Multi-Criteria Optimization – Improved Knowledge for Knowledge-Based Planning

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ABSTRACT

- Multi-Criteria Optimization (MCO) is a new and upcoming way to quickly create and assign radiotherapy treatment plans to patients. How does it compare clinical treatment plans?
- MCO allows the user to adjust various treatment plans that the computer has created based on upper and lower dose limits.
- Varian, the program that houses MCO treatment plans, has an easy to use interface to determine the best individualized plans for each cancer patient.
- Clinical treatment planning may take longer than MCO-generated plans, with possible inconsistent and suboptimal quality.

INTRODUCTION

- Eclipse RapidPlan (RP) is a solution from Varian Medical Systems for knowledge-based planning, an area of research in radiation therapy, which uses statistical and machine learning techniques to mine planning data and build predictive estimation of the dose-volume histograms (DVHs) for target volumes and organs-at-risks (OARs) for new patients.
- It is important to have a library of successful plans to configure the model to have the “good” knowledge, as “bad” knowledge will likely result in suboptimal plans.
- MCO is a mathematical solution to a complex problem set. MCO is used in fields where an optimal decision can be concluded from a variety of available trade-offs. The optimal point is the point at which no further gain can be made without losses in 1 or more of the trade-offs being explored.
- Therefore, MCO may present a better solution as it considers a variety of possibilities with trade-offs. This project will test whether treatment plans, optimized by MCO, can become a better source of the “planning knowledge”, and therefore, create a better RapidPlan model.

RESULTS

- Conformity indices are the ratio between the structure’s volume covered by an isodose and the planned target volume.
- MCO generated plans have a consistently lower conformity index for each of the target volumes.
- Median maximum dose needed for specific OARs decreases with the MCO-RP plans in comparison to regular RP plans.

CONCLUSION & FUTURE DIRECTION

- MCO is faster to prescribe treatment for pancreatic cancer.
- By manipulating limits, medical professionals can determine the amount of radiation each structure/organ receives.
- Trade-offs allow for side-by-side comparison of multiple plans that meet the limits previously set.
- MCO is a promising tool to treat future patients of pancreatic cancer to generate safe and consistent radiation treatment plans.

WORKS CITED