Supplementary material for Leijenaar, et al. Stability of FDG-PET Radiomics features: An integrated analysis of test-retest and inter-observer variability. Acta Oncol 2013;52:1391–1397.

Supplementary Appendix A. Definition of imaging features

First-order gray-level statistics

Let P define the first order histogram and $P(i)$ the fraction of voxels with intensity level i. N_i is the number of discrete intensity levels.

- **Energy**: the sum of all voxel SUV values squared.
- **Entropy**:

$$entropy = \sum_{i=1}^{N_l} P(i)\log_2 P(i)$$

- **Kurtosis**: the kurtosis of the first order histogram of voxel intensities.
- **Mean absolute deviation**: the mean of the absolute deviations of all voxel intensities around the mean intensity value.
- **Median**: the median intensity value.
- **Minimum**: the minimum intensity value.
- **Range**: the range of intensity values.
- **Root mean square**: the quadratic mean, or the square root of the mean of squares of all voxel intensities.
- **Skewness**: the skewness of the first order histogram of voxel SUV values.
- **Standard deviation**: the standard deviation of all SUV values.
- **SUV_{max}**: the maximum SUV value.
- **SUV_{mean}**: the mean SUV value.
- **SUV_{peak}**, defined as the mean SUV within a 1 cm^3 sphere centered around the maximum SUV voxel [1].
- **Uniformity**:

$$uniformity = \sum_{i=1}^{N_l} P(i)^2$$

- **Variance**: the variance of all SUV values.

Geometric features

Geometric features, describing the shape and size of the volume of interest. Let V be the volume and A the surface area of the volume of interest.

- **Compactness 1**:

$$compactness\,1 = \frac{V}{\sqrt{\pi}A^{\frac{2}{3}}}$$

- **Compactness 2**:

$$compactness\,2 = 36\pi\frac{V^2}{A^3}$$

- **Maximum 3D diameter**: the maximum three-dimensional tumor diameter.
- **Spherical disproportion**:

$$spherical\ disproportion = \frac{A}{4\pi R^2}$$

Where R is the radius of a sphere with the same volume as the tumor.

- **Sphericity**:

$$sphericity = \frac{\pi^{\frac{1}{3}}(6V)^{\frac{2}{3}}}{A}$$

- **Surface to volume ratio**: the surface area divided by the volume.

Gray-level co-occurrence matrix-based features

Gray level co-occurrence matrix-based features, as described by Haralick et al. [2]. Let:
$P(i, j)$ be the co-occurrence matrix,
N_g be the number of discrete intensity levels in the image,
μ be the mean of $P(i, j)$,
$\mu_x(i)$ be the mean of row i,
$\mu_y(j)$ be the mean of column j,
$\sigma_x(i)$ be the standard deviation of row i,
$\sigma_y(j)$ be the standard deviation of column j,

$$p_x(i) = \sum_{j=1}^{N_g} P(i,j),$$

$$p_y(j) = \sum_{i=1}^{N_g} P(i,j),$$

$$p_{x+y}(k) = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g} P(i,j)\,,\ i+j=\kappa,$$

$$\kappa = 2,3,\ldots 2N_g,$$

$$p_{x-y}(k) = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g} P(i,j)\,,\ i-j=\kappa,\ \kappa = 0,1,\ldots,N_g-1,$$

$$HXY1 = -\sum_{i=1}^{N_g}\sum_{j=1}^{N_g} P(i,j)\log(p_x(i)p_y(j)),$$

$$HXY2 = -\sum_{i=1}^{N_g}\sum_{j=1}^{N_g} p_x(i)p_y(j)\log(p_x(i)p_y(j)).$$

- **Autocorrelation**:

$$autocorrelation = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g} ijp(i,j)$$

- **Cluster prominence**:

$$cluster\ prominence = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}[i+j-\mu_x(i)-\mu_y(j)]^4 P(i,j)$$

- **Cluster shade**:

$$cluster\ shade = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}[i+j-\mu_x(i)-\mu_y(j)]^3 P(i,j)$$

- **Cluster tendency**:

$$cluster\ tendency = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}[i+j-\mu_x(i)-\mu_y(j)]^2 P(i,j)$$

