

Workshop Radiotherapy & Mathematics

Title: Multicriteria optimisation in radiation therapy

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Summary: Optimization of radiotherapy treatment plans is a multiobjective problem which involves several conflicting objectives regarding dose delivered to the tumor and organs/tissues at risk. In general, available treatment planning systems do not explicitly consider the multiobjective nature of the problem, minimizing instead some combination (generally a weighted sum) of the objectives. Selection of weights imposes an *a priori* trade-off which may not produce an acceptable treatment. In this case the optimization must be re-run until a solution with suitable balance between the conflicting objectives is found. Even when a suitable solution is found, it is possible that a better plan exists.

Multiobjective or MultiCriteria Optimization (MCO) techniques have recently been introduced in radiation therapy planning to deal with the above limitations. An approach widely studied over the last few years involves the construction of a set of plans, each one with a different compromise between the objectives. These plans aim at providing a good approximation of the Pareto front (a plan lies on the Pareto front if an objective cannot be improved without worsening at least one of the other objectives). Pre-computation of the Pareto front allows the treatment planner and clinicians to interactively evaluate different plans, obtained from combinations of Pareto optimal plans, selecting the most suitable treatment.

In this talk I will review optimization of radiotherapy treatments, with an emphasis on recent developments on MCO of radiotherapy plans. Advantages and shortcomings of MCO in radiation therapy will be discussed, as well as possible future research lines.