ADOPTICUM

Intel Realsense D455

This document gives a brief overview of the Intel Realsense D455. It is based on evaluation of the sensor performed by Stiftelsen Adopticum in a project financed by Kempestiftelserna. For more information about the sensor, please feel free to contact Adopticum.

Quick facts

- Laser triangulation
- Global shutter with wide FOV
- Global shutter RGB with depth and HW sync trigger

The D455 depth sensor can be easily up and running for a quick evaluation with the Intel Realsense viewer available. To use the measurement data from the sensor in real-time for other applications, some programming experience (C++, Python) will be needed. In which case the camera data is easily converted to data types that work with well-distributed image processing library OpenCv, as well as 3D data processing SDK:s like open3D, in python. There are tutorials available for getting things up and running quickly.

The camera can be used to get 3D measurements without any calibration. However, with time a recalibration can be needed if changes have occurred internally for the sensor, due to for example exposure to shocks or very low or high temperatures. The Intel Realsense SDK does offer code for performing a recalibration with the proper target (see Intel Realsense GitHub page), and the Intel Realsense viewer has tools for performing an On-Chip calibration (improving depth image quality).

The high framerate allows for measurement of fast-moving objects, with a decreased resolution affecting the precision of the measurements of the dimensions of the objects. Stationary objects can, with a lower frame rate, be measured in a bit more detail. The camera's weight is around 0.4 kg, which makes it easy to put on a moving vehicle for measurements while moving, where the gyroscopic and accelerometer data can be of use for positioning.

Knowing the limited accuracy of the sensor it can be useful for many applications where dm-accuracy is needed. For close range measurements the camera can perform better than that though, even within a few cm.

The cost for a D455 camera is around 5000 – 6000 sek.

ADOPTICUM

The D455 depth camera can be a useful and affordable choice for measurements indoors as well as outdoors, stationary as well as moving applications, if the application doesn't require sub cm precision or resolution.

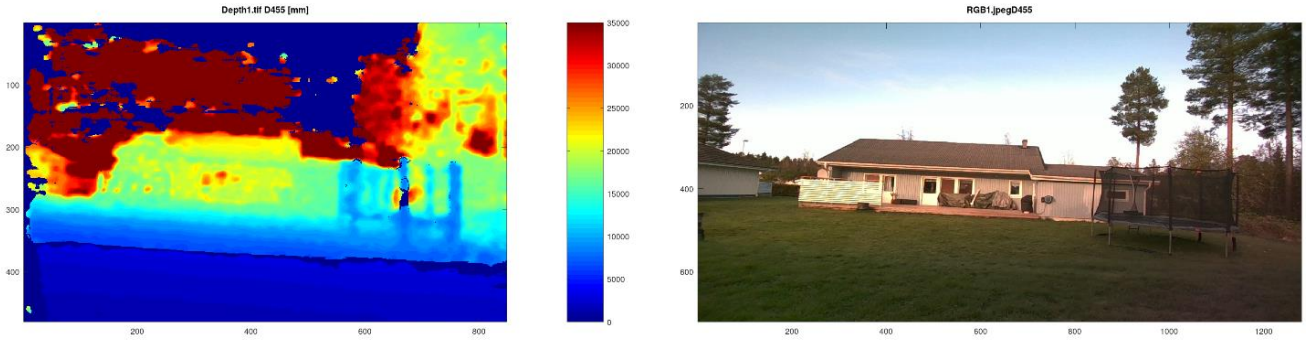

Figure 1: Depth image (to the left) and corresponding color image (to the right) from the D455 3D camera. The house in the image is about 20 m from the camera, showing hoiw the camera acquires depth measurements from far away scenes. Important to remember is that the accuracy of the camera does decrease with increasing distance from the camera.