- **Contrast**:

$$contrast = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}|i-j|^2 P(i,j)$$

- **Correlation**:

$$correlation = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_g} ijP(i,j)-\mu_i(i)\mu_j(j)}{\sigma_x(i)\sigma_y(j)}$$

- **Difference entropy**:

$$difference\ entropy = \sum_{i=0}^{N_g-1} P_{x-y}(i)\log_2\left[P_{x-y}(i)\right]$$

- **Dissimilarity**:

$$dissimilarity = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}|i-j|P(i,j)$$

- **Energy**:

$$energy = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}[P(i,j)]^2$$

- **Entropy**:

$$entropy = -\sum_{i=1}^{N_g}\sum_{j=1}^{N_g} P(i,j)\log_2[P(i,j)]$$

- **Homogeneity 1**:

$$homogeneity\,1 = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P(i,j)}{1+|i-j|}$$

- **Homogeneity 2**:

$$homogeneity\,2 = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P(i,j)}{1+|i-j|^2}$$

- **Informational measure of correlation 1 (IMC1)**:

$$IMC1 = \frac{H-HXY1}{\max\{HX,HY\}}$$

Where H is the entropy.

- **Informational measure of correlation 2 (IMC2)**:

$$IMC2 = \sqrt{1-e^{-2(HXY2-H)}}$$

Where H is the entropy.

- **Inverse Difference Moment Normalized (IDMN)**:

$$IDMN = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P(i,j)}{1+\left(\frac{|i-j|^2}{N^2}\right)}$$

- **Inverse Difference Normalized (IDN)**:

$$IDN = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P(i,j)}{1+\left(\frac{|i-j|}{N}\right)}$$

- **Inverse variance**:

$$inverse\ variance = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}\frac{P(i,j)}{|i-j|^2},\ i \neq j$$

- **Maximum probability**:

$$maximum\ probability = \max\{P(i,j)\}$$

- **Sum average**:

$$sum\ average = \sum_{i=2}^{2N_g}\left[iP_{x+y}(i)\right]$$

- **Sum entropy**:

$$sum\ entropy = -\sum_{i=2}^{2N_g} P_{x+y}(i)\log_2\left[P_{x+y}(i)\right]$$

- **Sum variance**:

$$sum\ variance = \sum_{i=2}^{2N_g}(i-SE)^2 P_{x+y}(i)$$

- **Variance**:

$$variance = \sum_{i=1}^{N_g}\sum_{j=1}^{N_g}(i-\mu)^2 P(i,j)$$

Gray-level run-length matrix-based features

Gray-level run-length matrix-based features, as described by Galloway et al. [3]. Let:

$p(i,j|\theta)$ be the (i,j) th entry in the given run-length matrix p for a direction θ,

N_g the number of discrete intensity values in the image,

N_r the number of different run lengths,

N_p the number of voxels in the image.

- **Short Run Emphasis (SRE)**:

$$SRE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\left[\frac{p(i,j\mid\theta)}{j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Long Run Emphasis (LRE)**:

$$LRE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}j^2 p(i,j\mid\theta)}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Gray Leven Non-Uniformity (GLN)**:

$$GLN = \frac{\sum_{i=1}^{N_g}\left[\sum_{j=1}^{N_r}p(i,j\mid\theta)\right]^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Run Length Non-Uniformity (RLN)**:

$$RLN = \frac{\sum_{j=1}^{N_r}\left[\sum_{i=1}^{N_g}p(i,j\mid\theta)\right]^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Run Percentage (RP)**:

$$RP = \sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\frac{p(i,j\mid\theta)}{N_p}$$

- **Low Gray Level Run Emphasis (LGLRE)**:

$$LGLRE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\left[\frac{p(i,j\mid\theta)}{i^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **High Gray Level Run Emphasis (HGLRE)**:

$$HGLRE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}i^2 p(i,j\mid\theta)}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Short Run Low Gray Level Emphasis (SRLGLE)**:

$$SRLGLE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\left[\frac{p(i,j\mid\theta)}{i^2 j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Short Run High Gray Level Emphasis (SRHGLE)**:

$$SRHGLE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\left[\frac{p(i,j\mid\theta)i^2}{j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Long Run Low Gray Level Emphasis (LRLGLE)**:

$$LRHGLE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}\left[\frac{p(i,j\mid\theta)j^2}{i^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

