Range of values and ICCs for quantifying contouring robustness for the selected textural features.

			ICC		
Variable	Min	Max	Estimate	Lower	Upper
LRLGLe-PET	0.02	4.21	0.95	0.93	0.96
RP-CT	12.05	153.76	0.93	0.91	0.95

Abbreviations: LRLGLe-PET: long run low gray level emphasis measured on PET; and RP-CT: run percentage measured on CT.

Geometry features

Variable	Equation	Description
Volume	N/A	Volume.
Surface area	N/A	Total surface area.
Boundingbox volume	N/A	The smallest cubic volume containing the volume of interest.
Extent	P01/P03	The volume to boundingbox ratio.
Major axis length	N/A	The length of the major axis.
Minor axis length	N/A	The length of the minor axis.
Flattening	$\frac{\mathrm{P05} - \mathrm{P06}}{\mathrm{P05}}$	A measure of how much the symmetry axis is compressed relative to the equatorial radius.
Aspect ratio	P06/P05	The minor axis length to the major axis length ratio.
Sphericity	$\frac{\pi^{\frac{1}{3}} \cdot (6 \cdot P01)^{\frac{2}{3}}}{P02}$	A measure of how spherical (round) an object is.
Convex area	N/A	Area of smallest convex polygon that contains the volume of interest.
Solidity	P01/P10	The volume to convex area ratio.
Equivalent diameter	$\left(\frac{6 \cdot P01}{\pi}\right)^{\frac{1}{3}}$	The diameter of a circle with the same area as the region.
Spherical disproportion	$\frac{P02}{4\pi R^2}$	A measure of surface regularity, indicating how close the shape is to a sphere.
Surface to volume ratio	P02/P01	The surface to volume ratio.
Compactness 1	$\frac{P01}{\sqrt{\pi} A^{\frac{2}{3}}}$	The degree to which a shape is compact. The most compact shape is a perfect sphere.
Compactness 2	$\frac{36\pi \cdot P01^2}{A^3}$	The degree to which a shape is compact. The most compact shape is a perfect sphere.

Total glycolytic volume

Variable	Equation	Description
Total glycolytic volume	Volume · Mean intensity	The total lesion volume and its metabolic activity.

First order texture features

Notation:

I The intensity values of the three dimensional image matrix with N voxels.

P The first order histogram with N_l discrete intensity levels.

Variable	Equation	Description
Minimum	N/A	Minimum intensity.
Maximum	N/A	Maximum intensity.
Range	Maximum - minimum	Intensity range.
Mean	$\mu = \frac{\sum I}{N}$	Mean intensity.
Quantile 0.025	N/A	Intensity of the 0.025 quantile.
Quantile 0.25	N/A	Intensity of the 0.25 quantile.
Median intensity	N/A	Median intensity.
Quantile 0.75	N/A	Intensity of the 0.75 quantile.
Quantile 0.975	N/A	Intensity of the 0.975 quantile.
Sum intensity	$\sum I$	Sum of all intensities.
Variance	$\frac{1}{N-1}\sum (I-\mu)^2$	Variance.
SD	$\sqrt{\frac{1}{N-1}\sum (I-\mu)^2}$	Standard deviation.
Skewness	$\frac{\frac{1}{N}\sum(I-\mu)^3}{\left(\sqrt{\frac{1}{N}\sum(I-\mu)^2}\right)^3}$	A measure of the asymmetry of the data around the sample mean.
Kurtosis	$\frac{\frac{1}{N}\sum(I-\mu)^4}{\left(\sqrt{\frac{1}{N}\sum(I-\mu)^2}\right)^2}$	A measure of how outlier-prone a distribution is.
Energy	$\sum I^2$	The summation of all squared intensities.
Entropy	$\sum_{i=1}^{Nl} P(i)\log_2 P(i)$	A measure of randomness, which is largest for random grey level distributions.
Mean absolute deviation	$\sum \lvert I-\mu \rvert$	The mean of the absolute deviations of all voxel intensities around the mean intensity value.
RMS	$\frac{\sqrt{\sum I^2}}{N}$	Root mean square.
Uniformity	$\sum_{i=1}^{N_l} P(i)^2$	A measure of how uniform a distribution is.

