

// ECR 2021 - Abstract

Revealing the most suitable CT radiomics features for retrospective studies with heterogeneous datasets

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Purpose or Learning Objective

There is a strong variability of CT images when using regular clinical imaging protocols, as it is often the case in retrospective studies. Their influence on the usability of radiomics features is still unclear. This study aims to assess the stability and discriminative power of radiomics features in 240 CT series of different reconstruction parameter variations using an anthropomorphic abdominal phantom.

Methods or Background

A novel anthropomorphic 3D-printed radiopaque CT phantom was created based on a CT of a cancer patient. Regions-Of-Interests (ROIs) were manually annotated in normal liver tissue and 3 lesion types: cysts, hemangioma and metastasis. 86 radiomics features were extracted from the ROIs in 30 repeated phantom acquisitions for 8 groups of CT parameter settings with varying reconstruction algorithms, reconstruction kernels, slice thicknesses and slice spacings. Univariate pairwise Wilcoxon signed-rank tests assessed the statistical significance of the feature variations among the 8 groups and 4 tissue classes.

Results or Findings

The variations of CT parameter settings produced statistically significant differences in pairwise comparisons, with more than 70% of the 86 radiomics features showing significant differences in their value distributions. All radiomics features were able to differentiate between the 4 classes of liver tissue in more than 40% of the performed tests. In a principal component analysis, the inter-class variation from the 4 classes was larger than the intra-class variations caused by CT reconstruction parameter variations in the 8 groups.

Conclusion

While the tested radiomics features are influenced by CT reconstruction parameters, the features have sufficient stability and discriminative power to differentiate tissue types. The presented approach using a 3D-printed phantom could systematically analyse different scanner types in the future.

Limitations

Not applicable

Ethics committee approval

Not applicable

Funding for this study

This work was partly supported by the Swiss Personalized Health Network (SPHN) with the QA4IQI-Quality assessment for interoperable quantitative CT-imaging project DMS2445, and the IMAGINE project.

It was also partially supported by the Swiss National Science Foundation (SNSF, grant 205320_179069).