**Table 4:** The optimal combinations for five machine learning regression models based on sensitivity analysis scenario training and validation

**ARAMT model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Train | | | | | | Test | | | | | |
| Combinations | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** | **Combinations** | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** |
| No A2 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A2 | 0.9921 | 0.4009 | 0.4954 | 0.50239 | 0.54367 |
| No A4 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A4 | 0.9496 | 0.6392 | 0.7358 | 0.800921 | 0.80897 |
| No A6 | 1 | 0 | 0 | 0.000036 | 0.000035 | No A6 | 0.9941 | 0.4975 | 0.5931 | 0.62341 | 0.64967 |
| No A13 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A13 | 0.9866 | 0.4612 | 0.606 | 0.57793 | 0.66381 |
| No A22 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A22 | 0.4944 | 0.9363 | 1.0912 | 1.173294 | 1.19536 |
| No A31 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A31 | 0.9846 | 0.3013 | 0.3203 | 0.37515 | 0.35071 |
| No A35 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A35 | 0.9555 | 0.7249 | 0.7955 | 0.90834 | 0.87147 |
| No A43 | 1 | 0 | 0 | 0.000035 | 0.000035 | No A43 | 0.9941 | 0.4703 | 0.5454 | 0.58936 | 0.59746 |
| No A46 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A46 | 0.9784 | 0.4817 | 0.6144 | 0.60364 | 0.67302 |
| No A60 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A60 | 0.985 | 0.2488 | 0.2783 | 0.31179 | 0.30484 |
| No A63 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A63 | 0.4285 | 0.9594 | 1.175 | 1.19713 | 1.2877 |
| No A64 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A64 | 0.9938 | 0.5271 | 0.6334 | 0.66043 | 0.69385 |
| No A75 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A75 | 0.9781 | 0.5878 | 0.7154 | 0.73655 | 0.78372 |
| No A76 | 1 | 0 | 0 | 0.000034 | 0.000035 | No A76 | 0.8892 | 0.698 | 0.7964 | 0.8746 | 0.87238 |

**AMT model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Train | | | | | | Test | | | | | |
| Combinations | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** | **Combinations** | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** |
| No A2 | 1 | 0.0035 | 0.0047 | 0.00444 | 0.004793 | No A2 | 0.8607 | 0.773 | 0.9139 | 0.96861 | 1.00111 |
| No A4 | 0.999 | 0.0077 | 0.0105 | 0.009924 | 0.01073 | No A4 | 0.8244 | 0.7692 | 0.9791 | 0.96381 | 1.07257 |
| No A6 | 1 | 0.0062 | 0.008 | 0.007939 | 0.008124 | No A6 | 0.7444 | 0.8275 | 0.991 | 1.03693 | 1.0856 |
| No A13 | 1 | 0.0056 | 0.0072 | 0.000721 | 0.007367 | No A13 | 0.7882 | 0.7852 | 0.9649 | 0.98386 | 1.05701 |
| No A22 | 1 | 0.0011 | 0.0016 | 0.001378 | 0.001628 | No A22 | -0.1611 | 1.7553 | 2.5627 | 2.19945 | 2.807307 |
| No A31 | 1 | 0.0049 | 0.0094 | 0.006341 | 0.009583 | No A31 | 0.94 | 0.2734 | 0.3634 | 0.34263 | 0.39812 |
| No A35 | 0.999 | 0.0102 | 0.0132 | 0.0131 | 0.01346 | No A35 | 0.7824 | 0.8105 | 1.0321 | 1.01554 | 1.13065 |
| No A43 | 1 | 0.0051 | 0.0065 | 0.006589 | 0.006639 | No A43 | 0.8407 | 0.697 | 0.8733 | 0.87336 | 0.95661 |
| No A46 | 1 | 0.0062 | 0.0092 | 0.007973 | 0.009427 | No A46 | 0.991 | 0.3468 | 0.5578 | 0.43453 | 0.61104 |
| No A60 | 0.999 | 0.0104 | 0.0126 | 0.01335 | 0.01286 | No A60 | 0.9378 | 0.6456 | 0.6797 | 0.80903 | 0.7446 |
| No A63 | 1 | 0.0111 | 0.0162 | 0.01428 | 0.01654 | No A63 | 0.4989 | 1.0559 | 1.174 | 1.32308 | 1.28689 |
| No A64 | 1 | 0.0055 | 0.0075 | 0.007056 | 0.007652 | No A64 | 0.8359 | 0.9587 | 1.0455 | 1.20129 | 1.14523 |
| No A75 | 0.999 | 0.0107 | 0.0131 | 0.01375 | 0.01338 | No A75 | 0.7953 | 1.004 | 1.0891 | 1.25804 | 1.193076 |
| No A76 | 1 | 0.0025 | 0.0032 | 0.00321 | 0.003295 | No A76 | 0.886 | 0.684 | 0.7859 | 0.85711 | 0.86093 |

