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Chance-Constrained Optimization for Treatment of Prostate and Other Cancers in Intensity-Modulated Proton Therapy

The quality of IMPT treatment plans may be drastically diminished by uncertainties such as proton range and patient setup errors. If these uncertainties are not figured into treatment planning, the dose distribution that the patient receives may not be the same as the planned dose distribution. New treatment plans, which include optimized software/programming, are needed to limit the influence of uncertainties and improve the robustness of treatment plans.

Researchers at Arizona State University in collaboration with researchers at the Mayo Clinic have developed a novel treatment planning method for use in radiation therapy for cancer patients. They applied a probabilistic framework in the IMPT planning subject to range and patent set up uncertainties. The framework hedges against the influence of uncertainties and improves robustness of treatment plans. Results from this method were compared with the conventional PTV-based method and demonstrated enhanced effectiveness. The total deviation between the real and prescribed dose is minimized under the nominal scenario to provide a convenient framework for treatment planners.

This tool generates superior IMPT plans compared to conventional methods with explicit control of plan robustness.

Potential Applications

- Treatment planning for IMPT

Benefits and Applications

- Hedges against the influence of uncertainties
- Improves robustness of treatment plans
- Minimizes the total deviation between real and prescribed dose
- Clinically acceptable plans are formed within 50 second
- MPT plans are produced with comparable target coverage, better target dose homogeneity and better normal tissue sparing
- The tolerance level may be varied to control the tradeoff between plan robustness and quality

For more information about the inventor(s) and their research, please see Dr. Liang's directory webpage