

Image protocol quality - well-documented image protocols (for example, contrast, slice thickness, energy, etc.) and/or usage of public image protocols allow reproducibility/replicability

protocols well documented

public protocol used

none

Multiple segmentations - possible actions are: segmentation by different physicians/algorithms/software, perturbing segmentations by (random) noise, segmentation at different breathing cycles. Analyse feature robustness to segmentation variabilities

yes

no

Phantom study on all scanners - detect inter-scanner differences and vendor-dependent features. Analyse feature robustness to these sources of variability

yes

no

Imaging at multiple time points - collect images of individuals at additional time points. Analyse feature robustness to temporal variabilities (for example, organ movement, organ expansion/shrinkage)

yes

no

Feature reduction or adjustment for multiple testing - decreases the risk of overfitting. Overfitting is inevitable if the number of features exceeds the number of samples. Consider feature robustness when selecting features

Either measure is implemented

Neither measure is implemented

Multivariable analysis with non radiomics features (for example, EGFR mutation) - is expected to provide a more holistic model. Permits correlating/inferencing between radiomics and non radiomics features

yes

no

Detect and discuss biological correlates - demonstration of phenotypic differences (possibly associated with underlying gene-protein expression patterns) deepens understanding of radiomics and biology

yes

no

Cut-off analyses - determine risk groups by either the median, a previously published cut-off or report a continuous risk variable. Reduces the risk of reporting overly optimistic results

yes

no

Discrimination statistics - report discrimination statistics (for example, C-statistic, ROC curve, AUC) and their statistical significance (for example, p-values, confidence intervals). One can also apply resampling method (for example, bootstrapping, cross-validation)

a discrimination statistic and its statistical significance are reported

a resampling method technique is also applied

none

Calibration statistics - report calibration statistics (for example, Calibration-in-the-large/slope, calibration plots) and their statistical significance (for example, P-values, confidence intervals). One can also apply resampling method (for example, bootstrapping, cross-validation)

a calibration statistic and its statistical significance are reported

a resampling method technique is applied

none

Prospective study registered in a trial database - provides the highest level of evidence supporting the clinical validity and usefulness of the radiomics biomarker

yes

no

Validation - the validation is performed without retraining and without adaptation of the cut-off value, provides crucial information with regard to credible clinical performance

No validation

validation is based on a dataset from the same institute

validation is based on a dataset from another institute

validation is based on two datasets from two distinct institutes

the study validates a previously published signature

validation is based on three or more datasets from distinct institutes

Comparison to 'gold standard' - assess the extent to which the model agrees with/is superior to the current 'gold standard' method (for example, TNM-staging for survival prediction). This comparison shows the added value of radiomics

yes

no

Potential clinical utility - report on the current and potential application of the model in a clinical setting (for example, decision curve analysis).

yes

no

Cost-effectiveness analysis - report on the cost-effectiveness of the clinical application (for example, QALYs generated)

yes

no

Open science and data - make code and data publicly available. Open science facilitates knowledge transfer and reproducibility of the study

scans are open source

region of interest segmentations are open source

the code is open sourced

radiomics features are calculated on a set of representative ROIs and the calculated features and representative ROIs are open source

Total score

19

(52.78%)