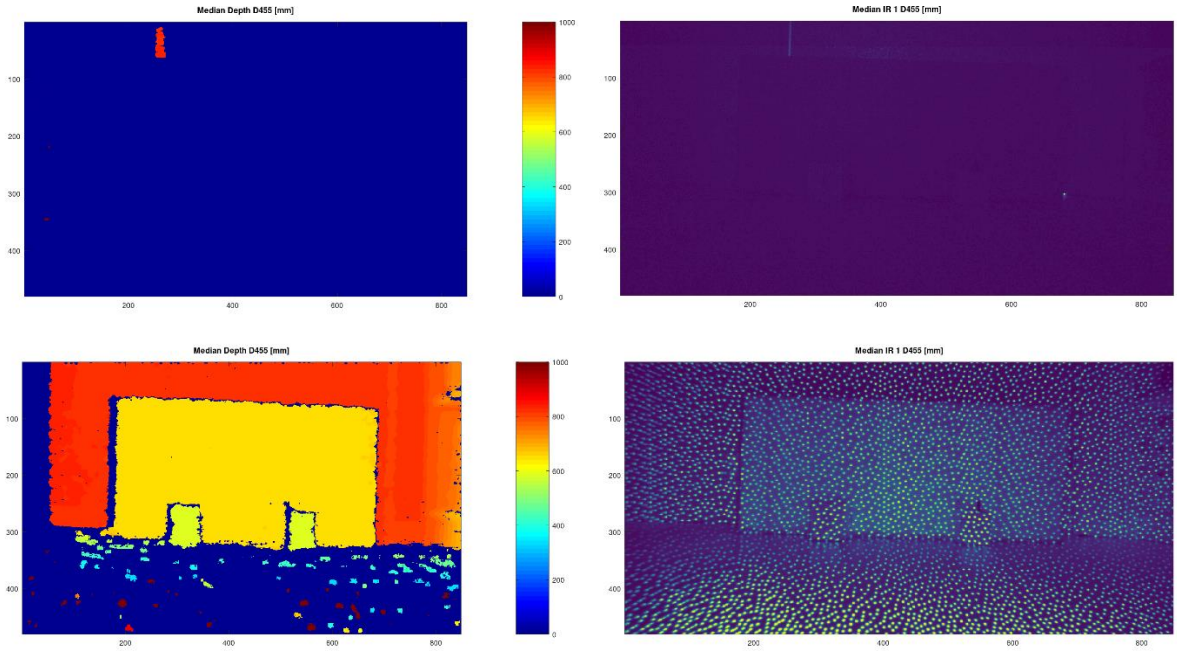

Figure 2: Top: Color image from the D455 camera. Others: Depth images (to the left) and corresponding monochrome left IR images (to the right) from the D455 3D camera. These images were calculated as the median from 5 consecutive depth/IR frames. The room was closed with windows covered and no lights were on. In the upper images no emitter was used, while the lower two images show the result when the camera's IR emitter was used. The bottom IR image shows the IR pattern from the emitter as several bright dots can be seen in the image. These help the stereo camera to perform well in the stereo pair matching, and thus the resulting depth measurements. In this case the scene can be measured when the emitter is used. When it is not, the room is simply too dark for the camera to see all the details in the scene to perform well, resulting in a mostly blank depth image.

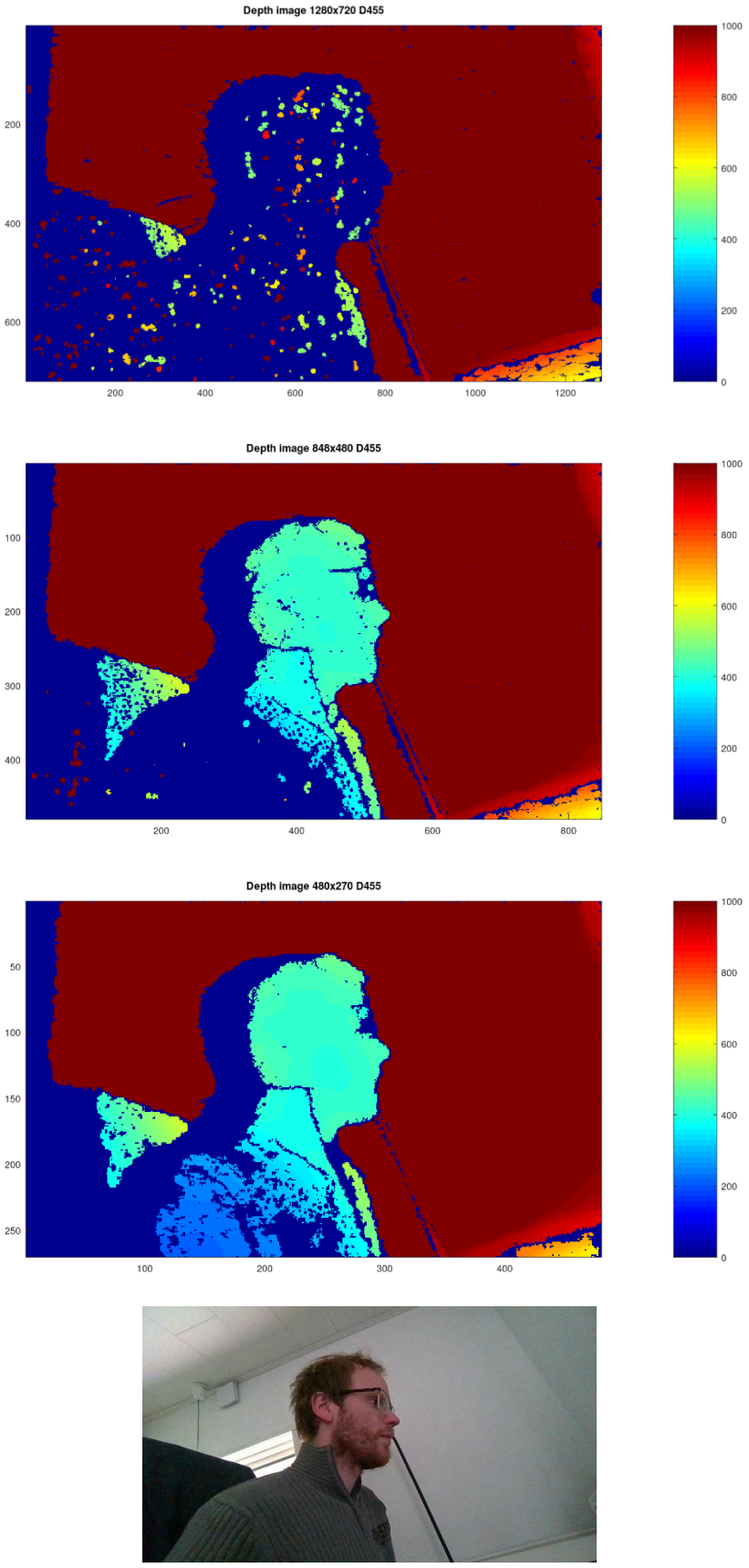

Figure 3: Depth images (measurements in mm) and a color image from the D455 3D camera. Illustrating how depth values are acquired for points closer to the camera when decreasing the X-resolution of the camera image. The highest resolution (top image) doesn't yield accurate values for a person at about 500 mm from the camera, but with decreasing resolution the images show more and more points at closer distances, down to about 200 mm from the camera for the lowest resolution.