Appendix

1. Ki-67 model

1.1 For T2 solid

5 features are retained:

[1] "Correlation_angle135_offset7"

[2] "LongRunEmphasis_angle0_offset1"

[3] "ShortRunLowGreyLevelEmphasis_angle135_offset1"

[4] "ShortRunEmphasis_angle135_offset4"

[5] "LongRunEmphasis_angle135_offset4"

Type of measure	Name	Formula
GLCM Parameters	Correlation_angle135_offset7"	$-\sum_{i,j}\frac{(i-\mu)(j-\mu)g(i,j)}{\sigma^2}$
RLM Parameters	LongRunEmphasis_angle0_offset1	$LRE(\theta)=\frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}p(i,j,\theta)j^2$
RLM Parameters	ShortRunLowGreyLevelEmphasis_angle135_offset1	$SRLGE(\theta)=\frac{1}{n_r}\sum_{j=1}^{N}\sum_{i=1}^{M}\frac{p(i,j,\theta)}{i^2j^2}$
RLM Parameters	ShortRunEmphasis_angle135_offset4	$SRE(\theta)=\frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}\frac{p(i,j,\theta)}{j^2}$
RLM Parameters	LongRunEmphasis_angle135_offset4	$LRE(\theta)=\frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}p(i,j,\theta)j^2$

Features	Test	Train	*p*-value
Correlation_angle135_offset7: mean(SD)	-0.084 (1.031)	3E-7 (1.000)	0.777
LongRunEmphasis_angle0_offset1: mean(SD)	-0.326 (0.819)	2E-7 (1.000)	0.245
ShortRunLowGreyLevelEmphasis_angle135_offset1: mean(SD)	0.397(1.600)	-1E-7 (1.000)	0.266
ShortRunEmphasis_angle135_offset4: mean(SD)	0.196(1.001)	2E-7 (1.000)	0.504
LongRunEmphasis_angle135_offset4: mean(SD)	-0.176(0.141)	1E-7 (1.000)	0.474

1.2 For T2 peritumoral areas in 20mm

5 features are retained:

[1] "GLCMEntropy_AllDirection_offset1_SD"

[2] "InverseDifferenceMoment_angle0_offset1"

[3] "LowGreyLevelRunEmphasis_AllDirection_offset1_SD"

[4] "ShortRunEmphasis_AllDirection_offset4_SD"

[5] "ShortRunEmphasis_AllDirection_offset7_SD"

Type of measure	Name	Formula
GLCM Parameters	GLCMEntropy_AllDirection_offset1_SD	$-\sum_{i,j} g(i,j)log_2(i,j)$
GLCM Parameters	InverseDifferenceMoment_angle0_offset1	$\sum\sum \frac{1}{1+(i-j)^2} g(i,j)$
RLM Parameters	LowGreyLevelRunEmphasis_AllDirection_offset1_SD	$LGRE(\theta) = \frac{1}{n_r}\sum_{j=1}^{N}\sum_{i=1}^{M}\frac{p(i,j,\theta)}{i^2}$
RLM Parameters	ShortRunEmphasis_AllDirection_offset4_SD	$SRE(\theta) = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}\frac{p(i,j,\theta)}{j^2}$
RLM Parameters	ShortRunEmphasis_AllDirection_offset7_SD	$SRE(\theta) = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}\frac{p(i,j,\theta)}{j^2}$

Features	Test	Train	*p*-value
GLCMEntropy_AllDirection_offset1_SD: mean(SD)	-0.109(1.074)	-4E-7(1.000)	0.715
InverseDifferenceMoment_angle0_offset1: mean(SD)	-0.039(0.806)	-4E-7(1.000)	0.888
LowGreyLevelRunEmphasis_AllDirection_offset1_SD: mean(SD)	-0.140(0.087)	-4E-7(1.000)	0.396
ShortRunEmphasis_AllDirection_offset4_SD: mean(SD)	-0.089(1.014)	-0.090(0.843)	0.997
ShortRunEmphasis_AllDirection_offset7_SD: mean(SD)	0.014(0.758)	-2E-7(1.000)	0.958

