

Msc Project / Internship

# Deep Learning for Industrial Robotic Applications



## About Delft Robotics

Delft Robotics is a spin-off company of the Factory-in-a-Day Project, which is led by the TU Delft Robotics Institute. At Delft Robotics we automate labour-intensive tasks using industrial robot arms, camera's and intelligent software. In order to do this, we make extensive use of Machine Learning, including state-of-the-art techniques such as Deep Learning.

Delft Robotics enables production companies to robotize their manual tasks. Our systems are able to handle variation in product shape, size and location.

This year we joined the Amazon Picking Challenge. Together with the Delft Robotics Institute we formed 'Team Delft'. This competition is about robotising a difficult task in the warehouses of Amazon, which consists of the object recognition and placement. We won this competition, and this confirms our idea that we belong to the top companies in intelligent robotics.



**Pictures of the deep learning object classification (left) and robot system (right) with which we won the Amazon Picking Challenge 2016.**

## **Example Projects:**

### Stereo reconstruction using Deep Learning:

A 3D view of the environment can be obtained with a stereo camera setup. A well known method for reconstructing a 3D view is the block matching algorithm. Corresponding features in the left and right camera are matched. The 3D location can be estimated using the camera parameters and the pixel disparity. The block matching algorithm contains a large number of parameters that need to be tuned in order to get a high quality 3D reconstruction. This project aims to replace the block matching algorithm by a deep neural network for obtaining the 3D scene.

### Object pose recognition using Deep Learning:

Finding the position and orientation of an object is crucial for robotic handling. The 3D pose of an object can be estimated in numerous ways. One possibility is to obtain a 3D reconstruction first, and apply pose recognition algorithms on the measured 3D point cloud and 3D model. Currently used methods are for example: Particle filter, Iterative Closest Point and Super4PCS. These methods often fail in finding the ground truth pose. In this project you will use the 3D point cloud and the 3D model as input and develop a deep network that estimates the full pose of the object.

### Product quality check using Deep Learning:

In order to be competitive, production companies usually need to deliver constant quality. These companies usually perform a check for defects at some points in their production line. The difference between an acceptable product and an unacceptable product is sometimes hard to see, and therefore hard to automate. These difficult quality checks are often manually performed by humans. It is expected that much better performance can be achieved using deep learning. In this project you will develop an automatic system that is able to distinguish between accepted products and rejected products using deep learning.

## **Preferred skills:**

- Programming experience with Python and/or C++
- Knowledge of Machine Learning and Computer Vision

## **More info:**

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