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Ongoing Deliverable D1.2

Description of Research Seminar: An
Application of Data Envelopment
Analysis to External Radiotherapy
Treatment Planning

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Participants: UGOE
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Research Seminar

offered by Kuan-Min Lin (University of Auckland)

on 13 March 2013,

in Kaiserslautern, Germany

Subject: An Application of Data Envelopment Analysis to External Radiotherapy Treatment Planning

Problem: The majority of commercial radiotherapy treatment planning systems requires planners to iteratively adjust the plan parameters in order to find a satisfactory plan. This iterative trial-and-error nature of radiotherapy treatment planning results in an inefficient planning process and in order to reduce such inefficiency, plans can be accepted without achieving the best attainable quality. We propose a quality assessment method based on data envelopment analysis (DEA) to address this inefficiency. This method compares a plan of interest to a set of past delivered plans and searches for evidence of potential further improvement. With the assistance of DEA, planners will be able to make informed decisions on whether further planning is required and ensure that a plan is only accepted when the plan quality is close to the best attainable one.

Main Results: We apply the DEA method to 37 prostate plans using two assessment parameters: rectal generalized equivalent uniform dose (gEUD) as the input and D95 (the minimum dose that is received by 95% volume of a structure) of the planning target volume (PTV) as the output. The percentage volume of rectum overlapping PTV is used to account for anatomical variations between patients and is included in the model as a non-discretionary output variable. Five plans that are considered of lesser quality by DEA are re-optimized with the goal to further improve rectal sparing. After re-optimization, all five plans improve in rectal

gEUD without clinically considerable deterioration of the PTV D95 value. For the five re-optimized plans, the rectal gEUD is reduced by an average of 1.84 Gray (Gy) with only an average reduction of 0.07 Gy in PTV D95. The results demonstrate that DEA can correctly identify plans with potential improvements in terms of the chosen input and outputs.

Participants: Researchers from UNIKL

Publication: LIN, K. M., SIMPSON, J., SASSO, G., RAITH, A. and EHRGOTT, M. 2013. Quality assessment for VMAT prostate radiotherapy planning based on data envelopment analysis. *Physics in Medicine and Biology*, 58, 5753-5769.