- **Long Run High Gray Level Emphasis (LRHGLE)**:

$$LRHGLE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)i^2 j^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_r}p(i,j\mid\theta)}$$

Gray-level size-zone matrix-based features

Gray-level size-zone matrix-based features, as described by Tixier et al. [4]. Let:

$p(i,j)$ be the (i,j) th entry in the given size-zone matrix p,

N_g the number of discrete intensity values in the image,

N_z the size of the largest, homogeneous region in the volume of interest,

N_a the number homogeneous areas in the image.

- **Small area Emphasis (SAE)**:

$$SAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}\left[\frac{p(i,j)}{j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Large area Emphasis (LAE)**:

$$LAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}j^2 p(i,j)}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Intensity variability (IV)**:

$$IV = \frac{\sum_{i=1}^{N_g}\left[\sum_{j=1}^{N_z}p(i,j)\right]^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Size-zone variability (SZV)**:

$$SZV = \frac{\sum_{i=1}^{N_z}\left[\sum_{j=1}^{N_g}p(i,j)\right]^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Zone Percentage (ZP)**:

$$ZP = \sum_{i=1}^{N_z}\sum_{j=1}^{N_g}\frac{p(i,j)}{N_a}$$

- **Low intensity Emphasis (LIE)**:

$$LIE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}\left[\frac{p(i,j)}{i^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **High intensity Emphasis (HIE)**:

$$HIE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}i^2 p(i,j)}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Low intensity small area Emphasis (LISAE)**:

$$LISAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{Nz}\left[\frac{p(i,j)}{i^2 j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **High intensity small area Emphasis (HISAE)**:

$$HISAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}\left[\frac{p(i,j)i^2}{j^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **Low intensity large area Emphasis (LILAE)**:

$$LILAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{Nz}\left[\frac{p(i,j)j^2}{i^2}\right]}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

- **High intensity large area Emphasis (HILAE)**:

$$HILAE = \frac{\sum_{i=1}^{N_g}\sum_{j=1}^{Nz}p(i,j)i^2 j^2}{\sum_{i=1}^{N_g}\sum_{j=1}^{N_z}p(i,j)}$$

Supplementary Appendix B. Tables

Table BI. Results for the test-retest analysis, showing ICC, $COV_{\%mean}$ and $COV_{\%range}$ ranges, as well as the number of features per feature group and per class, defined as high (ICC ≥ 0.8), medium (0.8 > ICC ≥ 0.5), or low (ICC < 0.5) stability. Median values of ICC, $COV_{\%mean}$ and $COV_{\%range}$ ranges are shown within brackets.

Stability class	N	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
First order statistics				
High stability	13	0.81–0.96 (0.92)	17.27–86.29 (23.45)	12.22–35.36 (14.67)
Medium stability	0	–	–	–
Low stability	2	0.27–0.28 (0.27)	57.29–110.48 (83.89)	55.61–60.58 (58.09)
IVH features				
High stability	18	0.80–0.94 (0.86)	17.09–44.07 (29.19)	3.39–23.78 (14.82)
Medium stability	3	0.61–0.78 (0.77)	37.26–105.65 (50.40)	6.03–28.04 (20.33)
Low stability	8	0.00–0.48 (0.27)	7.68–99.25 (46.30)	46.82–68.00 (60.54)
Geometric features				
High stability	8	0.81–0.88 (0.83)	12.25–37.61 (29.53)	3.80–31.58 (18.79)
Medium stability	0	–	–	–
Low stability	0	–	–	–
Textural features				
High stability	29	0.81–0.93 (0.89)	2.76–166.45 (36.90)	5.94–36.42 (19.25)
Medium stability	14	0.54–0.79 (0.64)	3.57–465.37 (75.93)	4.32–54.56 (33.96)
Low stability	1	0.35	84.19	53.59

Table BII. Results for the inter-observer analysis, showing ICC, $COV_{\%mean}$ and $COV_{\%range}$ ranges, as well as the number of features per feature group and per class, defined as high (ICC $\geq$ 0.8), medium (0.8 $>$ ICC $\geq$ 0.5), or low (ICC $<$ 0.5) stability. Median values of ICC, $COV_{\%mean}$ and $COV_{\%range}$ ranges are shown within brackets.

