ABSTRACT:

Stereotactic body radiation therapy (SBRT) of pulmonary lesions has been shown to safely deliver a high dose to the tumour in a small number of fractions while limiting exposure to healthy tissues. Nevertheless, geometric uncertainties associated with this treatment technique such as respiratory motion, daily anatomical variations (anatomical baseline shifts between daily and planned position) and the simultaneous movement between the tumour and the multileaf collimator during treatment delivery (known as interplay effect), influence the accuracy on the treatment effectiveness.

In this context, the goal of this work is to quantify the dosimetric impact of those geometric uncertainties in lung SBRT. To accomplish this, several methodologies have been implemented based on deformable image registration.

The findings of this study indicate that daily anatomical deviations in patient anatomy generally had a larger dosimetric impact than respiratory motion. Furthermore, this work suggests that the interplay effect can be a matter of concern for patients with highly irregular breathing patterns or for those who have prolonged breathing cycles, particularly when small field sizes are used for dose conformation.

The methodologies developed in this work would be highly beneficial for clinicians involved in treatment planning and delivery, since they allow for the evaluation of treatment robustness against the geometric uncertainties addressed in this study.

References to author publications that relate specifically to the dissertation:

