|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Algorithm | Hyperparameters | RAC  Strength | NAC  Strength | RAC Carbonization | RAC Chloride Ion Erosion | RAC Sulfate Corrosion |
| Decision Tree | Criterion | Squared Error | Squared Error | Squared Error | Squared Error | Squared Error |
| Max Depth | 5 | 10 | 10 | 7 | 5 |
| Max Features | 100 | 500 | 1000 | 1000 | 500 |
| Min Samples / Leaf | 1 | 1 | 2 | 2 | 1 |
| Min Samples Split | 2 | 2 | 2 | 2 | 5 |
| Random Forest | Bootstrap | True | True | True | True | True |
| Max Depth | 9 | 9 | 9 | 9 | 7 |
| Max Samples | 0.9 | 0.9 | 0.9 | 0.7 | 0.9 |
| Min Samples Leaf | 1 | 1 | 1 | 1 | 1 |
| Min Samples Split | 2 | 2 | 2 | 2 | 2 |
| No Of Estimators | 300 | 300 | 100 | 100 | 300 |
| AdaBoost | Learning Rate | 1 | 1 | 0.1 | 1 | 0.01 |
| Loss | Square | Square | Square | Square | Exponential |
| No Of Estimators | 50 | 500 | 500 | 1000 | 100 |
| GBDT | Criterion | Friedman MSE | Friedman MSE | Friedman MSE | Friedman MSE | Friedman MSE |
| Learning Rate | 0.1 | 0.15 | 0.15 | 0.2 | 0.2 |
| Loss | Squared Error | Squared Error | Squared Error | Squared Error | Squared Error |
| Max Depth | 3 | 5 | 3 | 3 | 3 |
| No Of Estimators | 500 | 100 | 231 | 231 | 50 |
| Subsample | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 |
| Historical GBDT | Learning Rate | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| Loss | Squared Error | Squared Error | Squared Error | Squared Error | Absolute Error |
| Max Depth | 4 | 5 | 3 | 3 | 4 |
| Max Iterations | 200 | 100 | 500 | 200 | 500 |
| Min Samples Leaf | 5 | 5 | 5 | 5 | 10 |
| XGBoost | Sample By Tree | 0.8 | 1 | 1 | 0.8 | 1 |
| Gamma | 0.5 | 0 | 0.1 | 0 | 0 |
| Learning Rate | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 |
| Max Depth | 5 | 5 | 3 | 3 | 5 |
| No Of Estimators | 200 | 100 | 200 | 207 | 200 |
| Reg Alpha | 0.3 | 0.1 | 0.3 | 0 | 0.1 |
| Subsample | 0.9 | 1 | 0.9 | 0.8 | 0.8 |
| XGBoost Random Forest | Learning Rate | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Max Depth | 7 | 7 | 7 | 7 | 7 |
| No Of Estimators | 50 | 50 | 100 | 500 | 50 |
| Reg Alpha | 0 | 0 | 0.1 | 0.3 | 0 |
| Reg Lamba | 0 | 0 | 0 | 0 | 0 |
| Subsample | 1 | 1 | 1 | 0.8 | 1 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Algorithm | Accuracy Metric | RAC Strength | NAC Strength | RAC Carbonization | RAC Chloride Ion Erosion | RAC Sulfate Corrosion |
| Decision Trees | R Squared | 76 | 81.87 | 76.5 | 51 | 60 |
| MSE | 55.25 | 0.031 | 12.6 | 91787 | 0.01 |
| RMSE | 6.6 | 0.177 | 3.55 | 1044 | 0.1 |
| MAE | 5 | 0.104 | 2.483 | 584 | 0.061 |
| Random Forest | R Squared | 83.4 | 89.87 | 86 | 76.8 | 86.5 |
| MSE | 42.35 | 0.071 | 7.4 | 85718 | 0.003 |
| RMSE | 6.506 | 0.267 | 2.72 | 621 | 0.057 |
| MAE | 4.465 | 0.079 | 1.948 | 439 | 0.033 |
| AdaBoost | R Squared | 70.1 | 89.9 | 71.6 | 68.8 | 81.9 |
| MSE | 76.93 | 0.22 | 14.489 | 12575 | 0.004 |
| RMSE | 8.771 | 0.469 | 3.806 | 615 | 0.063 |
| MAE | 7.029 | 0.294 | 3.073 | 516.128 | 0.043 |
| GBDT | R Squared | 86.1 | 89.97 | 94.5 | 86.5 | 86.2 |
| MSE | 35.82 | 0.05 | 3.207 | 35718 | 0.003 |
| RMSE | 5.985 | 0.224 | 1.791 | 485.508 | 0.058 |
| MAE | 4.093 | 0.086 | 1.236 | 332.121 | 0.041 |
| Historical GBDT | R Squared | 83 | 89.99 | 92.9 | 86.6 | 74.9 |
| MSE | 40.976 | 0.164 | 4.02 | 45127 | 0.005 |
| RMSE | 6.401 | 0.405 | 2.005 | 495 | 0.074 |
| MAE | 4.486 | 0.14 | 1.286 | 375.782 | 0.049 |
| XGBoost | R Squared | 92.1 | 89.998 | 93.9 | 86.3 | 80.3 |
| MSE | 21.212 | 0.118 | 3.867 | 33844 | 0.004 |
| RMSE | 4.606 | 0.344 | 1.967 | 483.574 | 0.066 |
| MAE | 3.764 | 0.14 | 1.337 | 349.1 | 0.04 |
| XGBoost  Random  Forest | R Squared | 83.3 | 89.979 | 86.4 | 75.7 | 85 |
| MSE | 42.55 | 0.083 | 7.266 | 13130 | 0.003 |
| RMSE | 6.523 | 0.289 | 2.68 | 634 | 0.058 |
| MAE | 4.506 | 0.084 | 1.86 | 457 | 0.033 |