# graduate admissions dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9972 | 1.2981 | 0.9972 | 0.5709 | 0.9946 | 0.4865 | 0.9760 | 0.1661 | 0.9972 | 1.1141 | 0.9910 | 0.0905 | 0.9719 | 0.0920 |
| | 20 | 0.9889 | 0.1377 | 0.9901 | 0.6906 | 0.9760 | 0.6837 | 0.9337 | 0.1821 | 0.9900 | 1.1856 | 0.9811 | 0.2354 | 0.9396 | 0.2346 |
| | 30 | 0.9796 | 0.1297 | 0.9838 | 0.4737 | 0.9692 | 0.5896 | 0.9193 | 0.1959 | 0.9838 | 1.3341 | 0.9677 | 0.3184 | 0.9030 | 0.5987 |
| | 40 | 0.9766 | 0.1768 | 0.9780 | 0.4500 | 0.9540 | 0.6273 | 0.8867 | 0.2048 | 0.9781 | 1.4380 | 0.9604 | 0.8826 | 0.8718 | 0.7107 |
| | Average | 0.9856 | 0.4356 | 0.9873 | 0.5463 | 0.9734 | 0.5968 | 0.9289 | 0.1872 | 0.9873 | 1.2680 | 0.9750 | 0.3817 | 0.9216 | 0.4090 |
| | Improvement | -0.1745% | 20.2688% | 1.2448% | 27.0120% | 6.0953% | -132.6176% | -0.1741% | 65.6475% | 1.0798% | -14.1118% | 6.9435% | -6.4948% | | |
| MCAR | 10 | 0.9900 | 0.1224 | 0.9906 | 0.5242 | 0.9836 | 0.5956 | 0.9771 | 0.1930 | 0.9907 | 1.5183 | 0.9871 | 0.1067 | 0.9778 | 0.1033 |
| | 20 | 0.9908 | 0.1208 | 0.9917 | 0.4680 | 0.9848 | 0.7116 | 0.9439 | 0.2033 | 0.9918 | 1.5373 | 0.9805 | 0.2703 | 0.9452 | 0.2358 |
| | 30 | 0.9833 | 0.1354 | 0.9851 | 0.5754 | 0.9688 | 0.5539 | 0.9133 | 0.2706 | 0.9859 | 1.2450 | 0.9758 | 0.3616 | 0.9151 | 0.3616 |
| | 40 | 0.9765 | 0.1209 | 0.9781 | 0.5167 | 0.9579 | 0.5760 | 0.8920 | 0.2051 | 0.9781 | 1.6934 | 0.9581 | 0.4086 | 0.8782 | 0.4919 |
| | Average | 0.9852 | 0.1249 | 0.9864 | 0.5211 | 0.9738 | 0.6093 | 0.9316 | 0.2180 | 0.9866 | 1.4985 | 0.9754 | 0.2868 | 0.9291 | 0.2982 |
| | Improvement | -0.1242% | 76.0360% | 1.1691% | 79.5044% | 5.7548% | 42.7192% | -0.1446% | 91.6668% | 1.0056% | 56.4622% | 6.0399% | 58.1211% | | |
| MNAR | 10 | 0.9950 | 0.1756 | 0.9947 | 0.4364 | 0.9867 | 0.5167 | 0.9699 | 0.3648 | 0.9948 | 0.7332 | 0.9902 | 0.1427 | 0.9584 | 0.1302 |
| | 20 | 0.9894 | 0.1373 | 0.9905 | 0.4596 | 0.9852 | 0.5540 | 0.9477 | 0.1793 | 0.9907 | 1.6696 | 0.9767 | 0.2335 | 0.9283 | 0.2531 |
| | 30 | 0.9820 | 0.1388 | 0.9862 | 0.4360 | 0.9689 | 0.5910 | 0.9008 | 0.1723 | 0.9865 | 1.1509 | 0.9683 | 0.2989 | 0.9012 | 0.3519 |
| | 40 | 0.9809 | 0.1196 | 0.9802 | 0.5210 | 0.9622 | 0.5192 | 0.8881 | 0.1537 | 0.9810 | 1.7187 | 0.9634 | 0.3727 | 0.8718 | 0.5006 |
| | Average | 0.9868 | 0.1428 | 0.9879 | 0.4632 | 0.9758 | 0.5452 | 0.9267 | 0.2175 | 0.9882 | 1.3181 | 0.9746 | 0.2619 | 0.9149 | 0.3089 |
| | Improvement | -0.1042% | 69.1688% | 1.1371% | 73.8037% | 6.4961% | 34.3441% | -0.1405% | 89.1642% | 1.2523% | 45.4743% | 7.8603% | 53.7712% | | |

# graduate admissions dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.1984 | 0.0085 | 0.2251 | 0.0102 | 0.3672 | 0.0174 | 0.8026 | 0.0372 | 0.2204 | 0.0100 | 0.8071 | 0.0390 | 1.0842 | 0.0390 |
| | 20 | 0.3745 | 0.0278 | 0.4234 | 0.0299 | 0.6540 | 0.0468 | 1.2905 | 0.0917 | 0.4312 | 0.0302 | 0.8757 | 0.0651 | 1.0239 | 0.0651 |
| | 30 | 0.4234 | 0.0457 | 0.4035 | 0.0417 | 0.6683 | 0.0644 | 1.3505 | 0.1278 | 0.4095 | 0.0417 | 0.9607 | 0.0946 | 1.2325 | 0.0946 |
| | 40 | 0.5683 | 0.0634 | 0.6893 | 0.0708 | 0.9348 | 0.1024 | 1.7685 | 0.1737 | 0.6896 | 0.0698 | 1.1683 | 0.1204 | 1.8156 | 0.1204 |
| | Average | 0.3911 | 0.0364 | 0.4353 | 0.0381 | 0.6561 | 0.0577 | 1.3030 | 0.1076 | 0.4376 | 0.0379 | 0.9530 | 0.0798 | 1.2891 | 0.0798 |
| | Improvement | | | 10.1491% | 4.6679% | 40.3825% | 37.0434% | 69.9818% | 66.2024% | 10.6269% | 4.1428% | 58.9549% | 54.4489% | 69.6570% | 54.4489% |
