

Automated Software System for Optimal Beam Setup in Radiation Cancer Therapy Systems

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Technology description

Radiation therapists must carefully determine beam angles and radiation dose to accurately target tumors while avoiding healthy tissue. Of special importance are nearby organs-at-risk, which often are affected by particular radiation treatments.

Currently, beam optimization relies on an estimate by an expert in the field to select an appropriate beam configuration. Intensity Modulated Radiation Therapy (IMRT) is a technique that uses highly precise external beams to optimize the radiation distribution to reduce exposure to healthy tissue. This method is vital in reducing adverse outcomes in patients with prostate cancer, primary brain tumors, metastatic brain tumors, head and neck cancers and other cancers with important surrounding tissue. While the system can significantly reduce treatment time, the use of multiple beam orientations and radiation blocking makes it extremely complex to configure. UW-Madison researchers have developed software that uses iterative processes and parallel computing power to select the optimal beam setup to treat tumors while sparing surrounding tissue. Therapists begin with an estimate of a dosage scheme, and the software computes the average dose that can be applied to each organ that may be at risk of radiation exposure. Each organ is given an adjustable weight of its importance. Based on those weights and potential beam configurations, the program uses nested partitioning—an industrial engineering technique that has never been applied to radiation treatment planning before—to evaluate each potential beam setup.

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing software that significantly improves the selection of the optimal beam angles to treat tumors with minimal exposure to surrounding healthy tissue.

Additional Information

D'Souza W., Zhang H., Nazareth D., Shi L. and Meyer R.R. 2008. A Nested Partitions Framework for Beam Angle Optimization in Intensity-Modulated Radiation Therapy. *Phys. in Med. and Bio.* 53, 3293-3307.

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Application area

Radiation treatment software

Advantages

Selects optimal beam angles to treat tumors and spare healthy tissue

Offers significantly better treatment plans than experts can produce

High accuracy allows greater daily doses, reducing treatment time.

Can be used with any type of radiation treatment

May be implemented as an add-on to an existing planning system

Parallel computation accelerates the process.

High throughput computing system performs steps quickly.

Relative weights of organs-at-risk can be adjusted to give certain organs more or less value.

Reduces patient discomfort

Reduces time required to select appropriate treatment

Significantly reduces radiation delivered to non-cancerous organs-at-risk near tumors

Institution

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