

BSc thesis, Project Work, MSc thesis

Title: Optimization of Radiation Therapy for Deformed Targets

Background: In robotic radiation therapy, ionizing radiation is delivered by a linear accelerator that is mounted on a robotic arm. This allows to deliver dose from practically arbitrary many directions that overlap in the target. Treatment planning determines from which directions dose should be delivered. However, target movement and deformation during treatment, e.g. due to breathing, can be impact the treatment quality but can be tracked. Simple movement can be accounted for but deformation of the target can be detrimental for treatment quality. The goal of this work is to evaluate the impact of deformation on the plan quality and optimize sets of beams that are robust against deformation of the target.

Tasks: Influence of deformation on current treatment planning should be evaluated using the existing Java framework for treatment planning. Furthermore, the framework should be extended to consider stochastic deformation of the target during optimization.

Specific steps include:

1. Familiarize with the treatment planning framework.
2. Evaluate influence of deformation on conventional treatment planning quality.
3. Implement different stochastic optimization strategies that consider deformation.
4. Evaluate optimization on a large set of simulated stochastic deformations.
5. Evaluate implemented approach on real deformation datasets.

Requirements: Good programming skills in Java, ability to work independently, ideally experience with linear optimization

Not required is experience in medicine or radiation therapy.

Difficulty: 🟡🟡🟡🟡

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