Digital Hand
–Identification of Position and Orientation of Hand Bones from MR Images–
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Recently, a computer manikin, which is a tool to assist designing human-friendly products, has been attracting increasing attention. It is a CAD system with human models and can evaluate products by virtual users. However, current computer manikins do not have adequately precise hand model, instead of the fact that most of the products are operated directly by human hand.

Therefore, we are collaborating with Digital Human Research Center of AIST on developing the technologies for a hand-specific computer manikin, Digital Hand (Fig. 1). In order to capture and model human hand motion accurately, the more detailed and accurate link structure (i.e. the centers and rotation axes of joints) needs to be modeled. The hand link structure is derived from relative movement of bones, measured in 3D medical images (MRI), between different poses of a hand. So we are developing a method to derive the precise position and orientation of each bone from MR images of multiple poses of the same subject.

We use MRI instead of CT, because it is preferable to avoid unnecessary risk of radiation exposure. However, in MR images, the contour of the bone region is obscure. So manual segmentation, which is a time consuming task, is unavoidable, because automatic segmentation using simple method such as thresholding cannot be used. Therefore we have proposed the model-matching method as follows, and succeeded in getting the valid position and orientation of a bone in a short time compared with processing all the data manually. (1)Bone surface polygon is generated as a bone model by manually extracting the bone region from one of the MR scanning data. (2)Initial configuration of the bone model is settled manually in MR volume data of different poses (Fig. 2). (3)The bone model is aligned in MR volume data to maximize the performance index that sums the brightness inside the bone model.

Keywords: Human, Modeling, Computer Manikin, Hand Bones, Registration, Medical Imaging

References
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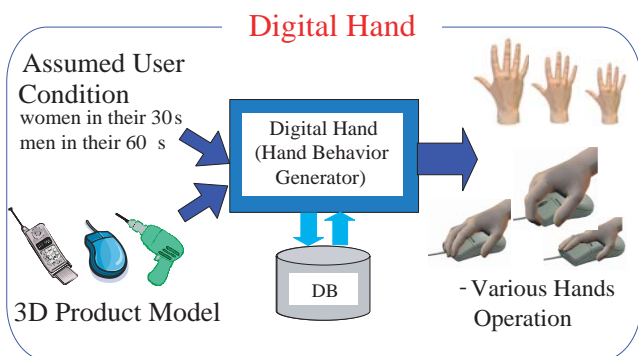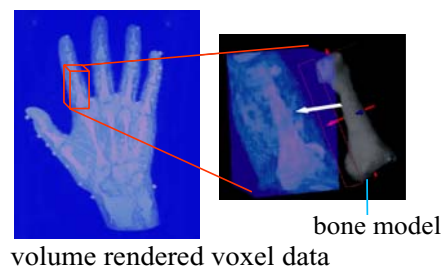
Fig.1　Outline of Digital Hand

Fig. 2　Initial Configuration Settlement