| MCAR | 10 | 0.3111 | 0.0160 | 0.3180 | 0.0165 | 0.3891 | 0.0211 | 0.5027 | 0.0247 | 0.3165 | 0.0164 | 0.5371 | 0.0251 | 0.5210 | 0.0251 |
| | 20 | 0.2986 | 0.0212 | 0.3337 | 0.0221 | 0.5744 | 0.0341 | 0.8139 | 0.0618 | 0.3320 | 0.0221 | 0.6694 | 0.0449 | 0.9478 | 0.0449 |
| | 30 | 0.4754 | 0.0416 | 0.4941 | 0.0445 | 0.8482 | 0.0717 | 1.1059 | 0.1040 | 0.4834 | 0.0423 | 0.6009 | 0.0641 | 1.1349 | 0.0641 |
| | 40 | 0.5149 | 0.0572 | 0.6133 | 0.0618 | 0.8388 | 0.0808 | 1.4420 | 0.1539 | 0.6199 | 0.0619 | 1.1455 | 0.1229 | 1.3343 | 0.1229 |
| | Average | 0.4000 | 0.0340 | 0.4398 | 0.0362 | 0.6626 | 0.0519 | 0.9661 | 0.0861 | 0.4379 | 0.0357 | 0.7382 | 0.0642 | 0.9845 | 0.0642 |
| | Improvement | | | 9.0454% | 6.1730% | 39.6358% | 34.5174% | 58.5993% | 60.5252% | 8.6649% | 4.6690% | 45.8183% | 47.0798% | 59.3720% | 47.0798% |
| MNAR | 10 | 0.3733 | 0.0216 | 0.4557 | 0.0251 | 0.3758 | 0.0306 | 0.7138 | 0.0434 | 0.4545 | 0.0247 | 0.7427 | 0.0433 | 1.0284 | 0.0433 |
| | 20 | 0.2764 | 0.0226 | 0.3758 | 0.0306 | 0.5541 | 0.0408 | 1.1947 | 0.0872 | 0.3714 | 0.0302 | 0.9748 | 0.0732 | 1.3140 | 0.0732 |
| | 30 | 0.3117 | 0.0338 | 0.4111 | 0.0377 | 0.5453 | 0.0519 | 1.5994 | 0.1343 | 0.4024 | 0.0373 | 0.9489 | 0.0809 | 1.5607 | 0.0809 |
| | 40 | 0.5593 | 0.0564 | 0.5743 | 0.0583 | 0.9770 | 0.0979 | 1.7356 | 0.1712 | 0.5781 | 0.0580 | 1.1238 | 0.1094 | 1.3572 | 0.1094 |
| | Average | 0.3802 | 0.0336 | 0.4542 | 0.0379 | 0.6131 | 0.0553 | 1.3109 | 0.1090 | 0.4516 | 0.0376 | 0.9476 | 0.0767 | 1.3151 | 0.0767 |
| | Improvement | | | 16.3070% | 11.4200% | 37.9883% | 39.2588% | 70.9991% | 69.1903% | 15.8220% | 10.5513% | 59.8798% | 56.1983% | 71.0925% | 56.1983% |

**diabetes dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9921 | 0.4613 | 0.9914 | 0.8835 | 0.9924 | 0.8482 | 0.9786 | 0.2338 | 0.9919 | 1.7921 | 0.9916 | 0.3275 | 0.9828 | 0.1432 |
| | 20 | 0.9892 | 0.4556 | 0.9907 | 1.0108 | 0.9849 | 1.0678 | 0.9526 | 0.2756 | 0.9908 | 1.7098 | 0.9833 | 0.6946 | 0.9697 | 0.1874 |
| | 30 | 0.9828 | 0.4533 | 0.9872 | 0.8922 | 0.9767 | 0.9129 | 0.9163 | 0.2277 | 0.9870 | 4.4210 | 0.9733 | 1.4944 | 0.9438 | 0.4928 |
| | 40 | 0.9777 | 0.4567 | 0.9813 | 1.2609 | 0.9661 | 1.0841 | 0.9270 | 0.2564 | 0.9816 | 3.6625 | 0.9677 | 1.3347 | 0.9294 | 0.4488 |
| | Average | 0.9854 | 0.4567 | 0.9877 | 1.0118 | 0.9800 | 0.9783 | 0.9436 | 0.2484 | 0.9878 | 2.8964 | 0.9790 | 0.9628 | 0.9564 | 0.3181 |
| | Improvement | | | -0.2253% | 54.8617% | 0.5535% | 53.3133% | 4.4290% | -83.8986% | -0.2433% | 84.2311% | 0.6569% | 52.5618% | 3.0351% | -43.5919% |
| MCAR | 10 | 0.9931 | 0.4536 | 0.9940 | 0.7921 | 0.9933 | 1.0525 | 0.9816 | 0.2439 | 0.9941 | 1.9411 | 0.9910 | 0.5493 | 0.9782 | 0.1385 |
| | 20 | 0.9842 | 0.4808 | 0.9885 | 1.0257 | 0.9844 | 1.1576 | 0.9702 | 0.2627 | 0.9880 | 1.6956 | 0.9825 | 0.6969 | 0.9710 | 0.2153 |
| | 30 | 0.9837 | 0.4993 | 0.9877 | 0.7853 | 0.9748 | 0.8331 | 0.9504 | 0.2166 | 0.9876 | 2.1640 | 0.9813 | 1.1914 | 0.9547 | 0.3735 |
| | 40 | 0.9834 | 0.4479 | 0.9866 | 1.0772 | 0.9706 | 0.9927 | 0.9272 | 0.2505 | 0.9868 | 3.2054 | 0.9752 | 1.8255 | 0.9242 | 0.4994 |
| | Average | 0.9861 | 0.4704 | 0.9892 | 0.9201 | 0.9808 | 1.0090 | 0.9574 | 0.2434 | 0.9891 | 2.2515 | 0.9825 | 1.0658 | 0.9570 | 0.3067 |
| | Improvement | | | -0.3105% | 48.8726% | 0.5442% | 53.3775% | 3.0035% | -93.2574% | -0.3062% | 79.1073% | 0.3660% | 55.8631% | 3.0386% | -53.3915% |
| MNAR | 10 | 0.9928 | 0.4359 | 0.9931 | 0.7755 | 0.9913 | 0.7893 | 0.9711 | 0.2551 | 0.9930 | 1.1943 | 0.9888 | 0.4014 | 0.9732 | 0.1371 |
