UNIKASSEL VERSITÄT

mrt
Mess- und Regelungstechnik
Univ.-Prof. Dr.-Ing. Andreas Kroll

Internship

Advanced Methods for Compensating the Size of Source Effect in Thermal Imaging Cameras

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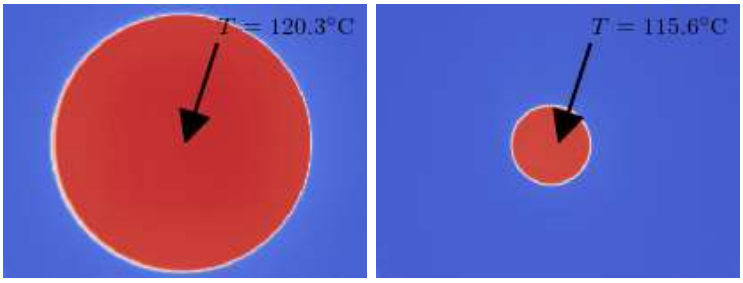

(a) $d_{\mathrm{cal}} \approx 268\,\mathrm{px}$ **(b)** $d_{\mathrm{cal}} \approx 81\,\mathrm{px}$

Figure 1: Influence of the Size of Source Effect on thermal images using different infrared calibrator diameters d_{cal} with a temperature of $T_{\mathrm{cal}} = 120\,^{\circ}\mathrm{C}$.

If absolute temperatures are to be measured with thermal imaging cameras, some boundary conditions must be considered. In addition to known effects such as the non-uniformity of the detector or the emissivity of the measurement object, the relative size of an object in relation to the field of view of the camera also has an impact on the measured temperatures. This **S**ize of **S**ource **E**ffect (SSE) named phenomenon has several physical causes such as chromatic aberration of the lens, reflections in the camera housing or crosstalk between individual detector elements, which are of varying importance depending on the type of camera. Besides the noise components of a camera (temporal and spatial), the SSE represents the largest part of the uncertainty budget of an infrared camera. At the Department of Measurement and Control, a digital filter is developed that compensates this effect in the best possible way. The existing approach already shows good results, but should be improved algorithmically and supplemented by potential advanced methods within the scope of this internship.

The following subtasks have to be carried out:

- Familiarize with temperature measurement with thermal imaging cameras and the size of source effect
- Performance tuning of the current filter implementation
- Selection and Implementation of suitable methods to extend the filter (e.g. segmentation of image components, extension of the current filter model, consideration of spatial frequencies)
- Construction of own calibration apertures, design of experience and recording of suitable test and training data with several termal imaging cameras from the department
- Comparison of filter properties and final evaluation with regard to effect compensation and performance
- Documentation of the program code as well as an internal report and presentation of the results

Experience in Python or C++ is of advantage, but compentence can be built up as part of the internship.

Supervisors:	S. Schramm (M. Sc.), Dr.-Ing. R. Schmoll, Prof. Dr.-Ing. A. Kroll
Begin:	June 2019
End:	November 2019