Berliner Colloquium für wissenschaftliche Visualisierung

Marc Alexa (TUB), Jürgen Döllner (HPI), Peter Eisert (HUB), Hans-Christian Hege (ZIB), Konrad Polthier (FUB), John Sullivan (TUB)

3D Personalized Reconstruction of External Shape and Internal Intensity Distribution from X-ray Images: Statistical Model-based Solutions

Guoyan Zheng, PhD, PD

Institute for Surgical Technology and Biomechanics, University of Bern

Montag, 6. August 2012; 17:15 Uhr
Zuse-Institut Berlin (ZIB), Takustraße 7, 14195 Berlin
Hörsaal (Rundbau, Erdgeschoss)

The applications of two-dimensional (2D) X-ray imaging in orthopaedics are pervasive, both pre-operatively and intra-operatively. However, due to the projective character of 2D X-ray imaging, the accuracy of an X-ray image based application is restricted. One way to address this limitation is to learn a statistical model and to adapt the learned model to the patient's individual anatomy based on a limited number of calibrated X-ray images. The reconstructed model can then provide detailed 3D information for the considered anatomical structure. In this talk, I will present various solutions that have been developed in my team for reconstructing 3D personalized external shape and internal intensity distribution. I will start with a solution that can reconstruct the external shape of an anatomical structure with none or mild degree of pathology even when a statistical model learned from a normal population is used. In order to apply 2D/3D reconstruction to an intra-operative application, we developed a fully automatic solution, combining particle filtering based morphological parameter detection, loopy belief propagation based contour extraction, and statistical shape model based 2D/3D registration. Our more recent work focuses on reconstructing not only the external shape but also the internal intensity distribution. Applications of our solutions are pre-operative planning, intra-operative surgical intervention, and post-operative treatment evaluation.