**GP model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Train | | | | | | Test | | | | | |
| Combinations | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** | **Combinations** | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** |
| No A2 | 0.9156 | 0.6568 | 0.8162 | 0.84312 | 0.83376 | No A2 | 0.8171 | 0.6765 | 0.7724 | 0.84764 | 0.84613 |
| No A4 | 0.9121 | 0.6582 | 0.8196 | 0.84498 | 0.83725 | No A4 | 0.8302 | 0.6817 | 0.7757 | 0.8542 | 0.84974 |
| No A6 | 0.9006 | 0.6577 | 0.8198 | 0.84432 | 0.83738 | No A6 | 0.8319 | 0.6837 | 0.7753 | 0.85671 | 0.8493 |
| No A13 | 0.9088 | 0.6587 | 0.8202 | 0.84557 | 0.83782 | No A13 | 0.8475 | 0.6796 | 0.7705 | 0.85157 | 0.84407 |
| No A22 | 0.9112 | 0.6598 | 0.8232 | 0.84703 | 0.8409 | No A22 | 0.7954 | 0.6852 | 0.7852 | 0.8586 | 0.86018 |
| No A31 | 0.9074 | 0.6595 | 0.8217 | 0.84657 | 0.83938 | No A31 | 0.8129 | 0.6922 | 0.7855 | 0.867421 | 0.86044 |
| No A35 | 0.9132 | 0.6626 | 0.8264 | 0.8506 | 0.84414 | No A35 | 0.7366 | 0.6894 | 0.7938 | 0.86383 | 0.86953 |
| No A43 | 0.9016 | 0.6562 | 0.8212 | 0.84236 | 0.83883 | No A43 | 0.8549 | 0.6832 | 0.7678 | 0.85606 | 0.84107 |
| No A46 | 0.8811 | 0.678 | 0.8445 | 0.87041 | 0.86265 | No A46 | 0.8469 | 0.7041 | 0.7959 | 0.8823 | 0.87191 |
| No A60 | 0.907 | 0.6645 | 0.8246 | 0.85303 | 0.84231 | No A60 | 0.8208 | 0.6916 | 0.7782 | 0.86656 | 0.8525 |
| No A63 | 0.8329 | 0.6876 | 0.8513 | 0.88273 | 0.86964 | No A63 | 0.7675 | 0.6903 | 0.8001 | 0.86496 | 0.87646 |
| No A64 | 0.9166 | 0.6557 | 0.8164 | 0.84174 | 0.83398 | No A64 | 0.8295 | 0.6764 | 0.7734 | 0.8476 | 0.84716 |
| No A75 | 0.9163 | 0.6629 | 0.8234 | 0.85099 | 0.84106 | No A75 | 0.8329 | 0.6813 | 0.7803 | 0.85369 | 0.85478 |
| No A76 | 0.9109 | 0.6591 | 0.8237 | 0.84611 | 0.84139 | No A76 | 0.7915 | 0.6992 | 0.7943 | 0.87613 | 0.870065 |

