Matching of intracardial and extracorporal electrode positions with segmented volume datasets of the human thorax

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Information about the electrophysical behaviour of the human heart can be gained by measurement of electrical potentials with intracardial and extracorporal electrodes. The intracardial potentials are measured by catheter electrodes within the heart and the extracorporal potentials by multichannel electrocardiographic instrumentation. For many applications the measured potentials are of interest in combination with the position of the electrodes and the conductivity distribution in the body. These applications include eg reconstruction of bioelectrial sources in the heart and visualization of body surface potential maps. Knowledge about the conductivity distribution in a human body can be derived from medical tomographic modalities [1].

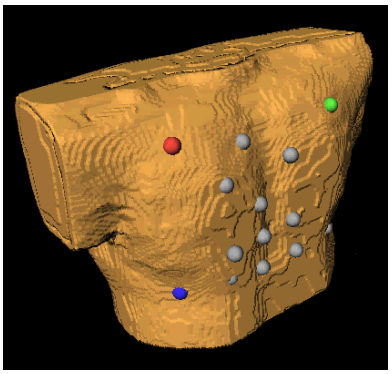

Figure 1: Matching of extracorporal electrodes with a human thorax dataset.

This work deals with the localization of an electrode array in a segmented volume dataset of the human thorax. The electrodes are localized by analysis of stereo images created with two different modalitities. Images from an optical system are used to localize extracorporal electrodes. The optical system consists of four CCD color cameras, which are positioned around a patient. Images from a biplanar X-ray system are utilized to detect the intracardial electrodes as well as a subset of the extracorporal electrodes. The electrode positions from the optical system and the X-ray image intensifier are matched into one coodinate system [2]. The volume dataset of the human thorax is constructed from MRI data using methods of digital image processing. The body surface is extracted and matched with the extracorporal electrode positions.

The matching is achieved by an initial transformation of the electrode array to the front of the thorax. This initial step is followed by a sequence of translations and rotations of the electrode array, which is controlled by the minimization of a quality function. The quality function is the sum of the euclidian norms of the distances between each electrode and the thorax surface. The minimization is realized with the direction set methode [3]. The matching result is shown in figure 1.

REFERENCES

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