| | 20 | 0.9833 | 0.4557 | 0.9890 | 0.9867 | 0.9773 | 1.1897 | 0.9498 | 0.2262 | 0.9894 | 1.7803 | 0.9782 | 0.7375 | 0.9599 | 0.2103 |
| | 30 | 0.9790 | 0.4543 | 0.9818 | 1.2344 | 0.9721 | 1.7225 | 0.9249 | 0.2616 | 0.9823 | 2.9466 | 0.9668 | 1.0277 | 0.9390 | 0.3819 |
| | 40 | 0.9670 | 0.4528 | 0.9784 | 0.7732 | 0.9664 | 1.0883 | 0.9144 | 0.3132 | 0.9789 | 3.8522 | 0.9557 | 1.8624 | 0.9237 | 0.5307 |
| | Average | 0.9805 | 0.4497 | 0.9856 | 0.9424 | 0.9768 | 1.1975 | 0.9400 | 0.2640 | 0.9859 | 2.4433 | 0.9724 | 1.0073 | 0.9490 | 0.3150 |
| | Improvement | | | -0.5140% | 52.2861% | 0.3826% | 62.4475% | 4.3055% | -70.3319% | -0.5471% | 81.5959% | 0.8371% | 55.3568% | 3.3245% | -42.7510% |

**diabetes dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.0042 | 0.0003 | 0.0044 | 0.0003 | 0.0041 | 0.0003 | 0.0069 | 0.0005 | 0.0043 | 0.0003 | 0.0043 | 0.0004 | 0.0062 | 0.0004 |
| | 20 | 0.0049 | 0.0005 | 0.0046 | 0.0004 | 0.0059 | 0.0005 | 0.0103 | 0.0011 | 0.0045 | 0.0004 | 0.0061 | 0.0008 | 0.0082 | 0.0008 |
| | 30 | 0.0061 | 0.0008 | 0.0053 | 0.0006 | 0.0072 | 0.0008 | 0.0138 | 0.0019 | 0.0053 | 0.0006 | 0.0076 | 0.0013 | 0.0112 | 0.0013 |
| | 40 | 0.0070 | 0.0011 | 0.0064 | 0.0008 | 0.0088 | 0.0012 | 0.0128 | 0.0020 | 0.0064 | 0.0008 | 0.0084 | 0.0015 | 0.0126 | 0.0015 |
| | Average | 0.0056 | 0.0007 | 0.0052 | 0.0005 | 0.0065 | 0.0007 | 0.0110 | 0.0014 | 0.0051 | 0.0005 | 0.0066 | 0.0010 | 0.0096 | 0.0010 |
| | Improvement | | | -7.7578% | -25.5879% | 14.2097% | 5.1067% | 49.1819% | 51.4286% | -8.6597% | -25.8255% | 15.7145% | 31.5392% | 41.7550% | 31.5392% |
| MCAR | 10 | 0.0039 | 0.0003 | 0.0037 | 0.0002 | 0.0039 | 0.0003 | 0.0064 | 0.0005 | 0.0036 | 0.0002 | 0.0045 | 0.0004 | 0.0070 | 0.0004 |
| | 20 | 0.0059 | 0.0006 | 0.0050 | 0.0005 | 0.0059 | 0.0006 | 0.0082 | 0.0009 | 0.0051 | 0.0005 | 0.0062 | 0.0008 | 0.0081 | 0.0008 |
| | 30 | 0.0060 | 0.0008 | 0.0052 | 0.0006 | 0.0075 | 0.0008 | 0.0106 | 0.0015 | 0.0052 | 0.0006 | 0.0064 | 0.0010 | 0.0101 | 0.0010 |
| | 40 | 0.0060 | 0.0009 | 0.0054 | 0.0008 | 0.0082 | 0.0012 | 0.0129 | 0.0021 | 0.0054 | 0.0008 | 0.0074 | 0.0015 | 0.0131 | 0.0015 |
| | Average | 0.0055 | 0.0007 | 0.0048 | 0.0005 | 0.0064 | 0.0007 | 0.0095 | 0.0013 | 0.0048 | 0.0005 | 0.0061 | 0.0009 | 0.0096 | 0.0009 |
| | Improvement | | | -13.1383% | -27.4518% | 14.2256% | 6.4513% | 42.6095% | 47.0371% | -12.9320% | -26.7963% | 10.6298% | 29.1009% | 42.8607% | 29.1009% |
| MNAR | 10 | 0.0039 | 0.0003 | 0.0039 | 0.0002 | 0.0044 | 0.0003 | 0.0080 | 0.0006 | 0.0039 | 0.0002 | 0.0050 | 0.0005 | 0.0077 | 0.0005 |
| | 20 | 0.0061 | 0.0006 | 0.0050 | 0.0005 | 0.0072 | 0.0007 | 0.0106 | 0.0012 | 0.0049 | 0.0005 | 0.0069 | 0.0011 | 0.0094 | 0.0011 |
| | 30 | 0.0068 | 0.0009 | 0.0063 | 0.0008 | 0.0069 | 0.0009 | 0.0130 | 0.0019 | 0.0062 | 0.0008 | 0.0085 | 0.0015 | 0.0116 | 0.0015 |
| | 40 | 0.0085 | 0.0013 | 0.0069 | 0.0009 | 0.0087 | 0.0012 | 0.0139 | 0.0022 | 0.0068 | 0.0009 | 0.0098 | 0.0017 | 0.0130 | 0.0017 |
| | Average | 0.0063 | 0.0008 | 0.0055 | 0.0006 | 0.0068 | 0.0008 | 0.0114 | 0.0015 | 0.0054 | 0.0006 | 0.0075 | 0.0012 | 0.0105 | 0.0012 |
| | Improvement | | | -14.5090% | -29.6676% | 7.0365% | -0.9395% | 44.5706% | 47.2033% | -15.7510% | -30.4308% | 16.3750% | 35.8677% | 39.7407% | 35.8677% |

