

Radiotherapy Treatment Planning – Dose Distribution Calculator

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Radiotherapy is a type of cancer treatment, in which tumour cells are destroyed by subjecting them to ionizing radiation. However, excessive radiation adversely affects all cells, including healthy tissue and critical organs. Therefore the aim of radiotherapy treatment planning is to deliver a tumouricidal dose over the tumour region while minimizing the radiation received by healthy tissue and organs at risk (OAR) in the vicinity of the tumour.

The treatment plan details how the radiation is applied to achieve this aim. The parameters of a treatment plan include the number and angles of the beams that apply radiation to the tumour, wedges that attenuate the radiation and the energy of each radiation beam. In brain cancer the treatment plans are stored in the form of DICOM RP image files. DICOM (Digital Image and Communications in Medicine) is a standard for storing and transmitting clinical image information.

The quality of a treatment plan is judged based on the resulting radiation dose distribution. The dose distribution is assessed to identify regions of overdosing (as compared to the guidelines) in the organs at risk or healthy tissue or regions of underdosing in the tumour.

The aim of this project is to design a dose distribution calculation software that calculates the radiation dose received either by each voxel or by a volume (e.g. tumour or organ at risk). Using the DICOM RP files, the software should be able to extract the treatment plan information from these files, display the tumour and organs at risk structures and possibly the beams, calculate the resulting dose distribution and display the information, ideally in graphical form (e.g. by using colour coded dose distribution areas or isodose lines, i.e. lines, which outline regions in which the dose falls below a particular threshold). Alternatively, the software can display the dose at a point when the user clicks on that point.