**Supplementary Table 1**: Demographics information for the subset of patients analyzed for cancer and noncancer classification.

|  |  |  |  |
| --- | --- | --- | --- |
|   | Training(n = 74) | Testing(n = 35) | Total(n = 109) |
| Age at RP, years (mean ­± SD) | 60 ± 6 | 60 ± 7 | 60 ± 6 |
| Race (n, %) (n = 101) |  |  |   |
| African American | 8 (4) | 3 (3) | 11 (10) |
| White/Caucasian | 52 (28) | 24 (26) | 76 (70) |
| Asian | 9 (5) | 3 (3) | 12 (11) |
| Other | 2 (1) | 0 (0) | 2 (2) |
| Preoperative PSA, ng/mL (n, %) |  |  |  |
| < 6 | 36 (19) | 21 (23) | 57 (52) |
| ≥ 6 – 10 | 25 (13) | 8 (9) | 33 (30) |
| ≥ 10 – 20 | 12 (6) | 5 (5) | 17 (16) |
| ≥ 20 – 30 | 1 (1) | 1 (1) | 2 (2) |
| Grade group at RP (n, %) |  |  |  |
| 6 | 14 (8) | 8 (9) | 22 (20) |
| 3+4 | 40 (22) | 15 (16) | 55 (50) |
| 4+3 | 10 (5) | 5 (5) | 15 (14) |
| 8 | 3 (2) | 1 (1) | 4 (4) |
| ≥ 9 | 7 (4) | 6 (6) | 13 (12) |
| Clinical Stage (n, %) |  |  |  |
| T1 | 68 (37) | 23 (25) | 91 (83) |
| T2 | 6 (3) | 12 (13) | 18 (17) |
| Surgical Stage (n, %) (n = 274) |  |  |
| 2a,b | 23 (12) | 9 (10) | 32 (29) |
| 2c | 24 (13) | 11 (12) | 35 (32) |
| 3a,b | 27 (15) | 15 (16) | 42 (39) |
| Cribriform Presence (n, %) (n = 257) | 18 (10) | 14 (15) | 32 (29) |

**Supplemental Table 2**. Extracted radiomic features from Pyradiomics. A two-sample t-test was performed to assess significance between features in the BCR regression analysis. *Abbreviations: GLCM = Gray Level Co-occurrence Matrix, GLRLM = Gray Level Run Length Matrix, GLSZM = Gray Level Size Zone Matrix, NGTDM = Neighbouring Gray Tone Difference Matrix, GLDM = Gray Level Dependence Matrix.*

