**One\_std:**

**RF**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Rf10** | **1.000** | **0.854** | **0.880** | Rf11 | 1.000 | 0.852 | 0.894 | RF3 | 1.000 | 0.776 | 0.764 |
| **动脉期** | Rf3 | 1.000 | 0.818 | 0.807 | **Rf5** | **1.000** | **0.839** | **0.829** | Rf10 | 1.000 | 0.827 | 0.816 |
| **静脉期** | Rf3 | 1.000 | 0.760 | 0.761 | **Rf5** | **1.000** | **0.791** | **0.827** | Rf12 | 1.000 | 0.788 | 0.805 |

**Lr:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Lr2 | 0.833 | 0.819 | 0.833 | **Lr2** | **0.850** | **0.838** | **0.819** | Lr1 | 0.821 | 0.812 | 0.799 |
| **动脉期** | Lr1 | 0.845 | 0.834 | 0.844 | **Lr3** | **0.856** | **0.838** | **0.837** | Lr1 | 0.845 | 0.834 | 0.844 |
| **静脉期** | Lr1 | 0.793 | 0.790 | 0.876 | Lr1 | 0.793 | 0.790 | 0.876 | **Lr1** | **0.792** | **0.798** | **0.826** |

**SVM:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | SVM1 | 0.821 | 0.812 | 0.799 | **SVM2** | **0.848** | **0.831** | **0.817** | SVM1 | 0.821 | 0.812 | 0.799 |
| **动脉期** | Svm1 | 0.845 | 0.831 | 0.844 | **14** | **0.906** | **0.843** | **0.792** | Svm1 | 0.845 | 0.831 | 0.844 |
| **静脉期** | **Svm1** | **0.793** | **0.787** | **0.876** | Svm1 | 0.793 | 0.787 | 0.876 | Svm1 | 0.792 | 0.787 | 0.826 |

**重新拆分数据及后：**

**Rf:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Rf5** | **1.000** | **0.913** | **0.805** | Rf6 | 1.000 | 0.895 | 0.808 | Rf8 | 1.000 | 0.896 | 0.837 |
| **动脉期** | **Rf12** | **1.000** | **0.912** | **0.705** | Rf3 | 1.000 | 0.868 | 0.694 | Rf4 | 1.000 | 0.869 | 0.712 |
| **静脉期** | **Rf3** | **1.000** | **0.868** | **0.687** | Rf3 | 1.000 | 0.868 | 0.687 | Rf9 | 1.000 | 0.832 | 0.777 |

**Lr:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Lr2** | **0.840** | **0.828** | **0.751** | Lr1 | 0.815 | 0.814 | 0.759 | Lr1 | 0.815 | 0.814 | 0.759 |
| **动脉期** | **Lr1** | **0.830** | **0.825** | **0.775** | Lr1 | 0.830 | 0.825 | 0.775 | Lr1 | 0.830 | 0.825 | 0.775 |
| **静脉期** | **Lr9** | **0.809** | **0.770** | **0.739** | Lr9 | 0.793 | 0.757 | 0.796 | Lr1 | 0.779 | 0.768 | 0.796 |

**Svm:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Svm2** | **0.840** | **0..834** | **0.759** | Svm2 | 0.840 | 0.834 | 0.759 | Svm1 | 0.814 | 0.811 | 0.759 |
| **动脉期** | **Svm1** | **0.830** | **0.821** | **0.775** | Svm1 | 0.830 | 0.821 | 0.775 | Svm1 | 0.830 | 0.821 | 0.775 |
| **静脉期** | Svm2 | 0.757 | 0.752 | 0.804 | Svm6 | 0.762 | 0.759 | 0.808 | **Svm1** | **0.780** | **0.770** | **0.796** |

**30features:**

**Rf:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Rf12** | **1.000** | **0.768** | **0.823** | Rf26 | 1.000 | 0.754 | 0.833 | Rf2 | 1.000 | 0.721 | 0.776 |
| **动脉期** | Rf3 | 1.000 | 0.761 | 0.766 | **Rf5** | **1.000** | **0.787** | **0.788** | Rf2 | 1.000 | 0.778 | 0.737 |
| **静脉期** | Rf4 | 1.000 | 0.729 | 0.658 | **Rf9** | **1.000** | **0.818** | **0.711** | Rf6 | 1.000 | 0.767 | 0.730 |

