Computer Vision (CV)

Content & Approach

The Computer vision (CV) workshop focuses on the application of *geometric element recognition* from images. A digital camera is mounted to visually sense the scene where the design components are placed. CV algorithms will be developed that are able to detect the geometrical entities, e.g., lines, polygons, and surfaces. The geometrical entities are used to estimate the shape, size, and orientation of the component to be “picked” by a robotic arm. Given a unique input (the particular component to be "placed"), the robotic arm is guided to the correct position and orientation to perform the "pick" action. *Deep learning* (DL) models will be developed that can map between an image and its geometrical representation, and use synthetic (self-generated) data to train the models. The *Python* programming language (Van Rossum & Drake Jr, 2009) is used. We operate on the *Google Colaboratory* computing platform, where the students are instructed to interact with the provided code, by running and analyzing the script on a web browser, preferably Google Chrome.

Prerequisites

No programming knowledge is required. During the practice, you will get familiar with the basics of Python tailored towards image reading and processing. It is therefore recommended to make yourself familiar with Google Colaboratory, and the basics of Python programming beforehand. Simple introductions for both will be placed on Github (similar to the repository we developed last year). For the Python introduction, you can start with Jupyter and Colab Notebooks and Basic data types in Python.

Objectives

Students learn:
In the 1st session a) To describe how a digital image is represented, read and manipulated by the computer. b) How to import an image to a Jupyter notebook running on Google Colab. c) Execute the code on Jupyter notebook.
In the 2nd session a) To analyze the code based on the input/output relations b) Set up the visual measurement experiment with the design components.

Deliverable

A Google Colab Jupyter notebook that is shared by the course instructor (casperengelenburg@gmail.com) after the 2nd session, containing both code and text cells demonstrating the visual measurement experiment performed by each group of 5 students.

References

Gonzalez, R. C., & Woods, R. (2007). *Digital Image Processing* (3rd ed.). New Jersey: Prentice Hall.

Van Rossum, G., & Drake Jr, F. L. (2009). *Dive Into Python 3* (Vol. 2). Springer.