**Profit dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.8714 | 1.2674 | 0.7921 | 0.1151 | 0.7831 | 0.1139 | 0.8399 | 0.0528 | 0.9772 | 0.4084 | 0.8792 | 0.0661 | 0.8562 | 0.0630 |
| | 20 | 0.9836 | 1.2725 | 0.9758 | 0.1102 | 0.9631 | 0.1210 | 0.9339 | 0.0516 | 0.9821 | 1.3258 | 0.9545 | 0.1157 | 0.9138 | 0.1476 |
| | 30 | 0.9768 | 1.2493 | 0.9781 | 0.1282 | 0.9546 | 0.1541 | 0.8881 | 0.0546 | 0.9785 | 1.2502 | 0.9361 | 0.2170 | 0.8837 | 0.2582 |
| | 40 | 0.9635 | 1.2449 | 0.9605 | 0.1112 | 0.9400 | 0.1139 | 0.8571 | 0.0506 | 0.9606 | 0.7545 | 0.9144 | 0.2187 | 0.8542 | 0.2884 |
| | Average | 0.9488 | 1.2585 | 0.9266 | 0.1162 | 0.9102 | 0.1257 | 0.8797 | 0.0524 | 0.9746 | 0.9347 | 0.9210 | 0.1544 | 0.8770 | 0.1893 |
| | Improvement | | | 2.3976% | -983.1013% | 4.2470% | -901.1578% | 7.8546% | -2302.3843% | -2.6409% | -34.6436% | 3.0198% | -715.3714% | 8.1968% | -564.8325% |
| MCAR | 10 | 0.9890 | 1.2172 | 0.9910 | 0.1216 | 0.9850 | 0.1225 | 0.9617 | 0.0441 | 0.9910 | 0.6658 | 0.9806 | 0.0693 | 0.9736 | 0.0736 |
| | 20 | 0.9724 | 1.2305 | 0.9729 | 0.1062 | 0.9605 | 0.1103 | 0.9047 | 0.0457 | 0.9736 | 0.3521 | 0.9464 | 0.1132 | 0.9131 | 0.1417 |
| | 30 | 0.9749 | 1.2357 | 0.9791 | 0.1076 | 0.9545 | 0.1060 | 0.8901 | 0.0464 | 0.9792 | 0.7672 | 0.9404 | 0.1470 | 0.9048 | 0.2075 |
| | 40 | 0.9431 | 1.2302 | 0.9469 | 0.1047 | 0.9187 | 0.1173 | 0.8283 | 0.0479 | 0.9417 | 0.7652 | 0.8918 | 0.1844 | 0.8216 | 0.2792 |
| | Average | 0.9698 | 1.2284 | 0.9725 | 0.1101 | 0.9547 | 0.1140 | 0.8962 | 0.0460 | 0.9714 | 0.6376 | 0.9398 | 0.1285 | 0.9033 | 0.1755 |
| | Improvement | | | -0.2690% | -1016.1758% | 1.5881% | -977.4782% | 8.2169% | -2570.5608% | -0.1581% | -92.6682% | 3.1976% | -856.2038% | 7.3699% | -600.0135% |
| MNAR | 10 | 0.9122 | 1.2224 | 0.9566 | 0.1155 | 0.9506 | 0.1178 | 0.8690 | 0.0509 | 0.9598 | 0.2843 | 0.9091 | 0.0679 | 0.8599 | 0.0738 |
| | 20 | 0.9697 | 1.2453 | 0.9753 | 0.1255 | 0.9602 | 0.1198 | 0.8810 | 0.0476 | 0.9740 | 0.3578 | 0.9183 | 0.1289 | 0.8753 | 0.1490 |
| | 30 | 0.7833 | 1.2205 | 0.6062 | 0.1243 | 0.5945 | 0.1224 | 0.6685 | 0.0514 | 0.8801 | 0.4284 | 0.7309 | 0.2263 | 0.6689 | 0.2137 |
| | 40 | 0.8782 | 1.2195 | 0.9302 | 0.1132 | 0.9031 | 0.1143 | 0.7320 | 0.0466 | 0.9419 | 0.7770 | 0.8245 | 0.2222 | 0.7130 | 0.2882 |
| | Average | 0.8858 | 1.2269 | 0.8671 | 0.1196 | 0.8521 | 0.1186 | 0.7876 | 0.0491 | 0.9390 | 0.4619 | 0.8457 | 0.1613 | 0.7793 | 0.1812 |
| | Improvement | | | 2.1651% | -925.8455% | 3.9629% | -934.8665% | 12.4730% | -2397.4559% | -5.6564% | -165.6350% | 4.7453% | -660.5741% | 13.6773% | -577.2241% |

**Profit dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 4162.2033 | 128.3914 | 6457.0069 | 160.0532 | 6519.5072 | 180.5623 | 5218.5287 | 344.3056 | 3790.1278 | 101.8140 | 4482.5282 | 298.6749 | 5172.7007 | 298.6749 |
| | 20 | 2141.7314 | 78.2446 | 5352.0969 | 107.0607 | 5424.7392 | 172.6326 | 7780.3962 | 828.8091 | 3738.8226 | 95.4186 | 6334.5291 | 715.1946 | 9526.5502 | 715.1946 |
| | 30 | 1708.3846 | 84.2499 | 410.9767 | 21.7223 | 4736.0490 | 92.1276 | 9661.1545 | 1405.4585 | 1284.9353 | 102.9880 | 6908.9522 | 1063.1161 | 10975.3111 | 1063.1161 |
| | 40 | 1930.4217 | 92.0180 | 828.9091 | 109.4531 | 4893.6143 | 224.2954 | 10787.0633 | 1674.8110 | 3694.2505 | 157.3384 | 7835.8435 | 1342.8315 | 11667.2475 | 1342.8315 |
| | Average | 2485.6853 | 95.7260 | 3262.2474 | 99.5723 | 5393.4774 | 167.4045 | 8361.7857 | 1063.3460 | 3127.0341 | 114.3897 | 6390.4632 | 854.9543 | 9335.4524 | 854.9543 |
| | Improvement | | | 23.5045% | 3.8629% | 53.9131% | 42.8176% | 70.2733% | 90.9977% | 20.5098% | 16.3159% | 61.1032% | 88.8034% | 73.3737% | 88.8034% |
