AbstractID: 11441 Title: Evaluation of Measure Discontinuity Metrics for 4-D CT Reconstruction Data

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Introduction Measure discontinuity plays a key role for a successful radiotherapy treatment planning in 4-D radiotherapy therapy, which is increasingly used for lung cancer treatment. An important issue is to define a metric that can determine which breath period is well trained and the obtained image data can be used to reconstruct the 4-D volume. We evaluate several metrics on 4-D CT data. Our research can give some practical guidance to determine the quality of the acquired data.

Method and Material Supporting s_1 is above s_2, the difference between the last slice in s_1 and the first slice in s_2 is computed (denoted as d). d should be following a distribution p. If we have no prior knowledge, Gaussian distribution is a reasonable choice that is $d \sim Gaussian(\mu, \sigma)$. The parameters of the distribution can be learned from the differences sets computed from s_1 and s_2. The metrics are computed based on these parameters.

Results (1) One of the metrics is effective which can detect about 83.3% stacks with large artifacts. By ROC analysis, the error at equal error rate (intersection with curve diagonal) is 0.833, the threshold at equal error is 0.0320 and the area under curve is 0.8747. (2) Pre-processing is important. (3) Not all metrics work well.

Conclusion Measure discontinuity is a fundamental issue in 4-D reconstruction, which is not well addressed in the state-of-the-art. The conclusions of our work are: (1) Ground truth data on large scale 4-D CT data should be created. To our knowledge, no work is done is this field; (2) The distribution of d, should be analyzed further. May be more complicated distributions are better than Gasussian distribution.