|  |  |  |
| --- | --- | --- |
| **Class** | **Radiomic Feature** | **p-value** |
| First Order | 10Percentile | 0.37 |
| 90Percentile | 0.02\* |
| Energy | 0.37 |
| Entropy | 0.87 |
| InterquartileRange | 0.04\* |
| Kurtosis | 0.22 |
| Maximum | 0.06+ |
| Mean | 0.02\* |
| MeanAbsoluteDeviation | 0.03\* |
| Median | 0.98 |
| Minimum | 0.65 |
| Range | 0.06+ |
| RobustMeanAbsoluteDeviation | 0.03\* |
| RootMeanSquared | 0.04\* |
| Skewness | 0.21 |
| TotalEnergy | 0.75 |
| Uniformity | 0.87 |
| Variance | 0.04\* |
| Shape | Elongation | 0.17 |
| Flatness | 0.17 |
| LeastAxisLength | 0.28 |
| MajorAxisLength | 0.80 |
| Maximum2DDiameterColumn | 0.68 |
| Maximum2DDiameterRow | 0.43 |
| Maximum2DDiameterSlice | 0.72 |
| Maximum3DDiameter | 0.57 |
| MeshVolume | 0.75 |
| MinorAxisLength | 0.35 |
| Sphericity | 0.14 |
| SurfaceArea | 0.95 |
| SurfaceVolumeRatio | 0.52 |
| VoxelVolume | 0.75 |
|  GLCM | Autocorrelation | 0.98 |
| ClusterProminence | 0.53 |
| ClusterShade | 0.76 |
| ClusterTendency | 0.56 |
| Contrast | 0.57 |
| Correlation | 0.55 |
| DifferenceAverage | 0.57 |
| DifferenceEntropy | 0.45 |
| DifferenceVariance | 0.48 |
| Id | 0.57 |
| Idm | 0.57 |
| Idmn | 0.57 |
| Idn | 0.57 |
| Imc1 | 0.43 |
| Imc2 | 0.59 |
| InverseVariance | 0.57 |
| JointAverage | 0.93 |
| JointEnergy | 0.55 |
| JointEntropy | 0.49 |
| MCC | 0.55 |
| MaximumProbability | 0.79 |
| SumAverage | 0.93 |
| SumEntropy | 0.45 |
| SumSquares | 0.95 |
| GLDM | DependenceEntropy | 0.31 |
| DependenceNonUniformity | 0.26 |
| DependenceNonUniformityNormalized | 0.34 |
| DependenceVariance | 0.59 |
| GrayLevelNonUniformity | 0.38 |
| GrayLevelVariance | 0.87 |
| HighGrayLevelEmphasis | 0.76 |
| LargeDependenceEmphasis | 0.76 |
| LargeDependenceHighGrayLevelEmphasis | 0.73 |
| LargeDependenceLowGrayLevelEmphasis | 0.83 |
| LowGrayLevelEmphasis | 0.76 |
| SmallDependenceEmphasis | 0.34 |
| SmallDependenceHighGrayLevelEmphasis | 0.27 |
| SmallDependenceLowGrayLevelEmphasis | 0.45 |
| GLRLM | GrayLevelNonUniformity | 0.46 |
| GrayLevelNonUniformityNormalized | 0.36 |
| GrayLevelVariance | 0.36 |
| HighGrayLevelRunEmphasis | 0.37 |
| LongRunEmphasis | 0.47 |
| LongRunHighGrayLevelEmphasis | 0.50 |
| LongRunLowGrayLevelEmphasis | 0.45 |
| LowGrayLevelRunEmphasis | 0.37 |
| RunEntropy | 0.42 |
| RunLengthNonUniformity | 0.49 |
| RunLengthNonUniformityNormalized | 0.85 |
| RunPercentage | 0.76 |
| RunVariance | 0.49 |
| ShortRunEmphasis | 0.69 |
| ShortRunHighGrayLevelEmphasis | 0.53 |
| ShortRunLowGrayLevelEmphasis | 0.98 |
| GLSZM | GrayLevelNonUniformity | 0.37 |
| GrayLevelNonUniformityNormalized | 0.23 |
| GrayLevelVariance | 0.23 |
| HighGrayLevelZoneEmphasis | 0.69 |
| LargeAreaEmphasis | 0.77 |
| LargeAreaHighGrayLevelEmphasis | 0.72 |
| LargeAreaLowGrayLevelEmphasis | 0.80 |
| LowGrayLevelZoneEmphasis | 0.69 |
| SizeZoneNonUniformity | 0.91 |
| SizeZoneNonUniformityNormalized | 0.07+ |
| SmallAreaEmphasis | 0.06+ |
| SmallAreaHighGrayLevelEmphasis | 0.07+ |
| SmallAreaLowGrayLevelEmphasis | 0.15 |
| ZoneEntropy | 0.06+ |
| ZonePercentage | 0.49 |
| ZoneVariance | 0.77 |
| NGTDM | Busyness | 0.90 |
| Coarseness | 0.64 |
| Complexity | 0.42 |
| Contrast | 0.44 |
| Strength | 0.64 |
| \* p < 0.05+ 0.05 < p < 0.1 |