GLCM-based second order textural features

Notation:

$GLCM(i,j)$	(i,j)th entry in a normalized GLCM.
N_g	Number of distinct grey levels in the quantized image.
$\sum_i GLCM(i,j)$ and $\sum_j GLCM(i,j)$	$\sum_{i=1}^{N_g} GLCM(i,j)$ and $\sum_{j=1}^{N_g} GLCM(i,j)$
$GLCM_x(i)$ and $GLCM_y(j)$	$\sum_j GLCM(i,j)$ and $\sum_i GLCM(i,j)$
$GLCM_{x+y}(k), \quad i+j=k$	$\sum_i \sum_j GLCM(i,j), k = 2,3,\dots,2N_g$
$GLCM_{x-y}(k), \quad \lvert i-j \rvert = k$	$\sum_i \sum_j GLCM(i,j), k = 0,1,\dots,N_g - 1$
μ_x and μ_y	The mean of $GLCM_x(i)$ and $GLCM_y(j)$
σ_x and σ_y	The standard deviation of $GLCM_x(i)$ and $GLCM_y(j)$
HX	$-\sum_i GLCM_x(i) \log_2[GLCM_x(i)]$, the entropy of $GLCM_x$
HY	$-\sum_i GLCM_y(j) \log_2[GLCM_y(j)]$, the entropy of $GLCM_y$
HXY	$-\sum_i \sum_j GLCM(i,j) \log_2[GLCM(i,j)]$
$HXY1$	$-\sum_i \sum_j GLCM(i,j) \log_2[GLCM_x(i) \cdot GLCM_y(j)]$
$HXY2$	$-\sum_i \sum_j GLCM_x(i) \cdot GLCM_y(j) \log_2[GLCM_x(i) \cdot GLCM_y(j)]$

Variable	Equation	Description
Autocorrelation	$\sum_i \sum_j (i \cdot j) GLCM(i,j)$	A measure of coarseness.
Contrast (inertia)	$\sum_i \sum_j \lvert i-j \rvert^2 GLCM(i,j)$	A measure of local variations present in the image. A high contrast value indicates a high degree of local variation.
Correlation	$\sum_i \sum_j \frac{(i-\mu_x)(j-\mu_y) GLCM(i,j)}{\sigma_x \sigma_y}$	A measure of grey tone linear dependency of neighbouring cells. For an image with large areas of similar intensities, correlation is higher than for an image with noisier, uncorrelated intensities.
Haralick's correlation	$\sum_i \sum_j \frac{(i \cdot j) GLCM(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y}$	A measure of how correlated a voxel is to its neighbour.
Cluster prominence	$\sum_i \sum_j (i+j-\mu_x-\mu_y)^4 GLCM(i,j)$	A measure of local intensity variation.
Cluster shade	$\sum_i \sum_j (i+j-\mu_x-\mu_y)^3 GLCM(i,j)$	A measure of the lack of symmetry of the matrix. High values represent asymmetric matrices.
Cluster tendency	$\sum_i \sum_j (i+j-\mu_x-\mu_y)^2 GLCM(i,j)$	Indicates into how many clusters the grey levels can be classified.
Dissimilarity	$\sum_i \sum_j \lvert i-j \rvert GLCM(i,j)$	A measure that defines the variation of grey level pairs.
Energy (Angular second moment)	$\sum_i \sum_j GLCM(i,j)^2$	Emphasizes local homogeneity. Homogeneous images have few dominant grey tone transitions, which results into a higher energy.
Entropy	$-\sum_i \sum_j GLCM(i,j) \cdot \log_2(GLCM(i,j))$	A measure of disorder. When the image is not texturally uniform, entropy is very large.
Homogeneity 1	$\sum_i \sum_j \frac{GLCM(i,j)}{1+\lvert i-j \rvert}$	A measure of local homogeneity, which measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal; high values indicate smooth texture with low variation.
Homogeneity 2	$\sum_i \sum_j \frac{GLCM(i,j)}{1+\lvert i-j \rvert^2}$	A measure of local homogeneity, which measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal; high values indicate smooth texture with low variation.
Maximum probability	$\max_{i,j} GLCM(i,j)$	Determines the grey level with the maximum probability in the GLCM. The maximum probability is expected to be high if the occurrence of the most predominant voxel pair is high.
Sum of squares: variance	$\sum_i \sum_j (i-\mu)^2 GLCM(i,j)$	A measure of heterogeneity, which characterizes the distribution of grey levels around the mean. This feature

