Local Dose Shaping for Planning Treatment in Radiotherapy (P-854)

Key Facts

- Physician is able to address individual local dose requirements
- Easy therapy optimization ("dose lines can be moved by drag an drop")
- Overcoming the problem that performance is memory bound
- Reducing the bottleneck between the memory and the CPU
- Avoiding high amount of complex arithmetics
- Runtime of a treatment planning tool is significantly reduced

Abstract

An optimal plan in modern treatment planning tools is found through the use of an iterative optimization algorithm, which deals with a high amount of patient-related data and number of treatment parameters to be optimized. Thus, calculating a good plan is a very time-consuming process which limits the application for patients in clinics and for research activities aiming for more accuracy. A common technique to handle the vast amount of radiation dose data is the concept of the influence matrix (DIJ), which stores the dose contribution of each bixel to the patient in the main memory of the computer. This study revealed that a bottleneck for the optimization time arises from the data transfer of the dose data between the memory and the CPU. In this note, we introduce a new method which speeds up the data transportation from stored dose data to the CPU. As an example we used the DIJ approach as is implemented in our treatment planning tool KonRad, developed at the DKFZ in Heidelberg. A data cycle reordering method is proposed to take the advantage of modern memory hardware. This induces a minimal eviction policy which results in a memory behaviour exhibiting a 2.6 times faster algorithm compared to the naive implementation. Although our method is described for the DIJ approach implemented in KonRad, we believe that any other planning tool which uses a similar approach to store the dose data will also benefit from the described methods.

Development Stage

A prototype of the hard-/software has been implemented with software KonRad and tested successfully.

Applications

New generation of radio treatment planning software in radiotherapy.

Advantages

- 2.6 times faster for treatment plans
- performance not memory bound
- no complex arithmetics
- hardware and software optimization
- individual local dose requirements for therapy optimization ("dose lines can be moved by drag an drop")
- automatic adjustment of the overall treatment plan
**TECHNOLOGY OFFER**

**Inventors**
The invention was jointly conceived at DKFZ by Peter Ziegenhein and Uwe Oelfke in the Department of Med. Phys. in Radiotherapy.

**Intellectual Property**

**References**


**Further Information**
No other public information is currently available, but further information (speaking with the inventor) is available under a signed Confidential Disclosure Agreement (CDA).

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![Diagram of Dose Cube and Dose Matrix Storage Pattern](image)

**Figure 1.** Dose cube and dose matrix storage pattern and their reference in KonRad.