

AbstractID: 10303 Title: Using a 3-dimensional Kernel Density Estimator For The Scoring Of Radiotherapy Treatment Volumes Against Multiple Expert Observers

**Purpose:** Several techniques exist for the numerical assessment of radiotherapy treatment volumes against a 'gold standard' volume, such as the conformity index. Such techniques are unable to encompass variations in clinical practice between individuals and institutions, and are ineffective in the assessment of acceptable levels of intra-observer variation in contouring. We present a novel algorithm based on a three-dimensional kernel density estimator (3DKDE) to produce a statistic capable of scoring a single target volume against a solution set containing multiple expert volumes.

**Methods & Materials:** The algorithm was coded using a multi-threaded Pascal compiler. A graphical user interface allows the operator to load multiple expert outlines into the system, calculate the solution space and visualise it in 3D. Individual volumes can then be scored rapidly against all the volumes in the solution space. As a planning exercise, 3 expert observers were asked to contour the GTV for a patient with a resected glioblastoma. Each observer contoured the case on three separate occasions. A solution space with all 9 outlines was constructed to make assessments of inter-observer and intra-observer variation.

**Results:** The system provides both a mean kernel density score (k-score), and voxel-by-voxel scores in the form of a k-score histogram. Similar outlines tend to have similar mean k-scores and k-score histogram profiles. Outlying volumes are readily identified by the system. Direct visualisation of the solution space provides information on the conformity between different expert observers, and intra-observer variation in contouring.

**Conclusion:** The 3DKDE scoring tool is a valuable technique for the quantitative assessment of volume contouring whilst taking into account variation in clinical practice. Further studies are planned to assess the utility of this technique in different disease sites.

**Conflict of interest:** None