// SCR 2021 Abstract

Assessment of the stability and discriminative power of radiomics features in liver lesions using an anthropomorphic 3D-printed CT phantom

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Purpose: The variability of CT images from different hospitals can have a strong influence on the analysis and comparison of radiomics features computed in the images. This study analyses how different CT reconstruction parameter variations impact the stability and discriminative power of radiomics features extracted in an anthropomorphic CT phantom generated with real patient texture data.

Methods and Materials: A radiopaque 3D-printed phantom, designed to simulate clinical CT imaging, was built based on an abdominal section from a cancer patient. The liver presents a metastasis, benign cysts and a hemangioma. 240 CT series were obtained varying the reconstruction algorithm and kernel and the slice thickness and spacing. 86 standard radiomics features were computed in manually annotated regions of interest within the lesions and within normal liver tissue. In total 8 reconstruction parameter variations, each containing 30 distinct acquisitions, were evaluated in pairwise comparisons using Wilcoxon signed-rank tests.

Results: All the variations resulted in statistically significant differences in at least 60/86 radiomics features. In only 15% of the stability tests, the CT parameter settings had no significant impact on the radiomics features. On the other hand, the radiomics features had an average 84% successful pairwise tests when differentiating between liver lesions and normal tissue. The radiomics features were ranked based on the percentages of successful stability and discriminative power tests for this task.

Conclusion: All four liver tissue patterns remain linearly separable in this task-based radiomics study despite the CT reconstruction parameter variations. Understanding the scale of changes produced from variations in the acquisition and reconstruction process can help to identify stable radiomics features that also show strong discriminative power.