Stability class	N	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
First order statistics				
High stability	14	0.87–1.00 (0.98)	2.07–58.17 (15.25)	1.20–22.75 (7.39)
Medium stability	1	0.79	65.81	41.21
Low stability	0	–	–	–
IVH features				
High stability	34	0.82–1.00 (0.97)	5.60–131.45 (28.57)	1.23–52.15 (10.70)
Medium stability	5	0.63–0.77 (0.72)	4.53–39.04 (21.74)	38.72–57.65 (51.14)
Low stability	0	–	–	–
Geometric features				
High stability	8	0.80–0.98 (0.97)	11.63–48.47 (26.79)	9.60–31.31 (19.20)
Medium stability	0	–	–	–
Low stability	0	–	–	–
Textural features				
High stability	39	0.80–0.99 (0.95)	1.20–257.20 (28.61)	5.34–40.03 (13.19)
Medium stability	3	0.50–0.77 (0.75)	44.46–128.87 (104.07)	12.38–51.25 (30.16)
Low stability	2	0.17–0.19 (0.18)	156.41–192.86 (174.63)	57.96–76.36 (67.16)

Table BIII. ICC, $COV_{\%mean}$ and $COV_{\%range}$ values for all first order statistics. ICC values marked with an asterix (*) are statistically non-significant ($p \geq 0.05$).

	Test-retest			Inter-observer		
Feature name	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
Energy	0.96	86.29	13.67	0.99	16.27	1.68
Entropy	0.91	17.27	22.26	0.97	7.41	10.61
Kurtosis	0.27*	57.29	60.58	0.91	26.25	19.97
Mean deviation	0.93	22.46	15.15	0.99	11.00	5.25
Median	0.85	28.59	17.48	0.89	25.02	16.37
Minimum	0.81	29.07	19.08	0.79	65.81	41.21
Range	0.92	24.04	15.96	0.99	8.22	4.76
Root mean square	0.90	22.27	13.99	0.97	14.22	9.53
Skewness	0.28*	110.48	55.61	0.87	58.17	22.75
Standard deviation	0.93	19.99	14.17	0.99	9.84	4.84
SUV_{max}	0.93	18.51	12.22	1.00	3.34	2.11
SUV_{mean}	0.87	23.45	14.67	0.95	17.95	11.85
SUV_{peak}	0.94	21.06	12.28	1.00	2.07	1.20
Uniformity	0.87	60.81	35.36	0.96	32.85	17.88
Variance	0.93	43.29	14.48	0.99	20.14	4.64

Table BIV. ICC, $COV_{\%mean}$ and $COV_{\%range}$ values for all intensity volume histogram features. ICC values marked with an asterix (*) are statistically non-significant ($p \geq 0.05$).

