Real-time Computer Vision in Industrial Automation

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Today, with the ongoing rise of Industry 4.0, the revolution based on smart technology, further productivity will be achieved with less human intervention. Engineers seek new ways of expanding and further develop towards this goal, as done during previous industrial revolutions. One of the areas that are being explored is computer vision; a field that may become increasingly important in the near future where better cameras, higher bandwidth and faster computation are present.

Computer vision is what allows a robot to see its environment, one could say it is the eyes of the machine. It allows the machine to understand where an object is, where it is moving and where it is going to be in the future. You might be surprised to hear that you have probably interacted with computer vision yourself, either by creating funny looking faces using filters on your phone, or by scanning a QR-code to log in to your online bank.

In our research, we found that a common use of computer vision in the field of industrial automaton is for so called, pick-and-place robots; robots that, e.g., picks up a finished product along a conveyor belt and places it in a cardboard box for packaging. This thesis therefore put most of its focus on exploring how computer vision can be used in new ways within this area, and found that measuring the velocity of an object accurately is a new, exciting use case for the technology.

To better understand what aspects affect the performance of such velocity measurement, a range of experiments were conducted. One of the interesting findings from these experiments, is how big of an impact the camera resolution has on the accuracy of a measurement. A direct relationship was found, showing that a camera with a 4x camera resolution results in a 3x increase in the measurement accuracy.

With the knowledge gained from the experiments, a pick-and-place prototype was designed and built. The prototype is composed of a conveyor belt with the object to be picked-up, which travels across a camera's field of view and further towards a delta robot, which can be viewed in Figure 1. This prototype utilizes computer vision to detect the object's position and velocity, which is then used for extrapolating the position further outside the camera's field of view. The prototype proved to be successful, resulting in a performance similar to a traditional implementation.

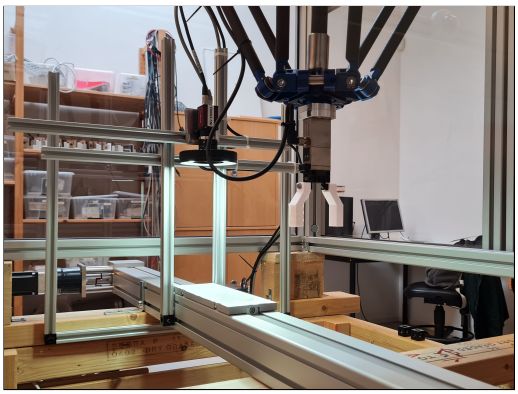

Fig. 1: Pick-and-place prototype.

The results from this project show great potential for the adaptation of real-time computer vision in the field of industrial automation. The future is bright, and it will be interesting to see how the industry adopts this technology in the years to come. This thesis provides a foundation for further studies in the field, which can further fuel the transition towards more vision-based solutions in the industry.

References

Berglund. J. Cedergren. J., 2021. *Real-Time Computer Vision in Industrial Automation*. Master's thesis report, TFRT 6130, Department of Automatic Control, Lund University, Lund, Sweden. URL: *https://lup.lub.lu.se/student-papers/*