**M5P model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Train | | | | | | Test | | | | | |
| Combinations | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** | **Combinations** | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** |
| No A2 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A2 | 0.8074 | 0.7941 | 0.8616 | 0.99499 | 0.94386 |
| No A4 | 0.975 | 0.1538 | 0.2177 | 0.19744 | 0.22238 | No A4 | 0.8332 | 0.6898 | 0.8217 | 0.86441 | 0.90102 |
| No A6 | 0.8925 | 0.2254 | 0.4415 | 0.28933 | 0.451 | No A6 | 0.8666 | 0.7015 | 0.8136 | 0.87902 | 0.89124 |
| No A13 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A13 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A22 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A22 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A31 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A31 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A35 | 0.8882 | 0.2362 | 0.4498 | 0.30324 | 0.45943 | No A35 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A43 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A43 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A46 | 0.9566 | 0.1986 | 0.2854 | 0.25494 | 0.29154 | No A46 | -0.1343 | 1.0091 | 1.424 | 1.26447 | 1.560769 |
| No A60 | 0.8909 | 0.2235 | 0.4446 | 0.28696 | 0.45414 | No A60 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A63 | 0.8448 | 0.3106 | 0.5238 | 0.39689 | 0.53502 | No A63 | 0.4751 | 0.8766 | 1.203 | 1.09846 | 1.31801 |
| No A64 | 0.8909 | 0.2235 | 0.4446 | 0.25494 | 0.45414 | No A64 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |
| No A75 | 0.8721 | 0.2795 | 0.4791 | 0.35878 | 0.48941 | No A75 | 0.8844 | 0.8348 | 0.9497 | 1.04602 | 1.04035 |
| No A76 | 0.8909 | 0.2235 | 0.4446 | 0.25494 | 0.45414 | No A76 | 0.8074 | 0.7941 | 0.8616 | 0.89499 | 0.94386 |

**RF model**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Train | | | | | | Test | | | | | |
| Combinations | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** | **Combinations** | **CC** | **MAE** | **RMSE** | **RAE** | **RRSE** |
| No A2 | 0.9826 | 0.278 | 0.3445 | 0.35686 | 0.35194 | No A2 | 0.7915 | 0.4602 | 0.6027 | 0.57663 | 0.66027 |
| No A4 | 0.9859 | 0.294 | 0.3741 | 0.3774 | 0.38218 | No A4 | 0.7444 | 0.5561 | 0.6691 | 0.69677 | 0.73297 |
| No A6 | 0.9853 | 0.2891 | 0.3585 | 0.37107 | 0.36621 | No A6 | 0.8681 | 0.4371 | 0.5585 | 0.5477 | 0.61178 |
| No A13 | 0.9839 | 0.283 | 0.3608 | 0.36331 | 0.36851 | No A13 | 0.8439 | 0.4565 | 0.5721 | 0.57199 | 0.62668 |
| No A22 | 0.9867 | 0.2732 | 0.3494 | 0.3507 | 0.35682 | No A22 | 0.788 | 0.4972 | 0.6241 | 0.62305 | 0.68367 |
| No A31 | 0.9845 | 0.29 | 0.3634 | 0.37223 | 0.37126 | No A31 | 0.7994 | 0.4492 | 0.5994 | 0.56285 | 0.65664 |
| No A35 | 0.9832 | 0.3097 | 0.3878 | 0.397661 | 0.39617 | No A35 | 0.8133 | 0.4907 | 0.6244 | 0.61493 | 0.68399 |
| No A43 | 0.9794 | 0.2803 | 0.3597 | 0.35989 | 0.36747 | No A43 | 0.895 | 0.5504 | 0.612 | 0.6897 | 0.67046 |
| No A46 | 0.982 | 0.3275 | 0.4089 | 0.42048 | 0.41771 | No A46 | 0.8516 | 0.5579 | 0.6311 | 0.69902 | 0.69131 |
| No A60 | 0.9821 | 0.2854 | 0.3616 | 0.36631 | 0.3694 | No A60 | 0.8487 | 0.493 | 0.593 | 0.61779 | 0.64961 |
| No A63 | 0.9754 | 0.3375 | 0.4121 | 0.43323 | 0.42093 | No A63 | 0.7288 | 0.4814 | 0.6526 | 0.60327 | 0.71486 |
| No A64 | 0.9854 | 0.2869 | 0.3531 | 0.36838 | 0.36072 | No A64 | 0.8332 | 0.4651 | 0.5971 | 0.58281 | 0.65406 |
| No A75 | 0.9826 | 0.2971 | 0.3681 | 0.38141 | 0.37605 | No A75 | 0.8161 | 0.474 | 0.6133 | 0.59394 | 0.67182 |
| No A76 | 0.9848 | 0.2945 | 0.3756 | 0.37812 | 0.38372 | No A76 | 0.7412 | 0.5317 | 0.6843 | 0.66629 | 0.74963 |