Purpose:

The aiming is getting accurate liver contour structures automatically for following adaptive radiation therapy in daily CBCT images which is very low-contrast comparing the planning CT.

Methods:

Probabilistic atlas is constructed by 50 intravenous contrast planning CT images by iterative affine registration process. The incoming CBCT images are registered with the atlas using deformable registration algorithm which is based on edge preserving scale space, and the liver contour structures are generated automatically by using the deformation map. Incorporating the intensity distribution of candidate liver region into the segmentation processing, we can further remove the irrelative tissue from the original liver region. Our algorithm is capable of segmenting the liver from low-contrast cone beam CT images.

In our probabilistic atlas construction process, firstly one training data is arbitrarily chosen as reference image while the rest of training datasets are registered to this reference using the affine transformation. For improving the efficiency of our method, iterative construction method is employed. The resulting atlas which is gained before is used as the reference image for the following atlas construction. This process can be iterated by many loops. However, we used two iterations for efficiency. This iterative atlas construction process can avoid bias toward the specific patient.

Results:

The experiments are tested on 10 newly incoming patient data. The volumetric overlap is on an average 87%-94% comparing with manually segmented tumors by oncologists. After evaluation by clinical oncologists, they concluded that the segmentation results are close to the manual results and the liver contours on CBCT which is produced by the deformation field automatically can be used for following adaptive radiation therapy.

Conclusions:

We can conclude that the proposed segmentation method is very effective with low contrast CBCT for adaptive radiation therapy in daily using.