3D Reconstruction of the Femoral Bone using two X-ray Images from Orthogonal Views

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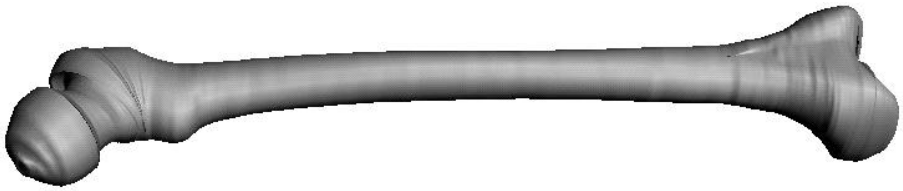
3D visualization of the femur including the femoral collumn and condyles is important for the clinician in a number of clinical problems (fracture of the femoral neck, planning of hip replacement etc.).

Traditionally, conventional 2D X-rays from several different projections or CT scans with subsequent 3D reconstruction has been used for visualization of the femur. CT scanning provides the best 3D visualization results, but is not always available, is expensive, and the radiation dose exceeds the dose used for conventional X-rays. On the other hand, 2D X-rays only provide 3D information in the sense that the radiologist puts them together mentally to a 3D model.

This poster presents a method that provides a real 3D model of the femur, but only requires two 2D X-ray images from orthogonal directions as input. The method uses information from the X-ray images to reconstruct a 3D model of the femur (see below).



To evaluate the results we also acquired a high resolution CT scan of the dry femur (voxel size 0.28 x 0.28 x 1.0 mm). Using an algorithm similar to the Marching Cubes algorithm we generated a 3D iso-surface model from the CT scan and registered the reconstructed femur to it.

The results showed a maximum distance between the two models of 4.13 mm on the shaft of the femur and 97 % of the model femur shaft less than 2 mm from the CT scan. Also the femoral head and condyles were well reconstructed; the poster will present a detailed analysis.

We believe our results show that it is possible to create a good reconstruction of the femur, even at the head and condyles, with only two X-ray images and a radiation dose that is much smaller than that used for CT scans.