	Test-retest			Inter-observer		
Feature name	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
$AIRV_{10\%}$	0.80	28.84	18.43	0.87	38.96	23.85
$AIRV_{20\%}$	0.82	28.07	17.48	0.89	32.61	20.96
$AIRV_{30\%}$	0.82	28.50	17.54	0.89	29.72	18.36
$AIRV_{40\%}$	0.83	29.57	17.91	0.89	27.60	17.40
$AIRV_{50\%}$	0.83	28.96	17.78	0.88	25.03	16.42
$AIRV_{60\%}$	0.86	26.86	16.24	0.90	21.88	14.15
$AIRV_{70\%}$	0.91	21.85	13.41	0.94	17.27	11.18
$AIRV_{80\%}$	0.91	20.91	13.21	0.96	13.90	8.78
$AIRV_{90\%}$	0.94	17.09	11.34	0.98	10.76	6.76
$AVRI_{10\%}$	–	–	–	0.98	46.68	10.66
$AVRI_{20\%}$	–	–	–	0.98	35.97	7.75
$AVRI_{30\%}$	–	–	–	0.99	29.54	6.01
$AVRI_{40\%}$	–	–	–	0.99	24.17	4.84
$AVRI_{50\%}$	–	–	–	0.99	18.82	3.88
$AVRI_{60\%}$	0.88	31.20	3.39	0.99	10.58	2.09
$AVRI_{70\%}$	0.87	41.35	4.52	1.00	5.71	1.23
$AVRI_{80\%}$	0.87	44.07	5.43	1.00	5.60	1.55
$AVRI_{90\%}$	0.61	105.65	20.33	0.99	7.92	2.22
$AVRI_{90\%-10\%}$	0.86	29.42	3.51	0.98	47.26	10.74
$AVRI_{80\%-20\%}$	0.85	31.71	3.84	0.98	37.91	8.07
$AVRI_{70\%-30\%}$	0.83	36.41	4.78	0.98	34.77	7.00
$AVRI_{60\%-40\%}$	0.77	37.26	6.03	0.98	35.16	7.10
$AIRV_{90\%-10\%}$	0.94	23.18	16.32	0.98	13.02	6.29
$AIRV_{80\%-20\%}$	0.87	30.33	19.18	0.98	15.49	7.17
$AIRV_{70\%-30\%}$	0.85	42.11	23.78	0.97	21.23	9.66
$AIRV_{60\%-40\%}$	0.78	50.40	28.04	0.90	39.13	17.91
$RVRI_{90\%-10\%}$	0.48	7.68	46.82	0.77	5.70	52.53
$RVRI_{80\%-20\%}$	0.34*	16.16	62.94	0.63	21.74	51.14
$RVRI_{70\%-30\%}$	−0.02*	37.24	68.00	0.72	30.54	38.72
$RVRI_{60\%-40\%}$	0.20*	51.82	54.78	0.74	39.04	38.90
$RVRI_{10\%}$	–	–	–	0.69	4.53	57.65
$RVRI_{20\%}$	–	–	–	0.82	15.92	41.26
$RVRI_{30\%}$	–	–	–	0.88	21.78	24.32
$RVRI_{40\%}$	–	–	–	0.88	29.60	20.43
$RVRI_{50\%}$	–	–	–	0.90	45.24	21.49
$RVRI_{60\%}$	0.10*	40.78	58.14	0.91	60.18	26.47
$RVRI_{70\%}$	−0.02*	62.45	68.00	0.91	76.83	34.34
$RVRI_{80\%}$	0.34*	71.38	62.94	0.93	131.45	52.15
$RVRI_{90\%}$	0.48	99.25	46.82	0.97	125.12	46.72

Table BV. ICC, $COV_{\%mean}$ and $COV_{\%range}$ values for all geometric features.

	Test-retest			Inter-observer		
Feature name	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
Compactness 1	0.85	27.83	7.60	0.98	21.75	9.60
Compactness 2	0.81	35.37	31.58	0.80	32.81	28.58
Maximum diameter	0.88	31.69	15.78	0.96	33.41	21.52
Sph. disproportion	0.81	13.74	30.93	0.80	13.04	31.31
Sphericity	0.81	12.25	30.44	0.80	11.63	29.38
Surface area	0.85	37.61	7.95	0.98	31.83	9.73
Surface/volume	0.83	23.35	21.80	0.97	21.52	16.88
Volume	0.84	31.24	3.80	0.98	48.47	11.19

Sph. Disproportion, Spherical disproportion.

Table BVI. ICC, $COV_{\%mean}$ and $COV_{\%range}$ values for all textural features, subdivided into gray-level co-occurrence, gray-level run-length and gray-level size-zone features. ICC values marked with asterix (*) are statistically non-significant ($p \geq 0.05$).