| MCAR | 10 | 1390.3376 | 48.7768 | 1203.5278 | 44.5159 | 1548.4950 | 118.5318 | 5780.9483 | 480.4209 | 1189.1690 | 43.3488 | 3613.2393 | 325.6768 | 4891.6903 | 325.6768 |
| | 20 | 2785.0125 | 122.0534 | 3862.9863 | 122.1957 | 3787.4367 | 228.6127 | 8113.1772 | 880.1184 | 3737.0207 | 118.5724 | 6198.6916 | 646.8742 | 8372.2230 | 646.8742 |
| | 30 | 767.7386 | 56.8047 | 1224.5527 | 87.6368 | 2370.9620 | 331.7301 | 8903.4685 | 1193.6127 | 1176.7239 | 77.0704 | 6579.0008 | 933.1081 | 9459.8351 | 933.1081 |
| | 40 | 3838.5535 | 152.7184 | 3904.9270 | 131.0445 | 4158.4559 | 308.6750 | 12374.6481 | 1829.0639 | 3852.0298 | 137.3997 | 9239.6350 | 1368.7675 | 12804.9693 | 1368.7675 |
| | Average | 2195.4105 | 95.0883 | 2548.9984 | 96.3482 | 2966.3374 | 246.8874 | 8793.0605 | 1095.8040 | 2488.7359 | 94.0978 | 6407.6417 | 818.6067 | 8882.1794 | 818.6067 |
| | Improvement | | | 13.8716% | 1.3077% | 25.9892% | 61.4851% | 75.0325% | 91.3225% | 11.7861% | -1.0526% | 65.7376% | 88.3841% | 75.2830% | 88.3841% |
| MNAR | 10 | 3890.3628 | 93.1636 | 3395.8300 | 81.4566 | 3299.0704 | 120.0371 | 7445.6013 | 431.5956 | 2988.4365 | 78.7033 | 6400.7257 | 367.3057 | 7853.9285 | 367.3057 |
| | 20 | 2628.4578 | 73.9532 | 2615.9840 | 82.8974 | 2784.0115 | 181.3751 | 10424.1968 | 975.3308 | 2998.6009 | 85.1601 | 7824.5078 | 684.0754 | 10440.3878 | 684.0754 |
| | 30 | 3926.1872 | 151.2281 | 7221.6405 | 196.7840 | 7144.9227 | 286.4528 | 11654.1275 | 1678.2099 | 3072.5599 | 206.3207 | 8906.6891 | 1396.5115 | 12531.3435 | 1396.5115 |
| | 40 | 4037.9006 | 175.3472 | 3245.5014 | 196.2182 | 3778.4325 | 441.7477 | 13486.7121 | 2073.9569 | 3061.8932 | 190.4974 | 10095.6964 | 1611.1693 | 14459.4018 | 1611.1693 |
| | Average | 3620.7271 | 123.4230 | 4119.7390 | 139.3391 | 4251.6093 | 257.4032 | 10752.6594 | 1289.7733 | 3030.3726 | 140.1704 | 8306.9047 | 1014.7655 | 11321.2654 | 1014.7655 |
| | Improvement | | | 12.1127% | 11.4225% | 14.8387% | 52.0507% | 66.3271% | 90.4306% | -19.4812% | 11.9479% | 56.4130% | 87.8373% | 68.0184% | 87.8373% |

**Wine dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9940 | 1.0109 | 0.9946 | 0.3143 | 0.9915 | 0.3220 | 0.9799 | 0.0951 | 0.9946 | 5.2023 | 0.9892 | 0.4322 | 0.9803 | 0.4915 |
| | 20 | 0.9892 | 1.0267 | 0.9921 | 0.3757 | 0.9849 | 0.3149 | 0.9654 | 0.0665 | 0.9923 | 6.4270 | 0.9847 | 0.8725 | 0.9676 | 0.9035 |
| | 30 | 0.9788 | 1.0047 | 0.9794 | 0.2719 | 0.9686 | 0.3530 | 0.9464 | 0.0524 | 0.9792 | 8.2385 | 0.9762 | 1.0908 | 0.9481 | 1.3808 |
| | 40 | 0.9758 | 1.0189 | 0.9834 | 0.2658 | 0.9676 | 0.2769 | 0.9308 | 0.0577 | 0.9831 | 4.6049 | 0.9660 | 1.4143 | 0.9346 | 1.8102 |
| | Average | 0.9844 | 1.0153 | 0.9874 | 0.3069 | 0.9781 | 0.3167 | 0.9556 | 0.0679 | 0.9873 | 6.1182 | 0.9790 | 0.9525 | 0.9576 | 1.1465 |
| | Improvement | | | -0.2986% | -230.7939% | 0.6447% | -220.5597% | 3.0177% | -1394.9858% | -0.2862% | 83.4055% | 0.5547% | -6.5928% | 2.7991% | 11.4477% |
| MCAR | 10 | 0.9930 | 1.0234 | 0.9947 | 0.3010 | 0.9903 | 0.2813 | 0.9797 | 0.0606 | 0.9947 | 2.8023 | 0.9899 | 0.3786 | 0.9812 | 0.4541 |
| | 20 | 0.9887 | 0.9937 | 0.9925 | 0.2888 | 0.9848 | 0.3618 | 0.9672 | 0.0616 | 0.9925 | 4.2242 | 0.9840 | 0.7675 | 0.9662 | 0.9212 |
| | 30 | 0.9822 | 0.9846 | 0.9859 | 0.2671 | 0.9741 | 0.3924 | 0.9490 | 0.0695 | 0.9846 | 6.1905 | 0.9767 | 1.1338 | 0.9509 | 1.4308 |
| | 40 | 0.9748 | 0.9781 | 0.9834 | 0.2541 | 0.9641 | 0.2597 | 0.9301 | 0.0558 | 0.9836 | 12.4922 | 0.9660 | 1.4819 | 0.9340 | 1.8721 |
