

Project work / BSc thesis / MSc thesis

Title: Motion aware treatment planning for radiation therapy

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 detrimental but can be tracked for example by using an ultrasound probe mounted to a robot. Simple movement can be accounted for but deformation of the target can influence plan quality. The goal of the 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. The existing framework for optimization of dose delivery should be extended to consider deformation of the target stochastically.

Specific steps include:

1. Familiarize with the treatment planning framework.
2. Implement deformations and translation of the target.
3. Generate treatment plans for discrete deformations and translations.
4. Evaluate influence of deformation and translation on treatment planning quality.
5. Compare beam sets for different deformations and translations.
6. (Implement optimization considering deformation.)
7. (Evaluate implemented approach on real deformation.)

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

Difficulty: 🟡🟡🟡🟡

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