AbstractID: 14176 Title: Adaptive Seasonal Autoregressive Model Based Intrafractional Lung Tumor Motion Prediction for Continuously Irradiation

Purpose: To irradiate continuously to a moving tumor, core techniques are to observe position and shape of the target tumor and to adapt the radiation beam to the intra-fractional motion and deformation. In addition, we need a compensation technique because measurement of the tumor position and control of the radiation device have some time delays. In this study, we propose a new prediction method of lung tumor motion, to compensate the time delays. **Method and Materials:** An essential core of the proposed method is adaptation to time-variant nature of lung tumor motion. Lung tumor motion observed at Hokkaido university hospital was used for development of the proposed method. The motion has time-variant, but periodic nature, that is, the cyclic period changes with time. This nature often causes the rise of the prediction error when we use conventional prediction method for periodical time series (e.g. seasonal autoregressive integral moving-average model: SARIMA). The proposed method is based on SARIMA model, but was developed to take into account the quasi-periodic nature of the lung tumor motion. To estimate the time-variant period, we adopted correlation analysis. Then, the conventional SARIMA model was modified to a time-variant SARIMA model by using the estimated period. **Results:** Prediction error of the proposed method was compared with that of the conventional methods, by using real lung tumor motion. Experimental results show that the prediction error of the proposed method was the least. The average of prediction error are 0.7911 [mm] at 0.5[sec] ahead and 0.8818[mm] at 1.0[sec] ahead, respectively. **Conclusion:** We have developed the new prediction method of the lung tumor motion for compensation of time-delays of radiation device. The proposed method achieved highly accurate prediction of the real lung tumor motion. The method can thus sufficient for continuously irradiation to the moving lung tumor.