**Lr:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Lr1 | 0.799 | 0.779 | 0.789 | **Lr2** | **0.830** | **0.791** | **0.774** | Lr1 | 0.799 | 0.779 | 0.789 |
| **动脉期** | **Lr1** | **0.819** | **0.817** | **0.797** | Lr2 | 0.839 | 0.802 | 0.797 | Lr1 | 0.824 | 0.786 | 0.797 |
| **静脉期** | Lr1 | 0.811 | 0.780 | 0.753 | Lr1 | 0.811 | 0.780 | 0.753 | **Lr1** | **0.809** | **0.791** | **0.764** |

**Svm:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Svm1 | 0.799 | 0.775 | 0.789 | **Svm2** | **0.827** | **0.788** | **0.782** | Svm1 | 0.799 | 0.775 | 0.789 |
| **动脉期** | **Svm1** | **0.820** | **0.818** | **0.797** | Svm1 | 0.823 | 0.798 | 0.797 | Svm1 | 0.823 | 0.798 | 0.797 |
| **静脉期** | Svm1 | 0.800 | 0.757 | 0.753 | Svm1 | 0.800 | 0.757 | 0.753 | **Svm1** | **0.808** | **0.784** | **0.764** |

**Model\_6**

**Rf:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Rf13 | 1.000 | 0.887 | 0.831 | **Rf20** | **1.000** | **0.903** | **0.827** | Rf5 | 1.000 | 0.868 | 0.774 |
| **动脉期** | Rf1 | 1.000 | 0.823 | 0.680 | Rf1 | 1.000 | 0.823 | 0.680 | **Rf3** | **1.000** | **0.845** | **0.764** |
| **静脉期** | Rf15 | 1.000 | 0.829 | 0.738 | Rf16 | 1.000 | 0.812 | 0.760 | **Rf15** | **1.000** | **0.833** | **0.766** |

**Lr:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Lr12 | 0.895 | 0.859 | 0.828 | Lr4 | 0.846 | 0.827 | 0.820 | **Lr5** | **0.882** | **0.864** | **0.753** |
| **动脉期** | Lr1 | 0.816 | 0.807 | 0.824 | Lr1 | 0.816 | 0.807 | 0.824 | **Lr4** | **0.868** | **0.857** | **0.831** |
| **静脉期** | **Lr1** | **0.822** | **0.814** | **0.791** | Lr1 | 0.822 | 0.814 | 0.791 | Lr1 | 0.822 | 0.814 | 0.791 |

**Svm:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | 12 | 0.894 | 0.856 | 0.805 | Svm8 | 0.869 | 0.854 | 0.804 | **21** | **0.935** | **0.863** | **0.739** |
| **动脉期** | Svm2 | 0.826 | 0.816 | 0.828 | Svm2 | 0.826 | 0.816 | 0.828 | **Svm6** | **0.876** | **0.866** | **0.812** |
| **静脉期** | **Svm1** | **0.821** | **0.813** | **0.791** | Svm1 | 0.821 | 0.813 | 0.791 | Svm1 | 0.821 | 0.813 | 0.791 |

**Model\_7**

**Rf:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | Rf14 |  | 0.911 | 0.810 | **Rf20** |  | **0.916** | **0.827** | Rf5 |  | 0.859 | 0.774 |
| **动脉期** | Rf2 |  | 0.836 | 0.713 | Rf2 |  | 0.836 | 0.713 | **Rf3** |  | **0.852** | **0.764** |
| **静脉期** | Rf14 |  | 0.840 | 0.737 | Rf12 |  | 0.837 | 0.749 | **Rf20** |  | **1.000** | **0.799** |

**Lr:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **Lr12** | **0.894** | **0.863** | **0.828** | Lr8 | 0.874 | 0.843 | 0.749 | Lr5 | 0.882 | 0.853 | 0.753 |
| **动脉期** | Lr1 | 0.815 | 0.802 | 0.824 | Lr1 | 0.815 | 0.802 | 0.824 | **Lr6** | **0.888** | **0.861** | **0.810** |
| **静脉期** | **Lr1** | **0.820** | **0.816** | **0.791** | Lr1 | 0.820 | 0.816 | 0.791 | Lr1 | 0.821 | 0.816 | 0.791 |

