Explanation of Nuclear Features

Feature Symbol 1	Feature Symbol 2	Feature Name	Feature Type	Origin	Paper / Website	Additional Info	Remarks
NF1	F1	Solidity	Shape features (by Matlab's regionprops)	Matlab	<u>Mathworks</u>		
NF2	F2	Extent					
NF3	F3	EquivDiameter					
NF4	F4	Eccentricity					
NF5	F5	MinorAxisLength / MajorAxisLength					
NF6	F6	Area					
NF7	F7	Perimeter					
NF8	F8	Mean	Intensity histogram based metrics	Matlab implementation (code adjusted for 2D) \nPORTSFeat(1:6)	<u>Mathworks</u>	Pyradiomics	
NF9	F9	Variance					
NF10	F10	Skewness					
NF11	F11	Kurtosis					
NF12	F12	Energy					
NF13	F13	Entropy					
NF14	F14	Angular second moment	Features of Gray- Tone-Spatial- Dependence-Matrix (GTSDM)	PORTSFeat(7:26)	function: compute_3D_GTSD M		called "Energy" in Soh 1999
NF15	F15	Contrast					

Feature Symbol 1	Feature Symbol 2	Feature Name	Feature Type	Origin	Paper / Website	Additional Info	Remarks
NF16	F16	Correlation					
NF17	F17	Sum of squares variance					
NF18	F18	Inverse Difference moment				van Griethuysen et. al., 2019	called "Homogeneity" in Soh 1999
NF19	F19	Sum average					
NF20	F20	Sum variance					
NF21	F21	Sum Entropy					
NF22	F22	Entropy					
NF23	F23	Difference Variance					
NF24	F24	Difference Entropy					
NF25	F25	Information Correlation 1					
NF26	F26	Information Correlation 2					
NF27	F27	Maximal Correlation Coefficient					*** NOT COMPUTED ALWAYS ZERO ***
NF28	F28	Autocorrelation	Texture Features from Soh (1999)				
NF29	F29	Dissimilarity					
NF30	F30	Cluster Shade					
NF31	F31	Cluster Prominence					
NF32	F32	Maximum Probability					
NF33	F33	Inverse Difference	Texture feature from Clausi (2002)			van Griethuysen et. al., 2019	

Feature Symbol 1	Feature Symbol 2	Feature Name	Feature Type	Origin	Paper / Website	Additional Info	Remarks
NF34	F34	Coarseness	Features of Neighborhood-Gray- Tone-Difference- Matrix(NGTDM)	PORTSFeat(27:31)	function: compute_NGTDM_m etrics		
NF35	F35	Contrast					
NF36	F36	Busyness					
NF37	F37	Complexity					
NF38	F38	Texture Strength					
NF39	F39	Small Zone Size Emphasis	Gray-Level Zone Size Metrics (GLZSM)	PORTSFeat(32:42)	function: compute_zone_size_ metrics		
NF40	F40	Large Zone Size Emphasis				van Griethuysen et. al., 2019	
NF41	F41	Low Gray-Level Zone Emphasis					
NF42	F42	High Gray-Level Zone Emphasis					
NF43	F43	Small Zone / Low Gray Emphasis					
NF44	F44	Small Zone / High Gray Emphasis					
NF45	F45	Large Zone / Low Gray Emphasis					
NF46	F46	Large Zone / High Gray Emphasis				van Griethuysen et. al., 2019	
NF47	F47	Gray-Level Non- Uniformity					
NF48	F48	Zone Size Non- Uniformity					

Feature Symbol 1	Feature Symbol 2	Feature Name	Feature Type	Origin	Paper / Website	Additional Info	Remarks
NF49	F49	Zone Size Percentage				van Griethuysen et. al., 2019	
NF50	F50	SHORT RUN EMPHASIS (SRE)	Gray Level Run Length Features (GRLE)	Matlab implementation (code adjusted)	Mathworks		
NF51	F51	LONG RUN EMPHASIS(LRE)					
NF52	F52	GRAY LEVEL NON- UNIFORMITY (GLN)					
NF53	F53	RUN PERCENTAGE (RP)				van Griethuysen et. al., 2019	
NF54	F54	RUN LENGTH NON- UNIFORMITY (RLN)					
NF55	F55	LOW GRAY LEVEL RUN EMPHASIS (LGRE)					
NF56	F56	HIGH GRAY LEVEL RUN EMPHASIS (HGRE)					
NF57	F57	Heterogeneity	Features of chromatin conformation (by paper of Verbeek et al)	Matlab implementation	Characterization of Chromatin Distribution in Cell Nuclei		
NF58	F58	Homogeneity					
NF59	F59	Margination					
NF60	F60	Clumping					
NF61	F61	Condensation					
NF62	F62	Closest Neighborhood Distance	Distance based features	Matlab implementation			

Feature Symbol 1	Feature Symbol 2	Feature Name	Feature Type	Origin	Paper / Website	Additional Info	Remarks
NF63	F63	Average Distance to 5 Closest Neighbors		Matlab implementation			
NF64	F64	Capacity Fractal Dimension (box counting)	Fractal dimension features	Matlab implementation	Reuter Lab GitHub		
NF65	F65	Information Fractal Dimension					
NF66	F66	Correlation Fractal Dimension					
NF67	F67	Probability Fractal Dimension					
NF68	F68	Mean Lacunarity over all box sizes					
NF69	F69	Median Lacunarity over all box sizes					