| | Average | 0.9847 | 0.9949 | 0.9891 | 0.2778 | 0.9783 | 0.3238 | 0.9565 | 0.0619 | 0.9889 | 6.4273 | 0.9792 | 0.9405 | 0.9581 | 1.1695 |
| | Improvement | | | -0.4489% | -258.1947% | 0.6516% | -207.2802% | 2.9460% | -1507.2144% | -0.4237% | 84.5203% | 0.5626% | -5.7927% | 2.7748% | 14.9302% |
| MNAR | 10 | 0.9826 | 0.9918 | 0.9850 | 0.3268 | 0.9816 | 0.2851 | 0.9650 | 0.0514 | 0.9850 | 5.3373 | 0.9766 | 0.3719 | 0.9616 | 0.4850 |
| | 20 | 0.9698 | 1.0232 | 0.9750 | 0.2602 | 0.9678 | 0.2910 | 0.9429 | 0.0547 | 0.9746 | 6.0004 | 0.9635 | 0.7970 | 0.9314 | 0.9722 |
| | 30 | 0.9648 | 1.0283 | 0.9730 | 0.3170 | 0.9622 | 0.2699 | 0.9270 | 0.0508 | 0.9731 | 5.6127 | 0.9573 | 1.1797 | 0.9197 | 1.3217 |
| | 40 | 0.9627 | 0.9825 | 0.9727 | 0.2627 | 0.9558 | 0.2754 | 0.9097 | 0.0722 | 0.9724 | 14.1998 | 0.9507 | 1.5224 | 0.9025 | 1.8642 |
| | Average | 0.9700 | 1.0065 | 0.9764 | 0.2917 | 0.9669 | 0.2804 | 0.9361 | 0.0572 | 0.9763 | 7.7875 | 0.9620 | 0.9678 | 0.9288 | 1.1608 |
| | Improvement | | | -0.6606% | -245.0306% | 0.3218% | -258.9860% | 3.6147% | -1658.0570% | -0.6437% | 87.0760% | 0.8259% | -4.0000% | 4.4317% | 13.2934% |

**Wine dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 1.2342 | 0.0336 | 1.0347 | 0.0272 | 1.2385 | 0.0398 | 1.7928 | 0.0613 | 1.0414 | 0.0273 | 1.5339 | 0.0481 | 2.0917 | 0.0481 |
| | 20 | 1.5864 | 0.0670 | 1.2572 | 0.0541 | 1.6824 | 0.0763 | 2.6521 | 0.1185 | 1.2723 | 0.0550 | 1.9729 | 0.0922 | 2.3227 | 0.0922 |
| | 30 | 1.6014 | 0.0873 | 1.2748 | 0.0728 | 1.9950 | 0.1085 | 2.9415 | 0.1686 | 1.2828 | 0.0731 | 2.1200 | 0.1293 | 2.8954 | 0.1293 |
| | 40 | 2.3168 | 0.1464 | 1.9356 | 0.1193 | 2.7143 | 0.1731 | 3.8659 | 0.2564 | 1.9492 | 0.1201 | 2.7051 | 0.1852 | 3.9389 | 0.1852 |
| | Average | 1.6847 | 0.0836 | 1.3756 | 0.0683 | 1.9075 | 0.0994 | 2.8131 | 0.1512 | 1.3864 | 0.0689 | 2.0830 | 0.1137 | 2.8122 | 0.1137 |
| | Improvement | | | -22.4720% | -22.3133% | 11.6811% | 15.9291% | 40.1119% | 44.7365% | -21.5157% | -21.2997% | 19.1201% | 26.4979% | 40.0930% | 26.4979% |
| MCAR | 10 | 0.9962 | 0.0339 | 0.9447 | 0.0307 | 1.4269 | 0.0472 | 2.0436 | 0.0737 | 0.9422 | 0.0306 | 1.2630 | 0.0492 | 1.7380 | 0.0492 |
| | 20 | 1.5056 | 0.0668 | 1.2150 | 0.0526 | 1.6958 | 0.0749 | 2.4380 | 0.1175 | 1.2130 | 0.0525 | 1.7291 | 0.0827 | 2.4229 | 0.0827 |
| | 30 | 1.8847 | 0.1020 | 1.5445 | 0.0830 | 2.0548 | 0.1110 | 3.0775 | 0.1752 | 1.5487 | 0.0839 | 2.0785 | 0.1220 | 3.0383 | 0.1220 |
| | 40 | 2.2190 | 0.1459 | 1.6601 | 0.1103 | 2.5496 | 0.1681 | 3.8929 | 0.2576 | 1.6642 | 0.1103 | 2.5122 | 0.1782 | 3.8014 | 0.1782 |
| | Average | 1.6514 | 0.0871 | 1.3411 | 0.0692 | 1.9318 | 0.1003 | 2.8630 | 0.1560 | 1.3420 | 0.0693 | 1.8957 | 0.1080 | 2.7501 | 0.1080 |
| | Improvement | | | -23.1372% | -25.9920% | 14.5149% | 13.1177% | 42.3201% | 44.1558% | -23.0509% | -25.6402% | 12.8902% | 19.3457% | 39.9535% | 19.3457% |
| MNAR | 10 | 1.3859 | 0.0434 | 1.2648 | 0.0380 | 1.5674 | 0.0482 | 1.9111 | 0.0655 | 1.2672 | 0.0379 | 1.6779 | 0.0604 | 2.5222 | 0.0604 |
| | 20 | 1.7831 | 0.0937 | 1.5110 | 0.0769 | 1.9816 | 0.1021 | 2.8390 | 0.1529 | 1.5172 | 0.0777 | 2.2615 | 0.1335 | 3.4073 | 0.1335 |
| | 30 | 2.1976 | 0.1136 | 1.7326 | 0.0890 | 2.1881 | 0.1170 | 3.4889 | 0.2038 | 1.7252 | 0.0885 | 2.7142 | 0.1675 | 3.9624 | 0.1675 |
| | 40 | 2.5355 | 0.1568 | 2.2039 | 0.1304 | 2.7387 | 0.1807 | 4.1654 | 0.2818 | 2.2210 | 0.1311 | 3.0876 | 0.2127 | 4.3817 | 0.2127 |
