Abstract

With the increasing significance of Industry 4.0, intelligent systems and services are gaining more and more importance in the life of an assembly factory. Whole product lines are being controlled and supervised by such systems in order to ensure the quality requirements of the product. However the size and the complexity of an assembly line differs from product to product and the individual steps can vary based on the manufacturer, the human factor is playing an important role in the process and hence human error shall be mitigated. Currently there are product lines in the factories of Robert Bosch, where the assembly itself is being performed by employees. The parts of the product will be gathered manually into an assembly tray from the so called product super markets. A completeness check will be initiated by the employee after the gathering process finished. If the result is positive, the assembly tray will be forwarded to the assembly station, where the trained employees are performing the final steps. In case of a false negative completeness check (part is not there, but is not recognized), the tray shall be sent back to the gathering station that produces unnecessary cost and delay. Therefore a system shall be developed that performs a camera sensor based completeness check.

My task is to create an experimental framework and evaluate the performance of different image processing algorithms. A proposal for possible solution with the highest accuracy and availability is to be given. The framework shall recognize the present parts and visually mark the location of the empty slots. For the recognition I will try two different algorithms and choose the better one. The first one is the examination of the disparity map created from stereo images. The other solution which I try is based on simple machine learning techniques. Those are morphology image processing and template matching. The whole process (capturing the images and running the algorithm) shall not take longer than three seconds, which means the decision of the better solution will based on runtime and accuracy.

First I have implemented the algorithms for segmentation and recognition, then I have created a graphical user interface for real time configuration and visualization. The stereo vision algorithm was slower and more resource intensive, than template matching and morphology image processing. With those I have reached fairly good results even on real time camera image.