AbstractID: 14168 Title: Simultaneous Estimation of Lung Tumor Image and Intrafractional Motion without Implanted Markers using kV-X-ray Fluoroscopy for Image-guided Radiotherapy

Purpose: The aim of this research is to develop a novel image processing method for accurate estimation of intrafractional lung tumor respiratory motion using kV-X-ray fluoroscopy without implanted fiducial makers that have been used and needed for image guided radiotherapy, but their implantation run the risk of pulmonary emphysema and pneumothorax. **Method and Materials:** We propose a technique for extracting the lung tumor image from the kV-X-ray fluoroscopic observation. An essential core of the method is in a simultaneous estimation of tumor image and motion by using sequences of fluoroscopic images that can provide pieces of information needed for the estimation. The tumor images extracted can then easily be used for motion estimation of the tumor by using conventional motion estimation techniques such as block matching (BM) and template matching (TM). **Results:** We have evaluated the new extraction method with TM using three patient kV-X-ray fluoroscopy data. An example of the tumor image extraction is shown in the supporting document. The average error and the standard deviation of the motion estimation were, respectively, 0.72 [mm] and 0.37 [mm] by the proposed method. This is clearly smaller than the average of 1.02 [mm] with the standard deviation 0.23[mm] by the conventional TM. Note that the comparison between the proposed method with TM and the conventional TM demonstrates the effectiveness of the new extraction technique. In addition, this result implies that the method can achieve within 1 [mm] of motion estimation accuracy without implanted markers and it's clinically acceptable. **Conclusion:** We have developed intrafractional motion estimation method of lung tumor without implanted markers. Any motion estimation technique can be incorporated into the proposed extraction method for accuracy improvement. The proposed method can achieve clinically sufficient accuracy estimation without implanted makers and thus can fundamentally reduce any patient's risk caused by the implantation.