# Method To Predict Three-Dimensional Radiotherapy Dose Distribution

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Technology description

At UC San Diego, we have developed a major advancein knowledge-based treatment planning: **full3Dd osedistribution prediction** . Similar to existing art1our method relies on learning from a plurality of previously treatedplans, but our method moves far beyondcurrent technology to synthesize past experience into voxel-by-voxel predictions for expected dose distributions for newpatients. Our currentembodiment already meets or exceedsthe accuracy of existing technology in DVH prediction, with the invaluable addition of identifying (a) precisely where the dose is expectedto be depositedin the patient and (b) the degreeof confidence in that voxel-by-voxel prediction.
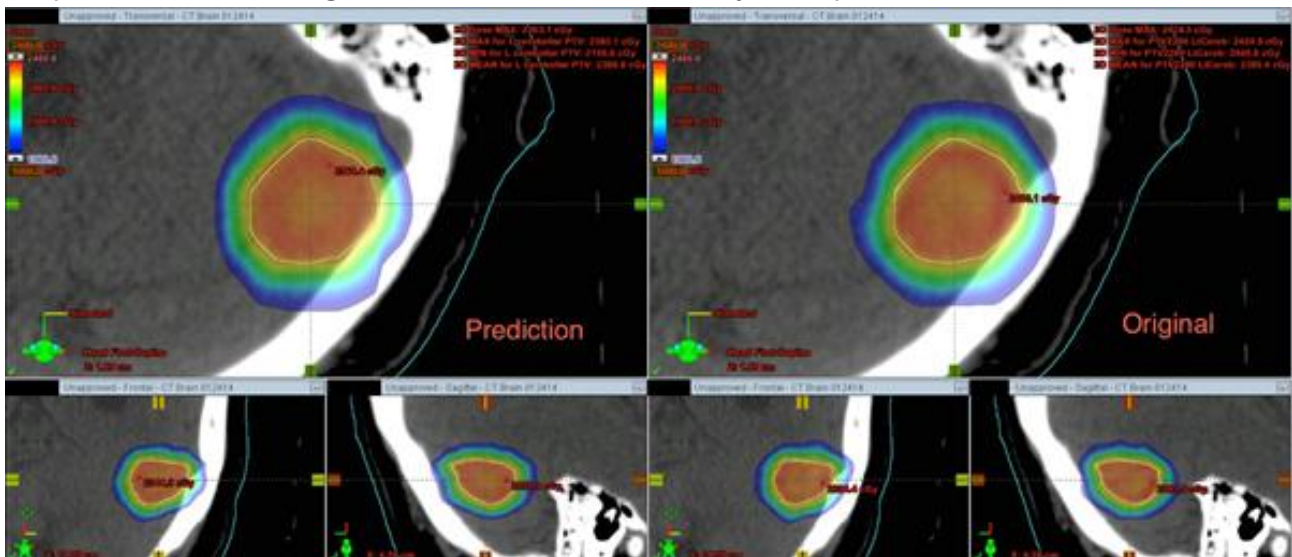
1SeeinparticularUS20120310615(onwhichDr.KevinMoorewastheleadinventor)andUS20120014507.

A painting is not the amountof blue, yellow,and red paint on a canvas; it is their arrangement that makes it art.

The advent of knowledge-based planning(KBP) represents a critical step forward in clinical radiotherapy, comfortably mentioned in the company of the other major advances in treatment planning(2Dàà3D-conformalààIMRT/RapidArcààKBP). While incredibly powerful, current knowledge-based methods result in dose-volume histogram(DVH) predictions that are ultimately limited by the inherent loss in spatial information of a DVH. In current incarnations of KBP (e.g.Varian's RapidPlanTM), these predictions must be converted into DVH-based optimization parametersto enact

automated planning, and when treatment planDVHsdiffer from their knowledge-based DVH predictions it requires significant expertise to discern the origin of the deviation. Troublingly, the investigation and resolution of these discrepancies necessarily falls into the hands of the same human treatment plannersthat knowledge-based planningpurports to outperform.

Application area

This technology opensup a number of new possible applications in treatment planningoptimization and plan evaluation. Some of these include:

·Immediately after contourapproval, radiation oncologists would have an expected treatment plan dose distribution to review, both guiding and accelerating the clinical decisionmaking process for fractionation, target/organ prioritization, etc.

·Treatment planners would have a powerful new diagnostic tool for understanding exactlywheresub-optimal plans are failing,increasing efficiency and further eliminating human failure from the planning process.

·New voxel-based optimization methods could be designed around these predictions, eliminating the need to convert DVH predictions to DVH-basedoptimization objectives and relativepriorities.

It is possible that this technology will herald yet another huge leap forward in clinical treatment planning, and in time the history of treatmentplanning advances could seen as:

2Dàà3D-conformalààIMRT/RapidArcàà1D-KBPàà**3D-KBP**.

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