Inverse Planning Simulated Annealing (IPSA)

Brachytherapy at UCSF ? Pioneering technology for world-class patient care

Inverse planning

The last decade has seen major changes in the way radiation treatments are delivered. The century-old objective of radiation therapy, to deliver a curative dose to the target while preserving normal tissues, can now be aimed at with a high degree of sophistication. However, in spite of major improvements achieved with three-dimensional (3-D) imaging modalities that allow the anatomy to be properly defined, brachytherapy worldwide is only slowly taking advantage of these important new pieces of information.

At UCSF, however, we are at the forefront of bringing new technology to your treatment. Insertion of the seeds for permanent implants or of catheters for afterloading treatment is now fully image guided, improving greatly the localization of the applicators. And anatomy-based dose planning (a.k.a. inverse planning) was transformed by UCSF Professor Jean Pouliot.

The inverse planning approach can be defined as a method of radiation treatment planning where one starts with the desired dose distribution, or clinical objectives, and then determines the treatment parameters that will achieve it. This is opposed to the conventional forward planning approach where the treatment parameters are first chosen and then the resulting dose distribution is calculated and evaluated. Since inverse treatment planning begins with the description of the desired dose distribution, it represents a change of paradigm in the planning process. CT or MRI images are used not only to define the anatomy for visual assessment and dose calculation, but also to optimize the dose distribution. Therefore, they provide the physician with added flexibility and control to shape the dose distribution. In inverse planning, the anatomical features together with the dose constraints constitute the starting point of the dose optimization process.

The main benefit of the inverse planning approach is that all clinical requirements (dose

coverage, normal tissue protection, etc.) are simultaneously and automatically taken into account in the planning process. While the conventional forward planning approach may be adequate for uncomplicated cases, the adjustment of a dose distribution to respect different dose constraints on various targets and organs at risk in a reasonable time for clinical application is often beyond human capabilities.

Inverse Planning Simulated Annealing (IPSA), developed by UCSF Professor Jean Pouliot, is the leading inverse planning technology in the world. The sophisticated non-linear objective function at the heart of the IPSA software offers the flexibility to describe multiple types of clinical objectives for multiple types of anatomical structures. Using this advanced planning algorithm the brachytherapy team is able to generate the best possible dose plan finely tailored for your specific need.

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