| | Average | 1.9755 | 0.1019 | 1.6781 | 0.0835 | 2.1190 | 0.1120 | 3.1011 | 0.1760 | 1.6826 | 0.0838 | 2.4353 | 0.1435 | 3.5684 | 0.1435 |
| | Improvement | | | -17.7252% | -21.9248% | 6.7698% | 9.0379% | 36.2960% | 42.1254% | -17.4062% | -21.5500% | 18.8795% | 29.0194% | 44.6387% | 29.0194% |

**California dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| **MAR** | 10 | 0.9739 | 115.6974 | 0.9760 | 0.2975 | 0.9738 | 0.2667 | 0.9557 | 0.0457 | 0.9957 | 22.8395 | 0.9723 | 2.0224 | 0.9558 | 3.5017 |
| | 20 | 0.9829 | 106.7511 | 0.9807 | 0.2498 | 0.9750 | 0.2627 | 0.9300 | 0.0457 | 0.9909 | 37.6780 | 0.9786 | 3.7176 | 0.9333 | 7.2658 |
| | 30 | 0.6926 | 105.3991 | 0.6979 | 0.2470 | 0.6900 | 0.2478 | 0.6514 | 0.0462 | 0.7091 | 39.3484 | 0.6873 | 5.6208 | 0.6561 | 11.3445 |
| | 40 | 0.6667 | 109.3749 | 0.6889 | 0.2441 | 0.6784 | 0.2512 | 0.6156 | 0.0492 | 0.7048 | 73.1590 | 0.6589 | 7.8723 | 0.6188 | 15.7904 |
| | Average | 0.8290 | 109.3056 | 0.8359 | 0.2596 | 0.8293 | 0.2571 | 0.7882 | 0.0467 | 0.8501 | 43.2562 | 0.8243 | 4.8083 | 0.7910 | 9.4756 |
| | Improvement | | | -0.8222% | -42000.6448% | -0.0336% | -42415.2195% | 5.1799% | -233865.2513% | -2.4831% | -152.6934% | 0.5742% | -2173.2781% | 4.8021% | -1053.5478% |
| **MCAR** | 10 | 0.9933 | 111.4315 | 0.9957 | 0.2939 | 0.9912 | 0.2581 | 0.9782 | 0.0442 | 0.9955 | 22.3669 | 0.9921 | 2.1550 | 0.9791 | 3.8967 |
| | 20 | 0.9761 | 107.7668 | 0.9850 | 0.2532 | 0.9730 | 0.2552 | 0.9390 | 0.0471 | 0.9852 | 16.8311 | 0.9722 | 4.0168 | 0.9401 | 7.9775 |
| | 30 | 0.7014 | 108.2830 | 0.7091 | 0.2465 | 0.6997 | 0.2479 | 0.6639 | 0.0409 | 0.7106 | 21.8946 | 0.6963 | 5.9870 | 0.6602 | 12.0287 |
| | 40 | 0.9665 | 108.3442 | 0.9792 | 0.2431 | 0.9559 | 0.2456 | 0.9046 | 0.0461 | 0.9795 | 36.6569 | 0.9615 | 8.0928 | 0.9111 | 16.3842 |
| | Average | 0.9093 | 108.9564 | 0.9173 | 0.2592 | 0.9049 | 0.2517 | 0.8714 | 0.0446 | 0.9177 | 24.4374 | 0.9055 | 5.0629 | 0.8726 | 10.0718 |
| | Improvement | | | -0.8663% | -41936.6819% | 0.4837% | -43185.1954% | 4.3498% | -244308.1471% | -0.9120% | -345.8595% | 0.4188% | -2052.0476% | 4.2057% | -981.7997% |
| **MNAR** | 10 | 0.9556 | 112.2752 | 0.9869 | 0.2890 | 0.9823 | 0.3007 | 0.9239 | 0.0511 | 0.9870 | 19.6521 | 0.9479 | 2.0022 | 0.9187 | 3.7357 |
| | 20 | 0.9513 | 109.0300 | 0.9655 | 0.2589 | 0.9555 | 0.2655 | 0.9053 | 0.0541 | 0.9656 | 26.4635 | 0.9407 | 3.7916 | 0.8998 | 7.2264 |
| | 30 | 0.6823 | 108.4197 | 0.6991 | 0.2546 | 0.6897 | 0.2526 | 0.6344 | 0.0474 | 0.7021 | 30.3255 | 0.6697 | 5.8725 | 0.6282 | 11.7714 |
| | 40 | 0.6773 | 110.1368 | 0.6944 | 0.3185 | 0.6826 | 0.3224 | 0.6218 | 0.0501 | 0.6963 | 34.7903 | 0.6628 | 8.6883 | 0.6098 | 16.5295 |
| | Average | 0.8166 | 109.9654 | 0.8365 | 0.2802 | 0.8275 | 0.2853 | 0.7714 | 0.0507 | 0.8377 | 27.8079 | 0.8053 | 5.0886 | 0.7641 | 9.8157 |
| | Improvement | | | -2.3765% | -39139.8167% | -1.3191% | -38442.5822% | 5.8633% | -216976.7481% | -2.5198% | -295.4472% | 1.4086% | -2060.9947% | 6.8684% | -1020.2975% |

**California dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| **MAR** | 10 | 32.3106 | 0.8978 | 31.0088 | 0.8174 | 46.9287 | 1.3504 | 55.6050 | 1.6536 | 30.2360 | 0.8130 | 33.5540 | 0.8495 | 51.2948 | 0.8495 |
| | 20 | 52.2358 | 2.0064 | 47.3363 | 1.7077 | 67.5491 | 2.7795 | 76.6247 | 3.2617 | 47.4557 | 1.7450 | 53.3314 | 1.9180 | 79.2264 | 1.9180 |
| | 30 | 65.7418 | 2.9074 | 63.3225 | 2.5940 | 85.5978 | 4.1761 | 100.8408 | 5.0968 | 60.9704 | 2.6484 | 66.6251 | 2.7576 | 92.4102 | 2.7576 |
