

Fully automatic system to accurately segment the proximal femur in anteroposterior pelvic radiographs

C. Lindner, S. Thiagarajah, J.M. Wilkinson, The arcOGEN Consortium, G.A. Wallis, T.F. Cootes

Background

Extraction of bone contours from radiographs plays an important role in disease diagnosis, prognosis, pre-operative planning, and analysis of treatment outcomes for conditions such as osteoarthritis or osteoporosis.

Objective

To develop a fully automatic system to accurately segment the proximal femur in anteroposterior pelvic radiographs, and to evaluate its application in the analysis of proximal femur shape variation between males and females.

Methods

The system utilises statistical shape models to fully automatically place 65 points along the contour of the proximal femur in anteroposterior pelvic radiographs. We evaluated and tested our segmentation system on 839 pelvic radiographs from the XXX data set, including a wide range of image quality and femur position. We used the automatically placed points to derive a statistical shape model for the analysis of *global* femur shape variation between male and female subject groups.

Results

The fully automatic system was found to achieve a mean point-to-curve error of less than 0.9mm for 99% of all 839 radiographs. Using the fully automatically derived statistical shape model, we found a significant difference between male and female radiographic proximal femur shape.

Conclusions

The fully automatic proximal femur segmentation system provides a rapid and accurate method to capture femur shape and for analyses of global shape variation between different radiographs and across data sets. This appears to be the most accurate fully automatic proximal femur segmentation system yet reported. All methods used are sufficiently general to be applied to other skeletal structures, for example the hand, knee or pelvis.

Keywords

Radiograph, proximal femur, bone segmentation, shape analysis, osteoarthritis, osteoporosis

Category: Image quantification and measurements of function