**Supplemental Table 3**. Model parameters for both the BCR and Cancer/Noncancer tree models. *Abbreviations: MSE = Mean Squared Error, GDI = Dini’s diversity index.*

|  |  |  |
| --- | --- | --- |
| **Property** | **BCR - Value** | **Cancer - Value** |
| Type | Regression | Classification |
| Split Criterion | MSE | GDI |
| Min. Number of Branch Node Observations | 10 | 10 |
| Min. Number of Leaf Node Observations | 4 | 1 |
| Max. Number of Decision Splits | 278 | 100 |
| Prune Criterion | MSE | Error |
| Predictor Selection | All Splits | All Splits |

**Supplemental Table 4**. Extracted radiomic features from Pyradiomics. A two-sample t-test was performed to assess significance between features in the cancer/noncancer classification analysis. *Abbreviations: GLCM = Gray Level Co-occurrence Matrix, GLRLM = Gray Level Run Length Matrix, GLSZM = Gray Level Size Zone Matrix, NGTDM = Neighbouring Gray Tone Difference Matrix, GLDM = Gray Level Dependence Matrix.*

|  |  |  |
| --- | --- | --- |
| **Class** | **Radiomic Feature** | **p-value** |
| First Order | 10Percentile | 4.73E-19\*\*\* |
| 90Percentile | 1.82E-06\*\*\* |
| Energy | 6.00E-70\*\*\* |
| Entropy | 5.31E-14\*\*\* |
| InterquartileRange | 7.94E-15\*\*\* |
| Kurtosis | 0.35 |
| Maximum | 1.60E-38\*\*\* |
| Mean | 0.66 |
| MeanAbsoluteDeviation | 1.77E-21\*\*\* |
| Median | 0.34 |
| Minimum | 2.01E-34\*\*\* |
| Range | 1.90E-46\*\*\* |
| RobustMeanAbsoluteDeviation | 4.51E-16\*\*\* |
| RootMeanSquared | 1.60E-08\*\*\* |
| Skewness | 0.25 |
| TotalEnergy | 3.19E-63\*\*\* |
| Uniformity | 3.34E-16\*\*\* |
| Variance | 1.71E-24\*\*\* |
| Shape | Elongation | 3.37E-20\*\*\* |
| Flatness | 0.02\* |
| LeastAxisLength | 2.23E-28\*\*\* |
| MajorAxisLength | 1.22E-16\*\*\* |
| Maximum2DDiameterColumn | 1.04E-41\*\*\* |
| Maximum2DDiameterRow | 9.85E-48\*\*\* |
| Maximum2DDiameterSlice | 1.03E-35\*\*\* |
| Maximum3DDiameter | 2.62E-34\*\*\* |
| MeshVolume | 9.45E-68\*\*\* |
| MinorAxisLength | 6.63E-55\*\*\* |
| Sphericity | 7.65E-14\*\*\* |
| SurfaceArea | 3.47E-72\*\*\* |
| SurfaceVolumeRatio | 4.82E-36\*\*\* |
| VoxelVolume | 1.04E-67\*\*\* |
|  GLCM | Autocorrelation | 0.14 |
| ClusterProminence | 1.78E-04\*\*\* |
| ClusterShade | 0.96 |
| ClusterTendency | 5.20E-20\*\*\* |
| Contrast | 1.26E-06\*\*\* |
| Correlation | 0.55 |
| DifferenceAverage | 1.26E-06\*\*\* |
| DifferenceEntropy | 2.89E-14\*\*\* |
| DifferenceVariance | 1.78E-14\*\*\* |
| Id | 1.26E-06\*\*\* |
| Idm | 1.26E-06\*\*\* |
| Idmn | 1.26E-06\*\*\* |
| Idn | 1.26E-06\*\*\* |
| Imc1 | 0.17 |