**Svm:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **特征类数** | **2kind** | | | | **3kind** | | | | **4kind** | | | |
| **模型和AUC值** | Model | train | Val | Test | Model | train | Val | Test | Model | train | Val | Test |
| **平扫期** | **12** | **0.891** | **0.856** | **0.805** | 11 | 0.885 | 0.852 | 0.841 | 20 | 0.929 | 0.856 | 0.751 |
| **动脉期** | 2 | 0.825 | 0.811 | 0.828 | 2 | 0.825 | 0.811 | 0.828 | **6** | **0.876** | **0.857** | **0.812** |
| **静脉期** | **1** | **0.820** | **0.812** | **0.791** | 1 | 0.820 | 0.812 | 0.791 | 1 | 0.820 | 0.813 | 0.791 |

**选取lr：**

平扫：0.828 [0.809,0.846]

动脉：0.810 [0.791,0.829]

静脉：0.791 [0.771.0.811]

平扫+动脉：0.841 [0.823, 0.859]

平扫+静脉：0.833 [0.815,0.852]

动脉+静脉：0.822 [0.803,0.840]

三期：0.839 [0.821,0.857]

non\_contrast and arterial:Ttest\_indResult(statistic=5.495819664160591, pvalue=4.386654544076355e-08)

non\_contrast and venous:Ttest\_indResult(statistic=10.796654745150857, pvalue=1.886987382845628e-26)

arterial and venous:Ttest\_indResult(statistic=5.471582012570708, pvalue=5.02089615008149e-08)

n\_a and n\_v:Ttest\_indResult(statistic=3.9033240466653183, pvalue=9.802620812466025e-05)

n\_a and n\_v:Ttest\_indResult(statistic=3.9033240466653183, pvalue=9.802620812466025e-05)

n\_v and a\_v:Ttest\_indResult(statistic=3.111944160504231, pvalue=0.0018848912011394888)

threeandn\_a:Ttest\_indResult(statistic=0.6345353321151374, pvalue=0.5258041627889589)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| model | Train AUC | Test AUC(95% CI) | sensesity | specialty | weight |
| Non-contrast | 0.876 | 0.828([0.699,0.950]) | 0.778 | 0.759 | / |
| Arterial | 0.860 | 0.810([0.681,0.936]) | 0.833 | 0.759 | / |
| Venous | 0.807 | 0.791([0.654,0.930]) | 0.833 | 0.759 | / |
| Three periods | 0.885 | 0.839([0.723,0.960]) | 0.833 | 0.793 | 1.79，1.88，0.25 |
| **Non-contrast + arterial** | **0.888** | **0.841([0.726,0.961])** | **0.833** | **0.828** | **1.86，1.96** |
| Arterial + venous | 0.860 | 0.822([0.701,0.944]) | 0.778 | 0.793 | 2.62，0.80 |
| Non-contrast + venous | 0.868 | 0.833([0.705,0.957]) | 0.778 | 0.793 | 2.49，0.91 |

**12.17更新**

wicoxon

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Non-contrast | Corticomedullar | Nephrographic | NC+C | C+N | NC+N | Three-phases |
| Non-contrast |  | 0.657 | 0.220 | 0.025 | 0.117 | 0.017 | 0.038 |
| Corticomedullar |  |  | 0.120 | 0.018 | 0.008 | 0.061 | 0.022 |
| Nephrographic |  |  |  | 0.011 | 0.002 | 0.007 | 0.007 |
| NC+Cn |  |  |  |  | 0.992 | 0.505 | 0.147 |
| C+N |  |  |  |  |  | 0.459 | 0.680 |
| NC+N |  |  |  |  |  |  | 0.505 |
| Three-phases |  |  |  |  |  |  |  |

non\_contrast (0.6942223663576866, 0.9550677681721494)

arterial (0.6842238416451829, 0.9395422259310307)

venous (0.660538699238018, 0.9176324325425864)

['non\_contrast', 'arterial'] (0.7196821120072872, 0.962969676770195)

['non\_contrast', 'venous'] (0.7088251574875453, 0.9543413260427607)

['arterial', 'venous'] (0.6951023661196056, 0.9402055167896057)