1.3 For T1 solid

3 features are retained:

[1] "LongRunEmphasis_angle45_offset1"

[2] "LongRunLowGreyLevelEmphasis_AllDirection_offset7_"

[3] "ShortRunEmphasis_AllDirection_offset7_SD"

Type of measure	Name	Formula
RLM Parameters	LongRunEmphasis_angle45_offset1	$LRE(\theta) = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N} p(i,j,\theta)j^2$
RLM Parameters	LongRunLowGreyLevelEmphasis_AllDirection_offset7	$LRLGE(\theta) = \frac{1}{n_r}\sum_{j=1}^{N}\sum_{i=1}^{M} \frac{p(i,j,\theta)}{i^2 j^2}$
RLM Parameters	ShortRunEmphasis_AllDirection_offset7_SD	$SRE(\theta) = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N} \frac{p(i,j,\theta)}{j^2}$

features	Test	Train	*p*-value
LongRunEmphasis_angle45_offset1: mean(SD)	0.533 (0.859)	1E-7 (1.000)	0.851
LongRunLowGreyLevelEmphasis_AllDirection_offset7_SD: mean(SD)	0.602 (1.245)	-1E-7 (1.000)	0.065
ShortRunEmphasis_AllDirection_offset7_SD: mean(SD)	-0.395 (0.420)	-0.171 (0.716)	0.297

2. p53 model :

2.1 For T2 peritumoral areas in 10 mm

7 features are retained:

[1] "Percentile30"

[2] "uniformity"

[3] "GLCMEnergy_angle135_offset4"

[4] "Inertia_angle0_offset1"

[5] "SurfaceVolumeRatio"

[6] "LongRunEmphasis_AllDirection_offset4_SD"

[7] "LongRunEmphasis_angle135_offset1"

Type of measure	Name	Formula
Histogram Parameters	Percentile30	$n=\frac{P}{100} * N$
Histogram Parameters	uniformity	$Uniformity = \sum_{i=1}^{N_i} \boldsymbol{p}(\boldsymbol{i})^2$
GLCM Parameters	GLCMEnergy_angle135_offset4	$-\sum_{i,j} g(i,j) log_2(i,j)$
Texture Parameters	Inertia_angle0_offset1	$\sum_{i,j} \left((\boldsymbol{i}-\boldsymbol{j})^2 \boldsymbol{g}(\boldsymbol{i},\boldsymbol{j}) \right)$
Form Factor Parameters	SurfaceVolumeRatio	Surface to volume ratio$=\frac{A}{V}$
RLM Parameters	LongRunEmphasis_AllDirection_offset4_SD	$LRE(\theta) = \frac{1}{n_r} \sum_{i=1}^{M} \sum_{j=1}^{N} p(i,j,\theta) j^2$
RLM Parameters	LongRunEmphasis_angle135_offset1	$LRE(\theta) = \frac{1}{n_r} \sum_{i=1}^{M} \sum_{j=1}^{N} p(i,j,\theta) j^2$

Features	Test	Train	*p*-value
Percentile30: mean(SD)	0.146 (0.814)	-3E-7 (1.000)	0.611
uniformity: mean(SD)	-0.169 (0.783)	-1E-7 (1.000)	0.553
GLCMEnergy_angle135_offset4: mean(SD)	-0.141(0.929)	0E-7(1.000)	0.635
Inertia_angle0_offset1: mean(SD)	-0.207(0.355)	0E-7(1.000)	0.282
SurfaceVolumeRatio: mean(SD)	0.327(1.072)	0E-7(1.000)	0.294
LongRunEmphasis_AllDirection_offset4_SD: mean(SD)	-0.131(0.150)	0E-7(1.000)	0.604
LongRunEmphasis_angle135_offset1: mean(SD)	-0.254(0.241)	0E-7(1.000)	0.322

