Supplementary Material

**Appendix. A.** The information of all 128 selected features. The symbol “√” indicates that the feature is selected.

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| --- | --- | --- | --- | --- | --- |
| Definition | Group | Radiomics Features | Method | *Ftop6* | *F’RT\_S* |
| S=3 | S=4 | S=5 |
| F1 | First-order | original\_firstorder\_10Percentile\_0 | CMIM; DISR; JMI; MIFS; MIM; MRMR; Alpha; | **√** | √ | √ | √ |
| F2 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_0 | CMIM; JMI; MIFS; |  |  |  |  |
| F3 | Wavelet | wavelet-HHL\_glszm\_LowGrayLevelZoneEmphasis\_0 | CMIM; |  |  |  |  |
| F4 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_1 | CMIM; |  |  |  |  |
| F5 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_11 | CMIM; |  |  |  |  |
| F6 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_12 | CMIM; |  |  |  |  |
| F7 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_17 | CMIM; |  |  |  |  |
| F8 | First-order | original\_firstorder\_90Percentile\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F9 | First-order | original\_firstorder\_Kurtosis\_0 | CMIM; DISR; MIM; Alpha; | √ |  |  |  |
| F10 | First-order | original\_firstorder\_MeanAbsoluteDeviation\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F11 | First-order | original\_firstorder\_Mean\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F12 | First-order | original\_firstorder\_Median\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F13 | First-order | original\_firstorder\_RootMeanSquared\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F14 | First-order | original\_firstorder\_Skewness\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F15 | First-order | original\_firstorder\_Variance\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F16 | GLCM | original\_glcm\_Autocorrelation\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F17 | GLCM | original\_glcm\_ClusterProminence\_0 | CMIM; DISR; MIM; Alpha; | √ | √ | √ | √ |
| F18 | GLCM | original\_glcm\_ClusterShade\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F19 | GLCM | original\_glcm\_ClusterTendency\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F20 | GLCM | original\_glcm\_Correlation\_0 | CMIM; DISR; MIM; |  |  |  |  |
| F21 | GLCM | original\_firstorder\_Minimum\_0 | DISR; MIM; |  |  |  |  |
| F22 | GLCM | original\_firstorder\_Range\_0 | DISR; MIM; |  |  |  |  |
| F23 | GLCM | original\_glcm\_DifferenceEntropy\_0 | DISR; MIM; |  |  |  |  |
| F24 | GLCM | original\_glcm\_DifferenceVariance\_0 | DISR; MIM; |  |  |  |  |
| F25 | GLCM | original\_glcm\_JointAverage\_0 | DISR; MIM; |  |  |  |  |
| F26 | GLCM | original\_glcm\_MCC\_0 | DISR; MIM; |  |  |  |  |
| F27 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_0 | JMI; MIFS; MRMR; |  |  |  |  |
| F28 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_20 | JMI; |  |  |  |  |
| F29 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_11 | JMI; |  |  |  |  |
| F30 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_18 | JMI; |  |  |  |  |
| F31 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_1 | JMI; |  |  |  |  |
| F32 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_13 | JMI; |  |  |  |  |
| F33 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_3 | JMI; MRMR; |  |  |  |  |
| F34 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_16 | JMI; |  |  |  |  |
| F35 | Wavelet | wavelet-HHH\_glszm\_HighGrayLevelZoneEmphasis\_18 | JMI; |  |  |  |  |
| F36 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_19 | JMI; |  |  |  |  |
| F37 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_47 | JMI; |  |  |  |  |
| F38 | Wavelet | wavelet-HHH\_glszm\_SizeZoneNonUniformity\_0 | JMI; |  |  |  |  |
| F39 | Wavelet | wavelet-HHL\_glszm\_LowGrayLevelZoneEmphasis\_47 | JMI; |  |  |  |  |