['non\_contrast', 'arterial', 'venous'] (0.723797988113491, 0.956875245633229)

non\_contrast and arterial:Ttest\_indResult(statistic=4.334116055719249, pvalue=1.53614909647412e-05)

non\_contrast and venous:Ttest\_indResult(statistic=12.035347295188407, pvalue=2.936789171151402e-32)

non\_contrast and n\_a:Ttest\_indResult(statistic=-5.796987092859052, pvalue=7.828497291156199e-09)

non\_contrast and a\_v:Ttest\_indResult(statistic=2.4211613111977317, pvalue=0.015559577951715161)

non\_contrast and n\_v:Ttest\_indResult(statistic=-2.4009252919704376, pvalue=0.01644457765541123)

non\_contrast and united:Ttest\_indResult(statistic=-5.560511267192482, pvalue=3.050990535692061e-08)

arterial and venous:Ttest\_indResult(statistic=7.799337236542908, pvalue=9.944243047310421e-15)

arterial and n\_a:Ttest\_indResult(statistic=-10.348782132347624, pvalue=1.7392503982530306e-24)

arterial and a\_v:Ttest\_indResult(statistic=-2.0212068103974823, pvalue=0.04339147313699849)

arterial and n\_v:Ttest\_indResult(statistic=-6.89424081146238, pvalue=7.236610485792282e-12)

arterial and united:Ttest\_indResult(statistic=-10.202542474788322, pvalue=7.344796486679036e-24)

venous and n\_a:Ttest\_indResult(statistic=-18.295010683871126, pvalue=2.981105689812318e-69)

venous and a\_v:Ttest\_indResult(statistic=-9.969671814246155, pvalue=7.013908452243228e-23)

venous and n\_v:Ttest\_indResult(statistic=-14.818765819412482, pvalue=3.236978204850817e-47)

venous and united:Ttest\_indResult(statistic=-18.307438826657734, pvalue=2.452041677082423e-69)

n\_a and a\_v:Ttest\_indResult(statistic=8.496826945937546, pvalue=3.7492352016005974e-17)

n\_a and n\_v:Ttest\_indResult(statistic=3.494067369370779, pvalue=0.00048608201382202424)

n\_a and united:Ttest\_indResult(statistic=0.36397520868219657, pvalue=0.7159150334573499)

n\_v and a\_v:Ttest\_indResult(statistic=4.977113983076007, pvalue=7.006993720489381e-07)

n\_v and united:Ttest\_indResult(statistic=-3.205200928498902, pvalue=0.0013709804286259038)

a\_v and united:Ttest\_indResult(statistic=-8.313009658489397, pvalue=1.7018499381093876e-16)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Non-contrast | Corticomedullar | Nephrographic | NC+C | C+N | NC+N | Three-phases |
| Non-contrast |  | 1.54e-5 | 2.94e-32 | 7.83e-9 | 0.0156 | 0.0164 | 3.05e-8 |
| Corticomedullar |  |  | 9.94e-15 | 1.74e-24 | 0.0434 | 7.24e-12 | 7.34e-24 |
| Nephrographic |  |  |  | 2.98e-69 | 7.01e-23 | 3.24e-47 | 2.45e-69 |
| NC+C |  |  |  |  | 3.75e-17 | 4.86e-4 | 0.716 |
| C+N |  |  |  |  |  | 7.001e-7 | 1.70e-16 |
| NC+N |  |  |  |  |  |  | 1.47e-3 |
| Three-phases |  |  |  |  |  |  |  |

训练集（不含smote）：

non\_contrast (0.8120074420384937, 0.9418140038356304)

NCP: auc:0.876, acc: 0.761, sen: 0.732, spe: 0.779

arterial (0.7783349074195993, 0.9420524177558984)

CMP: auc:0.860, acc: 0.817, sen: 0.780, spe: 0.838

venous (0.721761891006899, 0.8935369418007715)

NP: auc:0.807, acc: 0.697, sen: 0.634, spe: 0.735

['non\_contrast', 'arterial'] (0.8178781151860404, 0.9570220206015327)

NCP+CMP: auc:0.888, acc: 0.817, sen: 0.707, spe: 0.882

['non\_contrast', 'venous'] (0.8001754072282629, 0.9366011521657028)

NCP+NP: auc:0.868, acc: 0.771, sen: 0.659, spe: 0.838

['arterial', 'venous'] (0.7872882351028504, 0.9372229723147406)

CMP+NP: auc:0.860, acc: 0.807, sen: 0.683, spe: 0.882

['non\_contrast', 'arterial', 'venous'] (0.8162519953230186, 0.9569944919052916)

NCP+CMP+NP: auc:0.885, acc: 0.826, sen: 0.732, spe: 0.882