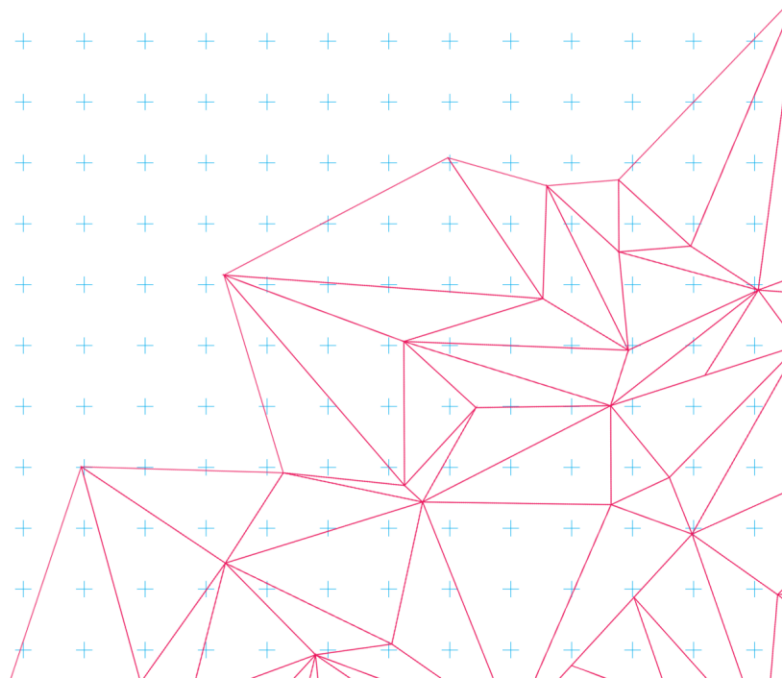
https://we.tl/t-fM3gtkKHa1

Input and involvement of challenge owner

Vanderlande will assign a project owner to the challenge that can provide the team with the required information and connects the team to internal experts. Support to the team can be given in the form of weekly update meeting, brainstorms, or feedback sessions. We will leave it up to the team to organize this according to their needs.

Resources

We offer the team a physical test setup (robot, cameras) and workplace at Vanderlande's Innovation Lab at the TU/e campus. A physical test set (~20 items) and large data set will be available for testing and validation. There will be a project owner assigned from Vanderlande to provide the team with the relevant context and expertise of the challenge.

Roles of different disciplines (only for ISBEP)

Computer Science and Engineering	Ideally, the classification system could be applied to any new set of items, and should be able to update itself when a customer changes characteristics of items. For this, an IT system is needed that keeps track of everything.
Data Science	A large dataset with item characteristics is available, but we don't know which of those characteristics are helpful or needed for automatic classification. This student could focus on extracting features from this data set that are necessary to reliably classify items as pickable.
Electrical Engineering	One potential direction of the project is to use camera's or other types of sensors to map the characteristics of various items. These characteristics should then reliably be stored in the automatic classification system.
Industrial Design	Design of a demonstrator that showcases the critical aspects of the solution on a stakeholder level.
Psychology and Technology	Design an interface where a human operator can work with the classified data in ways that allow them to suggest or overrule a classification.
Industrial Engineering	Determine the scalability of the solution for a system of 10.000 items, 100.000 items, or many more.
Mechanical Engineering	One potential direction of the project is to use camera's or other types of sensors to map the characteristics of various items. These characteristics should then reliably be stored in the automatic classification system.