| F40 | Wavelet | wavelet-HHL\_glszm\_LowGrayLevelZoneEmphasis\_41 | JMI; |  |  |  |  |
| F41 | Wavelet | wavelet-HHL\_glszm\_SizeZoneNonUniformity\_2 | JMI; |  |  |  |  |
| F42 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_37 | JMI; |  |  |  |  |
| F43 | Wavelet | wavelet-HHH\_glszm\_GrayLevelVariance\_3 | JMI; MIFS; |  |  |  |  |
| F44 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_34 | JMI; |  |  |  |  |
| F45 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_9 | MIFS; MRMR; |  |  |  |  |
| F46 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_3 | MIFS; MRMR; |  |  |  |  |
| F47 | Wavelet | wavelet-HHH\_glszm\_GrayLevelVariance\_2 | MIFS; MRMR; |  |  |  |  |
| F48 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_2 | MIFS; MRMR; |  |  |  |  |
| F49 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_46 | MIFS; MRMR; |  |  |  |  |
| F50 | Wavelet | wavelet-HHH\_glszm\_GrayLevelVariance\_0 | MIFS; MRMR; |  |  |  |  |
| F51 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_3 | MIFS; |  |  |  |  |
| F52 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_6 | MIFS; MRMR; |  |  |  |  |
| F53 | Wavelet | wavelet-HHH\_glszm\_HighGrayLevelZoneEmphasis\_3 | MIFS; MRMR; |  |  |  |  |
| F54 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_6 | MIFS; |  |  |  |  |
| F55 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_15 | MIFS; MRMR; |  |  |  |  |
| F56 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_3 | MIFS; |  |  |  |  |
| F57 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_49 | MIFS; |  |  |  |  |
| F58 | Wavelet | wavelet-HHL\_glszm\_GrayLevelNonUniformityNormalized\_36 | MIFS; |  |  |  |  |
| F59 | Wavelet | wavelet-HHH\_glszm\_HighGrayLevelZoneEmphasis\_10 | MRMR; |  |  |  |  |
| F60 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_14 | MRMR; |  |  |  |  |
| F61 | Wavelet | wavelet-HHL\_glszm\_HighGrayLevelZoneEmphasis\_0 | MRMR; |  |  |  |  |
| F62 | Wavelet | wavelet-HHL\_glszm\_LowGrayLevelZoneEmphasis\_9 | MRMR; |  |  |  |  |
| F63 | Wavelet | wavelet-HHH\_glszm\_GrayLevelNonUniformityNormalized\_12 | MRMR; |  |  |  |  |
| F64 | Wavelet | wavelet-HHL\_glszm\_GrayLevelVariance\_44 | MRMR; |  |  |  |  |
| F65 | Wavelet | log-sigma-1-0-mm-3D\_firstorder\_Mean\_20 | Fisher; ReliefF; Alpha; FS; TS; | √ |  |  |  |
| F66 | Wavelet | log-sigma-2-0-mm-3D\_firstorder\_Mean\_20 | Fisher; ReliefF; FS; TS; | √ |  |  |  |
| F67 | Wavelet | log-sigma-1-0-mm-3D\_firstorder\_Mean\_21 | Fisher; ReliefF; FS; TS; | √ |  |  |  |
| F68 | Wavelet | log-sigma-2-0-mm-3D\_firstorder\_Mean\_21 | Fisher; ReliefF; FS; TS; | √ |  |  |  |
| F69 | Wavelet | wavelet-LLH\_firstorder\_Variance\_17 | LS; |  |  |  |  |
| F70 | Wavelet | log-sigma-2-0-mm-3D\_firstorder\_90Percentile\_20 | LS; |  |  |  |  |
| F71 | Wavelet | wavelet-LHH\_gldm\_GrayLevelVariance\_25 | LS; |  |  |  |  |
| F72 | Wavelet | wavelet-LHH\_firstorder\_RootMeanSquared\_31 | LS; |  |  |  |  |
| F73 | GLCM | original\_glcm\_SumSquares\_39 | LS; |  |  |  |  |
| F74 | First-order | original\_firstorder\_90Percentile\_48 | LS; |  |  |  |  |
| F75 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Mean\_17 | ReliefF; | √ |  |  |  |
| F76 | Log-sigma | log-sigma-2-0-mm-3D\_firstorder\_Mean\_17 | ReliefF; | √ | √ |  |  |
| F77 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Mean\_18 | ReliefF; Lasso; | √ |  |  |  |
| F78 | Log-sigma | log-sigma-2-0-mm-3D\_firstorder\_Mean\_18 | ReliefF; | √ |  |  |  |
| F79 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Mean\_19 | ReliefF; Lasso; TS; | √ |  |  |  |
| F80 | Log-sigma | log-sigma-2-0-mm-3D\_firstorder\_Mean\_19 | ReliefF; FS; TS; | √ |  |  |  |
| F81 | Log-sigma | log-sigma-3-0-mm-3D\_firstorder\_Mean\_19 | ReliefF; | √ | √ |  | √ |
| F82 | Wavelet | wavelet-LHL\_firstorder\_Mean\_19 | ReliefF; | √ | √ | √ | √ |
| F83 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Skewness\_0 | Alpha; | √ | √ | √ | √ |
