

Chapter 2

Image Acquisition

Image acquisition is a typical process preceding image analysis and processing. The various stages of image acquisition should take into account: room size [51], infrared camera type [52, 53] (in particular its spatial resolution [54], temperature resolution and range of wavelengths), patient positioning and adequate preparation of the patient before examination (bearing in mind the restrictions described in the previous chapter) [55–59]. The distance of the infrared camera from the patient, artificial and natural sources of heat, and interference (noise) that can get into the measurement path play an important role during image acquisition.

Typical patient positioning relative to the infrared camera is shown in Fig. 2.1 [60, 61, 62].

The patient (Fig. 2.1) is typically standing 1.5–2 m away from the camera (depending on the focal length of the objective lens) [63, 64, 65]. The infrared camera is connected directly (via USB) to the computer equipped with data analysis software. The data obtained from the infrared camera can also be transferred using a data carrier, e.g. SD card/RAM. In this case, these are usually *.jpg, *.bmp files and the format tailored to Matlab, i.e. *.mat, Further denoted as $L_{GRAY}(m,n)$. The application discussed in the monograph is tailored to the latter type of files (*.mat). The computer used for data analysis was a PC with Microsoft Windows 7 Operating System Version 6.1 (Build 7601: Service Pack 1) and Intel® Core i7 3.6 GHz, 64 GB RAM. The Matlab version 7.11.0.584 (R2010b) and Image Processing Toolbox Version 7.1 (R2010b) were applied. The images were obtained retrospectively. They were acquired with various types of infrared cameras, starting with Agema 470 allowing for the acquisition of images with a spatial resolution of 140×140 pixels, through Agema 590 allowing for the acquisition of images with a spatial resolution of 320×240 pixels and ending with the FLIR A6750sc allowing for image acquisition with a resolution of 640×512 pixels. The temperature resolution mostly ranged from 0.1 to 0.05 [°C]. The length of the registered infrared radiation was in the range from 2 to 5 μm and further to 15 μm . This covers the range of peak, maximum emission for the human skin, which ranges from 9 to 12 μm -according to the analyses made by the American physiologist

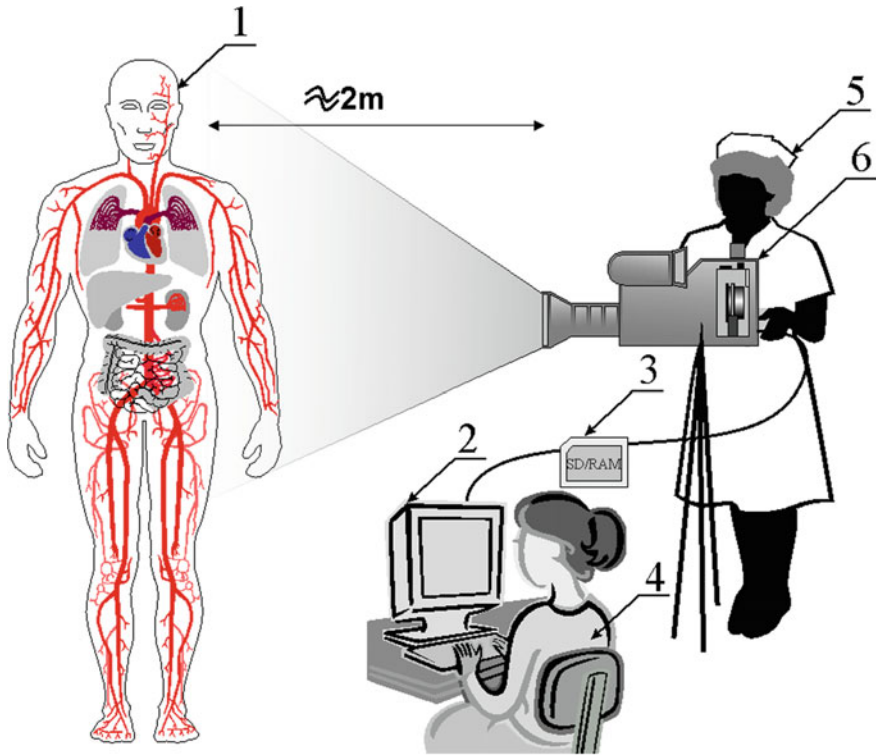


Fig. 2.1 Typical course of infrared image acquisition: 1 Patient; 2 Computer; 3 Memory card; 4 Computer operator; 5 Camera operator; 6 Infrared camera

J. D. Hardy (1934). Patients were aged 12–85 years. The patients suffered from different ailments, both dermatological and orthopaedic [66]. All patients gave voluntary consent to research. All measurements, which provided the images for analysis, were carried out in accordance with the Declaration of Helsinki. It should be emphasized here that no tests or measurements were performed on humans for the purposes of this monograph. The monograph is only tailored to the description of the methods and tools designed for analysis of the acquired thermal images. The next two chapters present image pre-processing and processing methods proposed by the author together with application and source code examples.

Processing Medical Thermal Images

Using Matlab®

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