NEW EDGE DETECTION METHOD FOR AUTOMATED FEATURE EXTRACTION FROM KNEE X-RAY IMAGES

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Automating the severity grading of knee osteoarthritis (OA) is a challenging task especially in the early stage cases. Evaluation of the joint space is subjective in some cases and the commonly used K-L-grading may not take into account all the relevant and visible radiologic features related to osteoarthritis. For instance, the shape of eminentia is not included in the K-L criteria. Our hypothesis is that the changes in the shape of eminentia can be related to the development of knee OA. Therefore, as a visually detectable feature in X-ray images it can be taken into account in the radiological assessment of the severity of knee OA. The changes in the eminentia are not considered, for example, in the commonly used Osteoarthritis Initiative (OAI) repository that provides access to the large data set from the eleven year longitudinal cohort study.

Thus, in order to explicitly include the eminentia shape information in the automated assessment of knee OA, a tool to extract the shape information from X-ray images is needed. We developed a rule-based algorithm that first extracts the knee joint area by using image gradients and the known bone structure properties. Then the observed edges are iteratively approximated from the edges detected by Canny-algorithm. Finally a smooth continuous spline function is fitted to the detected edges to assist the evaluation of the edge shape. The developed method can be useful for radiologists, because it reduces the amount of work to manually determine the shape of the eminentia. Moreover, the method can be useful for developing machine learning based classification models as it can be used to produce a new input feature for automated grading or ground truth values for neural network based edge detection models.