| F84 | Wavelet | wavelet-LHH\_firstorder\_Median\_0 | Alpha; | √ | √ | √ | √ |
| F85 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Skewness\_14 | Alpha; | √ |  |  |  |
| F86 | Wavelet | wavelet-LHL\_firstorder\_Median\_14 | Alpha; | √ | √ | √ | √ |
| F87 | Log-sigma | log-sigma-1-0-mm-3D\_glrlm\_LongRunEmphasis\_20 | Alpha; | √ | √ | √ | √ |
| F88 | Wavelet | wavelet-LHL\_firstorder\_Mean\_3 | Alpha; | √ | √ | √ | √ |
| F89 | Log-sigma | original\_glrlm\_LongRunEmphasis\_33 | Alpha; | √ |  |  |  |
| F90 | Wavelet | wavelet-LLL\_firstorder\_Kurtosis\_0 | Lasso; | √ | √ | √ |  |
| F91 | Wavelet | wavelet-LLL\_glrlm\_LongRunHighGrayLevelEmphasis\_0 | Lasso; | √ |  |  | √ |
| F92 | Wavelet | wavelet-LLL\_gldm\_LargeDependenceHighGrayLevelEmphasis\_0 | Lasso; | √ | √ | √ | √ |
| F93 | Wavelet | wavelet-HLL\_firstorder\_Minimum\_16 | Lasso; | √ | √ | √ | √ |
| F94 | Wavelet | wavelet-HLL\_firstorder\_Median\_17 | Lasso; | √ | √ | √ |  |
| F95 | Wavelet | wavelet-HHL\_firstorder\_Skewness\_17 | Lasso; | √ | √ | √ | √ |
| F96 | Wavelet | wavelet-LHL\_glcm\_Imc2\_18 | Lasso; | √ |  |  |  |
| F97 | Log-sigma | log-sigma-2-0-mm-3D\_firstorder\_Skewness\_19 | Lasso; | √ |  |  |  |
| F98 | Wavelet | wavelet-HLL\_firstorder\_Median\_19 | Lasso; | √ |  |  |  |
| F99 | First-order | original\_firstorder\_Energy\_20 | Lasso; | √ | √ | √ | √ |
| F100 | Log-sigma | log-sigma-1-0-mm-3D\_glcm\_MaximumProbability\_20 | Lasso; | √ | √ |  | √ |
| F101 | Wavelet | wavelet-HLL\_firstorder\_Skewness\_21 | Lasso; | √ |  | √ | √ |
| F102 | GLCM | original\_glcm\_MaximumProbability\_26 | Lasso; | √ | √ | √ | √ |
| F103 | First-order | wavelet-LHH\_firstorder\_Median\_45 | Lasso; | √ | √ | √ | √ |
| F104 | Log-sigma | log-sigma-2-0-mm-3D\_glszm\_ZoneVariance\_18 | MCFS |  |  |  |  |
| F105 | Log-sigma | log-sigma-2-0-mm-3D\_glszm\_LargeAreaEmphasis\_18 | MCFS |  |  |  |  |
| F106 | Log-sigma | log-sigma-4-0-mm-3D\_firstorder\_Mean\_35 | MCFS |  |  |  |  |
| F107 | Log-sigma | log-sigma-4-0-mm-3D\_firstorder\_Mean\_36 | MCFS |  |  |  |  |
| F108 | Log-sigma | log-sigma-4-0-mm-3D\_firstorder\_Mean\_34 | MCFS |  |  |  |  |
| F109 | Log-sigma | log-sigma-2-0-mm-3D\_gldm\_GrayLevelNonUniformity\_17 | MCFS |  |  |  |  |
| F110 | GLCM | original\_glcm\_DifferenceVariance\_9 | MCFS |  |  |  |  |
| F111 | GLCM | original\_glcm\_DifferenceVariance\_10 | MCFS |  |  |  |  |
| F112 | Log-sigma | log-sigma-2-0-mm-3D\_gldm\_GrayLevelNonUniformity\_16 | MCFS |  |  |  |  |
| F113 | Log-sigma | log-sigma-2-0-mm-3D\_gldm\_GrayLevelNonUniformity\_18 | MCFS |  |  |  |  |
| F114 | GLCM | original\_glcm\_DifferenceVariance\_8 | MCFS |  |  |  |  |
| F115 | Log-sigma | log-sigma-1-0-mm-3D\_gldm\_LargeDependenceEmphasis\_12 | MCFS |  |  |  |  |
| F116 | Wavelet | wavelet-HLL\_firstorder\_Entropy\_15 | MCFS |  |  |  |  |
| F117 | Log-sigma | log-sigma-4-0-mm-3D\_firstorder\_Mean\_49 | MCFS |  |  |  |  |
| F118 | Log-sigma | log-sigma-1-0-mm-3D\_gldm\_LargeDependenceEmphasis\_13 | MCFS |  |  |  |  |
| F119 | Log-sigma | log-sigma-1-0-mm-3D\_glrlm\_RunPercentage\_12 | MCFS |  |  |  |  |
| F120 | Wavelet | wavelet-HLL\_firstorder\_Entropy\_14 | MCFS |  |  |  |  |
| F121 | GLDM | original\_gldm\_LargeDependenceHighGrayLevelEmphasis\_13 | MCFS |  |  |  |  |
| F122 | Wavelet | wavelet-HLL\_firstorder\_Entropy\_16 | MCFS |  |  |  |  |
| F123 | GLDM | original\_gldm\_LargeDependenceHighGrayLevelEmphasis\_14 | MCFS |  |  |  |  |
| F124 | Log-sigma | log-sigma-1-0-mm-3D\_firstorder\_Mean\_22 | FS; TS; | √ |  | √ |  |
| F125 | Log-sigma | log-sigma-2-0-mm-3D\_firstorder\_Mean\_22 | FS; TS; | √ |  |  |  |
| F126 | Log-sigma | log-sigma-3-0-mm-3D\_firstorder\_Mean\_20 | TS; | √ |  |  | √ |
| F127 | Wavelet | wavelet-HLL\_firstorder\_Mean\_20 | TS; | √ | √ |  | √ |
| F128 | Wavelet | wavelet-HLL\_firstorder\_Mean\_21 | TS; | √ |  |  | √ |