



# Dynamics of the wrist joint

## Detection of dynamic distance maps in the wrist joint from 4D CT-images

### Background

The human wrist joint consists of eight carpal bones and numerous ligaments permitting a large variety of motions. In a pathological situation the biomechanical interaction between bones might be disturbed. A clinically important parameter for diagnosis of wrist pathology is the distance between bone surfaces and its change during motion of the hand. Hand pose dependent distance measurements are expected to be useful to detect local cartilage damage.

In current radiological practice of diagnosing patients with wrist problems often plain (2D) radiographs are acquired. For skeletal pathology static imaging modalities are in most cases sufficient to diagnose fractures and dislocations of bony structures. For dynamic abnormalities these static images are insufficient. Video fluoroscopy is able to visualize dynamic abnormalities. However, the limitations of this method are that the video frames are only 2D projections of a 3D phenomenon and do not quantify or visualize motion patterns in 3D.

To allow for imaging of real time 3D motion of the carpal bones in the wrist, we recently developed a 4D-CT protocol. The challenge of this bachelor project is to extract dynamic distance maps from the 4D-CT images for local cartilage damage detection.

### Internship

You will be involved in 4D-CT imaging of the wrist joint and extraction of dynamic distance maps from 4D-CT images. During the internship you will develop and implement a method to measure local distances between adjacent bones in each 3D time frame of a 4D-CT image. These distance measurement need to be combined in a dynamic distance map. The relationship between the extracted distance maps and the physics of the CT-imaging will be investigated by 4D experiments at different settings of the acquisition- and reconstruction parameters of the scanner. For this internship some experience with C or C++ programming is a prerequisite.

### Contact

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The internship will be at the department of Biomedical Engineering and Physics at the AMC.