2.2 For T1 solid

10 features are retained:

[1] "histogramEnergy"

[2] "Correlation_AllDirection_offset1"

[3] "Correlation_angle90_offset7"

[4] "InverseDifferenceMoment_AllDirection_offset7"

[5] "InverseDifferenceMoment_AllDirection_offset7_SD"

[6] "ShortRunEmphasis_AllDirection_offset7_SD"

[7] "InverseDifferenceMoment_angle45_offset7"

[8] "ShortRunEmphasis_angle0_offset1"

[9] "GLCMEnergy_AllDirection_offset1_SD"

[10] "HaralickCorrelation_AllDirection_offset1"

Type of measure	Name	Formula
Histogram Parameters	histogramEnergy	$energy = \sum_{i}^{N} X(i)^2$
Texture Parameters	Correlation_AllDirection_offset1	$-\sum_{i,j} \frac{(i-\mu)(j-\mu)g(i,j)}{\sigma^2}$
Texture Parameters	Correlation_angle90_offset7	$-\sum_{i,j} \frac{(i-\mu)(j-\mu)g(i,j)}{\sigma^2}$
GLCM Parameters	InverseDifferenceMoment_AllDirection_offset7	$\sum\sum \frac{1}{1+(i-j)^2} g(i,j)$
GLCM Parameters	InverseDifferenceMoment_AllDirection_offset7_SD	$\sum\sum \frac{1}{1+(i-j)^2} g(i,j)$
RLM Parameters	ShortRunEmphasis_AllDirection_offset7_SD	$SRE(\theta) = \frac{1}{n_r} \sum_{i=1}^{M} \sum_{j=1}^{N} \frac{p(i,j,\theta)}{j^2}$
GLCM Parameters	InverseDifferenceMoment_angle45_offset7	$\sum\sum \frac{1}{1+(i-j)^2} g(i,j)$
RLM Parameters	ShortRunEmphasis_angle0_offset1	$SRE(\theta) = \frac{1}{n_r} \sum_{i=1}^{M} \sum_{j=1}^{N} \frac{p(i,j,\theta)}{j^2}$
GLCM Parameters	GLCMEnergy_AllDirection_offset1_SD	$\sum_{i,j} g(i,j)^2$
GLCM Parameters	HaralickCorrelation_AllDirection_offset1	$-\sum_{i,j} \frac{(i,j)g(i,j) - \mu_t^2}{\sigma_t^2}$

Features	Test	Train	*p*-value

histogramEnergy：mean (SD)	0.174 (1.238)	1E-7 (1.000)	0.600
Correlation_AllDirection_offset1：mean (SD)	0.117 (0.895)	-0.112 (0.778)	0.365
Correlation_angle90_offset7：mean (SD)	0.141 (0.877)	-0.116 (0.756)	0.298
InverseDifferenceMoment_AllDirection_offset7：mean (SD)	-0.188 (0.858)	1E-7 (1.000)	0.522
InverseDifferenceMoment_AllDirection_offset7_SD：mean (SD)	-0.038 (0.765)	-3E-7 (1.000)	0.895
ShortRunEmphasis_AllDirection_offset7_SD：mean (SD)	0.112 (0.880)	-5E-7 (1.000)	0.704
InverseDifferenceMoment_angle45_offset7：mean (SD)	0.225 (0.909)	-2E-7 (1.000)	0.450
ShortRunEmphasis_angle0_offset1：mean (SD)	0.254 (1.032)	2E-7 (1.000)	0.413
GLCMEnergy_AllDirection_offset1_SD：mean (SD)	0.063 (0.651)	-2E-7 (1.000)	0.820
HaralickCorrelation_AllDirection_offset1：mean (SD)	0.117 (0.895)	1E-7 (1.000)	0694