| Imc2 | 4.24E-04\*\*\* |
| InverseVariance | 1.26E-06\*\*\* |
| JointAverage | 0.06+ |
| JointEnergy | 8.54E-22\*\*\* |
| JointEntropy | 2.30E-21\*\*\* |
| MCC | 4.83E-26\*\*\* |
| MaximumProbability | 0.86 |
| SumAverage | 0.06+ |
| SumEntropy | 4.03E-23\*\*\* |
| SumSquares | 1.46E-21\*\*\* |
| GLDM | DependenceEntropy | 4.77E-24\*\*\* |
| DependenceNonUniformity | 4.15E-56\*\*\* |
| DependenceNonUniformityNormalized | 7.76E-07\*\*\* |
| DependenceVariance | 7.44E-52\*\*\* |
| GrayLevelNonUniformity | 3.53E-74\*\*\* |
| GrayLevelVariance | 3.34E-16\*\*\* |
| HighGrayLevelEmphasis | 0.19 |
| LargeDependenceEmphasis | 2.25E-72\*\*\* |
| LargeDependenceHighGrayLevelEmphasis | 4.15E-61\*\*\* |
| LargeDependenceLowGrayLevelEmphasis | 4.98E-48\*\*\* |
| LowGrayLevelEmphasis | 0.19 |
| SmallDependenceEmphasis | 4.75E-35\*\*\* |
| SmallDependenceHighGrayLevelEmphasis | 1.95E-35\*\*\* |
| SmallDependenceLowGrayLevelEmphasis | 3.54E-24\*\*\* |
| GLRLM | GrayLevelNonUniformity | 2.26E-75\*\*\* |
| GrayLevelNonUniformityNormalized | 2.08E-11\*\*\* |
| GrayLevelVariance | 2.08E-11\*\*\* |
| HighGrayLevelRunEmphasis | 0.29 |
| LongRunEmphasis | 1.26E-26\*\*\* |
| LongRunHighGrayLevelEmphasis | 2.26E-26\*\*\* |
| LongRunLowGrayLevelEmphasis | 7.25E-21\*\*\* |
| LowGrayLevelRunEmphasis | 0.29 |
| RunEntropy | 2.30E-12\*\*\* |
| RunLengthNonUniformity | 2.24E-58\*\*\* |
| RunLengthNonUniformityNormalized | 2.67E-08\*\*\* |
| RunPercentage | 1.54E-04\*\*\* |
| RunVariance | 4.50E-32\*\*\* |
| ShortRunEmphasis | 5.76E-04\*\*\* |
| ShortRunHighGrayLevelEmphasis | 0.004\*\* |
| ShortRunLowGrayLevelEmphasis | 0.003\*\* |
| GLSZM | GrayLevelNonUniformity | 7.08E-31\*\*\* |
| GrayLevelNonUniformityNormalized | 0.02\* |
| GrayLevelVariance | 0.02\* |
| HighGrayLevelZoneEmphasis | 0.002\*\* |
| LargeAreaEmphasis | 1.33E-50\*\*\* |
| LargeAreaHighGrayLevelEmphasis | 1.35E-47\*\*\* |
| LargeAreaLowGrayLevelEmphasis | 1.39E-46\*\*\* |
| LowGrayLevelZoneEmphasis | 0.002\*\* |
| SizeZoneNonUniformity | 9.24E-26\*\*\* |
| SizeZoneNonUniformityNormalized | 1.21E-04\*\*\* |
| SmallAreaEmphasis | 1.67E-08\*\*\* |
| SmallAreaHighGrayLevelEmphasis | 3.79E-07\*\*\* |
| SmallAreaLowGrayLevelEmphasis | 4.78E-05\*\*\* |
| ZoneEntropy | 2.51E-17\*\*\* |
| ZonePercentage | 9.78E-13\*\*\* |
| ZoneVariance | 7.79E-53\*\*\* |
| NGTDM | Busyness | 3.29E-04\*\*\* |
| Coarseness | 0.02\* |
| Complexity | 1.97E-29\*\*\* |
| Contrast | 3.19E-34\*\*\* |
| Strength | 2.97E-07\*\*\* |
| \* p < 0.05\*\* 0.001 < p < 0.01\*\*\* p < 0.001+ 0.05 < p < 0.1 |