Purpose: In order to achieve tumor positioning for radiotherapy planning automatically and accurately, an efficient tumor positioning method is proposed by jointly registration and segmentation for 18F-FDG PET-CT scans.

Methods: At the first stage, the tumor is segmented from PET scans by region growing using the manual seeds which employs the SUV monotonous features, and then the tumor contours are transferred to corresponding CT images automatically for following radiation therapy planning by a new deformable registration method which is implemented by combining edge preserving scale space with the free form deformation. The edge preserving scale space which is able to select edges and contours of an image according to their geometric size is derived from the total variation model with the L1 norm (TV-L1). At each scale, the selected edges and contours are sufficiently strong to drive the deformation using the FFD grid, then the deformation fields are gained by a coarse to fine manner.

Datasets were collected from 5 patients treated under the PET-CT scanner (GE medical systems, Discovery LS). Before treatment planning, the GTV (gross tumor volume) is delineated on every section of the PET scans by the radiation oncologist and the result will be compared with proposed automatic segmentation method. Of the 5 patients investigated here, all are non-small cell lung carcinoma (NSCLC) patients.

Results: After evaluation of the experiment results by three clinical oncologists, they concluded that the segmentation results are very close to the manual results and the GTV contours on CT scan which is produced by the deformation field automatically can be used for radiation therapy planning. The volumetric overlap is on an average 90%-97% comparing with manually segmented tumors by oncologists.

Conclusions: We can conclude that an efficient tumor positioning method is proposed by jointly registration and segmentation for FDG PET-CT datasets.