		puts relatively high weights on the elements that differ from the average value of the GLCM.
Sum average	$\sum_{i=2}^{2N_g} i \cdot GLCM_{x+y}(i)$	A measure of the relation between clear and dense areas in an image.
Sum entropy	$-\sum_{i=2}^{2N_g} GLCM_{x+y}(i) \cdot \log(GLCM_{x+y}(i))$	Entropy of the sum histogram.
Sum variance	$-\sum_{i=2}^{2N_g} (i - \text{Sum entropy})^2 \cdot GLCM_{x+y}(i)$	Variance of the sum histogram.
Difference variance 1	$\sum_{i=0}^{N_g-1} i^2 \cdot GLCM_{x-y}(i)$	Variance of the difference histogram.
Difference variance 2	$\frac{1}{N_g - 1}\sum_i \sum_j (GLCM(i,j) - \mu)^2$	Variance of the difference histogram.
Difference entropy	$-\sum_{i=0}^{N_g-1} GLCM_{x-y}(i) \cdot \log(GLCM_{x-y}(i)$	Entropy of the difference histogram.
Information measure of correlation 1	$\frac{HXY - HXY1}{\max(HX, HY)}$	This measure is a function of the joint probability density distribution $p(x,y)$ of the two variables x and y, and is invariant under a change of parameterization $x' = f(x)$, $y' = g(y)$, and reduces to the classical correlation coefficient when $p(x, y)$ is normal.
Information measure of correlation 2	$\sqrt{1 - e^{-2(HXY2 - HXY)}}$	This measure is a function of the joint probability density distribution $p(x,y)$ of the two variables x and y, and is invariant under a change of parameterization $x' = f(x)$, $y' = g(y)$, and reduces to the classical correlation coefficient when $p(x, y)$ is normal.
Inverse difference normalized	$\sum_i \sum_j \frac{GLCM(i,j)}{1 + \frac{\lvert i-j \rvert^2}{N_g}}$	A measure of image local homogeneity as it assumes larger values for smaller grey tone differences in pair elements. It is more sensitive to the presence of near diagonal elements in the GLCM.
Inverse difference moment normalized	$\sum_i \sum_j \frac{GLCM(i,j)}{1 + \frac{(i-j)^2}{N_g}}$	A measure of image local homogeneity as it assumes larger values for smaller grey tone differences in pair elements. It is more sensitive to the presence of near diagonal elements in the GLCM.

GLRLM-based second order textural features.

Notation:

$GLRLM(i,j)$	(i,j)th entry in a GLRLM.
$\sum_i GLRLM(i,j)$ and $\sum_j GLRLM\ (i,j)$	$\sum_{i=1}^{M} GLRLM(i,j)$ and $\sum_{j=1}^{N} GLRLM\ (i,j)$
n_r	$\sum_i \sum_j GLRLM(i,j)$
n_p	$\sum_i \sum_j j \cdot GLRLM(i,j)$

