

Object Detection for an Autonomous Robot Lawn Mower

Using Convolutional Neural Networks

Graduate Candidates



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Introduction: Ronovatec is developing an autonomous robotic lawn mower for extensive sports fields like golf courses or football fields. The lawn mower has a laser scanner to detect large objects, but small ones cannot be detected so far. To solve this problem, a camera-based object detection should be implemented. A convolutional neural network should be able to classify different objects or animals like footballs, golfballs, leaves, branches, hedgehogs or cans.

Approach: To identify the objects mentioned above the YOLOv5 algorithm is used. This is a state-of-the-art object detection algorithm, which is actively developed. For model training, a labelled dataset of representative images is needed. The images were taken with a camera mounted on a table trolley, since the lawn mower was not available. To collect images that are as realistic as possible, the camera was mounted on the same height as it would be on the lawn mower. Furthermore, the trolley was pushed over the lawn while the images were taken to create a natural motion blur. These images containing test objects were then manually and later automatically labelled to generate a dataset. This process was repeated under different environmental conditions to increase the variance of the data. The dataset was then shuffled, split into three different sets and then fed into the model for training and inference. In order to then speed up inference, the performance gain of different GPUs was investigated, since GPUs are commonly used for speed improvement in AI applications.

Result: It was possible to train different-sized models (differing in inference speed and accuracy) to recognize a set of objects containing footballs, golfballs

and cans with high accuracy. The speed could be increased by an approximate factor of four by just adding a low-priced GPU. Furthermore, the training process could be simplified for future training. Therefore, it is easily possible to add more images to the dataset and consequently increase accuracy by training the model with a larger dataset.

First version of the robot lawn mower (RoviMo)

<https://ronovatec.com/images/onsite/vaduz-11-20/v7.jpg>



Table trolley with camera (highlighted red)

Own presentment



Detected objects on a lawn (volleyballs and footballs belong to the class «football»)

Own presentment



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