	Test-retest			Inter-observer		
Feature name	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)	ICC	$COV_{\%mean}$ (%)	$COV_{\%range}$ (%)
Gray level co-occurrence						
Autocorrelation	0.91	42.46	12.86	0.96	31.11	10.19
Cluster prominence	0.93	166.45	25.08	0.99	80.99	9.70
Cluster shade	0.64	395.05	44.09	0.88	137.31	19.20
Cluster tendency	0.93	67.65	21.48	0.99	27.04	6.26
Contrast	0.91	46.18	20.63	0.97	23.79	5.34
Correlation	0.82	160.13	34.11	0.89	22.39	16.08
Difference entropy	0.89	11.46	14.76	0.98	8.60	10.31
Dissimilarity	0.91	22.39	18.69	0.95	15.67	7.76
Energy	0.89	110.90	30.02	0.97	147.25	40.03
Entropy	0.90	21.35	20.65	0.98	8.95	9.71
Homogeneity 1	0.88	12.55	19.25	0.94	11.64	13.19
Homogeneity 2	0.88	17.90	18.63	0.93	17.33	13.95
IMC1	0.82	−51.02	36.42	0.97	−28.61	18.63
IMC2	0.90	13.83	27.91	0.95	7.88	21.36
IDMN	0.64	3.57	39.51	0.94	1.20	15.73
IDN	0.58	3.87	30.64	0.92	2.26	18.52
Inverse variance	0.88	19.74	25.69	0.95	13.52	11.72
Max. prob.	0.91	60.94	23.42	0.96	87.14	30.49
Sum average	0.90	19.33	13.07	0.95	18.39	12.37
Sum entropy	0.93	15.24	18.67	0.98	8.17	11.69
Sum variance	0.90	46.89	12.77	0.96	33.81	10.04
Variance	0.92	37.16	11.90	0.96	29.42	10.17
Gray level run length						
GLN	0.79	34.51	4.32	0.97	54.19	13.08
HGLRE	0.91	41.17	13.25	0.96	30.01	9.69
LGLRE	0.57	70.48	38.36	0.80	98.37	36.08
LRE	0.84	15.57	19.60	0.90	11.19	13.75
LRHGLE	0.91	36.64	12.31	0.95	29.68	9.64
LRLGLE	0.66	35.16	28.40	0.89	40.15	27.81
RLN	0.85	36.90	5.94	0.98	41.07	9.05
RP	0.81	3.53	16.43	0.90	3.42	14.93
SRE	0.85	2.76	17.31	0.91	2.55	15.06
SRHGLE	0.88	21.58	14.79	0.95	19.63	12.82
SRLGLE	0.55	69.61	40.28	0.81	97.44	38.64
Gray level size zone						
HIE	0.82	64.68	28.69	0.97	36.77	11.71
HILAE	0.74	349.20	20.50	0.93	227.47	16.51
HISAE	0.54	89.82	44.75	0.96	26.45	10.10
IV	0.64	81.39	13.46	0.17	156.41	76.36
LAE	0.79	465.37	27.62	0.85	257.20	14.68
LIE	0.56	55.69	37.28	0.50	123.87	51.25
LILAE	0.72	106.64	27.79	0.75	104.07	12.38
LISAE	0.54	107.07	54.56	0.19	192.86	57.96
SAE	0.35*	84.19	53.59	0.77	44.46	30.16
SZV	0.81	83.06	31.33	0.81	55.47	14.88
ZP	0.84	74.53	34.66	0.85	67.29	23.63

IMC1, informational measure of correlation 1; IMC2, informational measure of correlation 2; IDMN, inverse difference moment normalized; IDN, inverse difference normalized; Max. prob., maximum probability, GLN, gray-level non-uniformity; HGLRE, high gray-level run emphasis; HIE, high intensity emphasis; HILAE, high intensity larte area emphasis; HISAE, high intensity small area emphasis; IV, intensity variability; LAE, large area emphasis; LGLRE, low gray-level run emphasis; LIE, low intensity emphasis; LILAE, low intensity large area emphasis; LISAE, low intensity small area emphasis; LRE, long run emphasis; LRHGLE, long run high gray-level emphasis; LRLGLE, long run low gray-level emphasis; RLN, run length non-uniformity; RP, run percentage; SRE, short run emphasis; SRHGLE, short run high gray-level emphasis; SRLGLE, short run low gray-level emphasis; SAE, small area emphasis; SZV, size zone variability; ZP, Zone Percentage.

Supplementary Appendix C. References

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