

AbstractID: 1264 Title: A Decision-Analyzer for Optimal On- and Off-line Management of Adaptive Prostate Radiotherapy

A wealth of new information is currently entering the field of therapeutic medicine. In radiotherapy, a variety of new imaging technologies for anatomical imaging, for example on-board kilovoltage/megavoltage CT, ultrasound, or functional imaging like PET, MRI, and MRS will be able to provide information about the treatment response.

Bayesian statistics is an efficient way to handle new information for feedback and subsequent adaptation of a process. Furthermore, a decision tree allows for natural representation of the flow of actions and their statistical consequences (typically represented by known or estimated probability density functions) over a given time period. For prostate treatments, explicit consideration must be given to inter-fraction organ motion and hence the action space must contain pre-irradiation imaging, pre-irradiation correction, and post-irradiation imaging. The "non-actions" are explicitly incorporated into the decision tree.

A software tool has been developed to analyze decision trees, solve for the optimal sequence of decisions, and continuously refine the parameters that define the current knowledge about the prostate position and inter-fraction motion. A utility function ranks the decision-maker's preferences. The important question of tradeoffs for the sake of efficiency of the treatment processes can be explored. By considering the costs associated with interventions, it can be investigated, if it is necessary to image and/or correct the patient daily. Within the presented framework, on- and offline strategies can be treated in a unified manner.

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