Variable	Equation	Description
Short Run Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLRLM(i,j)}{j^2}$	Is highly dependent on the occurrence of short runs and is expected large for fine textures.
Long Run Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLRLM(i,j) \cdot j^2$	Is highly dependent on the occurrence of long runs and is expected large for coarse textures.
Grey-Level Nonuniformity	$\frac{1}{n_r}\sum_i \left(\sum_j GLRLM(i,j)\right)^2$	Measures the similarity of grey level values throughout the image and is expected small if grey level values are similar throughout the image.
Run Length Nonuniformity	$\frac{1}{n_r}\sum_j \left(\sum_i GLRLM(i,j)\right)^2$	Measures the similarity of the length of runs throughout the image and is expected small if run lengths are similar throughout the image.
Run Percentage	$\frac{n_r}{n_p}$	Measures the heterogeneity and the distribution of runs of an image in a specific direction and is expected large for images with a heterogeneous texture.
Low Grey-Level Run Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLRLM(i,j)}{i^2}$	Is highly dependent on the occurrence of runs with low grey levels.
High Grey-Level Run Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLRLM(i,j) \cdot i^2$	Is highly dependent on the occurrence of runs with high grey levels.
Short Run Low Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLRLM(i,j)}{i^2 \cdot j^2}$	Is highly dependent on the occurrence of short runs with low grey levels.
Short Run High Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLRLM(i,j) \cdot i^2}{j^2}$	Is highly dependent on the occurrence of short runs with high grey levels.
Long Run Low Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLRLM(i,j) \cdot j^2}{i^2}$	Is highly dependent on the occurrence of long runs with low grey levels.
Long Run High Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLRLM(i,j) \cdot i^2 \cdot j^2$	Is highly dependent on the occurrence of long runs with high grey levels.

GLSZM-based second order textural features.

Notation:

$GLSZM(i,j)$	(i,j)th entry in a GLSZM.
$\sum_i GLSZM(i,j)$ and $\sum_j GLSZM(i,j)$	$\sum_{i=1}^{M} GLSZM(i,j)$ and $\sum_{j=1}^{N} GLSZM(i,j)$
n_r	$\sum_i \sum_j GLSZM(i,j)$
n_p	$\sum_i \sum_j j \cdot GSZLM(i,j)$

Variable	Equation	Description
Small Zone Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLSZM(i,j)}{j^2}$	Is highly dependent on the occurrence of small zones and is expected large for fine textures.
Large Zone Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLSZM(i,j) \cdot j^2$	Is highly dependent on the occurrence of large zones and is expected large for fine textures.
Grey-Level Nonuniformity	$\frac{1}{n_r}\sum_i \left(\sum_j GLSZM(i,j)\right)^2$	Measures the similarity of grey level values throughout the image and is expected small if grey level values are similar throughout the image.
Size Zone Nonuniformity	$\frac{1}{n_r}\sum_j \left(\sum_i GLSZM(i,j)\right)^2$	Measures the similarity of the length of runs throughout the image and is expected small if size zones are similar throughout the image.
Zone Percentage	$\frac{n_r}{n_p}$	Measures the heterogeneity and the distribution of size zones of an image in a specific direction and is expected large for images with a heterogeneous texture.
Low Grey-Level Zone Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLSZM(i,j)}{i^2}$	Is highly dependent on the occurrence of zones with low grey levels.
High Grey-Level Zone Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLSZM(i,j) \cdot i^2$	Is highly dependent on the occurrence of zones with high grey levels.
Small Zone Low Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLSZM(i,j)}{i^2 \cdot j^2}$	Is highly dependent on the occurrence of small zones with low grey levels.
Small Zone High Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLSZM(i,j) \cdot i^2}{j^2}$	Is highly dependent on the occurrence of small zones with high grey levels.
Large Zone Low Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j \frac{GLSZM(i,j) \cdot j^2}{i^2}$	Is highly dependent on the occurrence of large zones with low grey levels.
Large Zone High Grey-Level Emphasis	$\frac{1}{n_r}\sum_i \sum_j GLSZM(i,j) \cdot i^2 \cdot j^2$	Is highly dependent on the occurrence of large zones with high grey levels.