Market Sector:
AGRIFOOD, LOGISTICS, WASTE MANAGEMENT

Technology Theme:
ROBOTICS & AUTOMATION

ROBOTIC BIN PICKING OF UNKNOWN OBJECTS

HANDLING OBJECTS WITHOUT THE NEED FOR CAD DATA OR DESIGNED GRASPS ENABLES FASTER DEPLOYMENT OF ROBOTIC SOLUTIONS

The MTC demonstrates a state of the art technique for bin picking using a trained model to find the best position to place a vacuum cup. The MTC has shown that the model can be trained on simulated data reducing the need for labour intensive manual data collection and labelling.

> MTC Robotics Engineers are proving that design and development can be dematerialised in the creation of cost-efficient intelligent solutions to automate operations where predetermined programming is less viable.
>
> **Dr Alejandra Matamoros, Technology Manager, MTC**

THE CHALLENGE

Bin picking is a common handling task seen across industry where single parts must be separated from an unstructured bulk input.

Traditional methods use CAD data and high cost sensors to accurately identify individual parts and test a range of pre-engineered grasps for feasibility.

These approaches are expensive to implement, require substantial engineering time to program, and cannot be applied to objects which are not easily represented by CAD models. Examples include objects that exhibit high variety such as food products and deformable objects.

MTC'S SOLUTION

- Reviewed and down-selected approaches from academic publications showing that neural network based inference systems can work well for picking items unknown to the system.
- A neural network based approach was implemented using PyTorch machine learning framework to generalise learned behaviour to new scenes.
- Algorithms trained with open source manually labelled dataset and simulated dataset.
- Performance testing completed using low cost depth camera and collaborative robot system which would be affordable for many SMEs.

THE OUTCOME

- Tested on range of objects including sheet metal components, fruit and cosmetics containers.
- The models trained with manually labelled data and trained with only simulated data performed well with 92% and 94% of attempted picks being successful, respectively.
- Performance of the model trained on purely simulated data showed that this approach is a good solution to reduce the burden of data gathering for specific use cases.
- Excellent performance on items not present in the training data showed that the method generalised well to any items with suitable features for vacuum picking without the need for use case specific training data.

BENEFITS TO THE CLIENT

- Fast deployment of vacuum based robotic bin picking, MTC is able to perform quick testing for suitability of method to customer use cases.
- Much lower investment and set up cost compared to traditional bin picking systems.
- Tested picking success rates suggest that this method is suitable for industrial applications.
- MTC's ability to create simulated training data allows for this technique to be adapted quickly to more difficult to pick parts.

> This project demonstrates MTC's determination to adopt academic developments with potential to transform robotics in manufacturing. The transferability of this technique to pick new objects will allow MTC to quickly test with customer parts and advise on implementation strategies.
>
> **Mark Robson, Senior Research Engineer, Robotics, MTC**

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