| | 40 | 88.2185 | 4.2629 | 105.6495 | 3.9622 | 125.9870 | 6.1641 | 126.0448 | 7.3287 | 83.0702 | 3.8634 | 89.1710 | 4.0398 | 118.3153 | 4.0398 |
| | Average | 59.6266 | 2.5186 | 61.8292 | 2.2703 | 81.5157 | 3.6175 | 89.7788 | 4.3352 | 55.4331 | 2.2675 | 60.6704 | 2.3912 | 85.3117 | 2.3912 |
| | Improvement | | | 3.5624% | -10.9358% | 26.8525% | 30.3771% | 33.5849% | 41.9034% | -7.5651% | -11.0764% | 1.7203% | -5.3284% | 30.1073% | -5.3284% |
| **MCAR** | 10 | 52.8075 | 1.2712 | 49.2731 | 1.1369 | 63.9986 | 1.8142 | 67.1350 | 2.0534 | 51.0716 | 1.1443 | 48.1534 | 1.1612 | 67.1093 | 1.1612 |
| | 20 | 107.0147 | 2.7224 | 103.5050 | 2.5414 | 72.2126 | 3.1112 | 122.7579 | 4.1593 | 103.5327 | 2.5448 | 107.3149 | 2.6602 | 130.4005 | 2.6602 |
| | 30 | 78.4218 | 3.3628 | 72.2126 | 3.1112 | 101.8505 | 5.2614 | 108.6612 | 5.7241 | 74.0113 | 3.1240 | 74.0694 | 3.2049 | 103.0696 | 3.2049 |
| | 40 | 109.4060 | 4.5664 | 104.1366 | 4.2827 | 131.5768 | 7.0485 | 140.9340 | 7.4876 | 103.9974 | 4.2907 | 109.8187 | 4.3192 | 133.6080 | 4.3192 |
| | Average | 86.9125 | 2.9807 | 82.2818 | 2.7681 | 92.4096 | 4.3088 | 109.8720 | 4.8561 | 83.1532 | 2.7759 | 84.8391 | 2.8364 | 108.5468 | 2.8364 |
| | Improvement | | | -5.6278% | -7.6818% | 5.9487% | 30.8234% | 20.8966% | 38.6193% | -4.5209% | -7.3764% | -2.4439% | -5.0885% | 19.9309% | -5.0885% |
| **MNAR** | 10 | 99.3908 | 2.5108 | 91.7004 | 2.2767 | 100.1166 | 2.6666 | 106.5341 | 2.9970 | 91.7645 | 2.2789 | 99.6467 | 2.7395 | 112.8797 | 2.7395 |
| | 20 | 99.8943 | 3.5180 | 90.9355 | 3.1881 | 109.7880 | 4.3668 | 112.9277 | 4.5306 | 90.7902 | 3.1838 | 100.2411 | 3.8367 | 125.5429 | 3.8367 |
| | 30 | 107.6085 | 4.3732 | 112.8983 | 4.0815 | 132.8942 | 5.6207 | 130.5849 | 6.1597 | 98.9425 | 3.9831 | 108.7457 | 4.7418 | 137.4176 | 4.7418 |
| | 40 | 129.7642 | 6.0916 | 119.7480 | 5.6121 | 143.1999 | 8.0485 | 155.9890 | 8.7749 | 120.3014 | 5.6083 | 128.0921 | 6.5089 | 159.6170 | 6.5089 |
| | Average | 109.1644 | 4.1234 | 103.8206 | 3.7896 | 121.4997 | 5.1756 | 126.5089 | 5.6156 | 100.4497 | 3.7635 | 109.1814 | 4.4567 | 133.8643 | 4.4567 |
| | Improvement | | | -5.1472% | -8.8092% | 10.1525% | 20.3301% | 13.7101% | 26.5714% | -8.6758% | -9.5624% | 0.0155% | 7.4786% | 18.4514% | 7.4786% |

**diamond dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9927 | 31.9178 | 0.9746 | 0.6220 | 0.9690 | 0.5005 | 0.9724 | 0.0589 | 0.9923 | 73.8956 | 0.9891 | 9.3667 | 0.9697 | 23.2302 |
| | 20 | 0.9884 | 37.8729 | 0.9852 | 0.5490 | 0.9745 | 0.5195 | 0.9481 | 0.0538 | 0.9884 | 233.4352 | 0.9807 | 17.4641 | 0.9456 | 41.6056 |
| | 30 | 0.9829 | 36.8791 | 0.9764 | 0.5316 | 0.9621 | 0.5531 | 0.9268 | 0.0572 | 0.9807 | 198.7877 | 0.9722 | 27.9822 | 0.9230 | 65.3636 |
| | 40 | 0.9768 | 32.8338 | 0.9763 | 0.5502 | 0.9565 | 0.5770 | 0.9050 | 0.0586 | 0.9769 | 397.1262 | 0.9632 | 43.3750 | 0.9021 | 86.9743 |
| | Average | 0.9852 | 34.8759 | 0.9781 | 0.5632 | 0.9655 | 0.5375 | 0.9381 | 0.0571 | 0.9846 | 225.8112 | 0.9763 | 24.5470 | 0.9351 | 54.2934 |
| | Improvement | | | 0.7232% | -6092.5620% | 2.0402% | -6388.4903% | 5.0245% | -60954.4142% | 0.0622% | 84.5553% | 0.9091% | -42.0782% | 5.3563% | 35.7640% |
| MCAR | 10 | 0.9946 | 31.3212 | 0.9945 | 0.5851 | 0.9889 | 0.5457 | 0.9771 | 0.0540 | 0.9946 | 59.5788 | 0.9922 | 10.0140 | 0.9781 | 19.7634 |
| | 20 | 0.9883 | 31.5702 | 0.9884 | 0.4993 | 0.9772 | 0.5131 | 0.9548 | 0.0558 | 0.9879 | 93.6527 | 0.9843 | 21.1890 | 0.9569 | 40.9356 |
| | 30 | 0.9823 | 31.4436 | 0.9825 | 0.4897 | 0.9661 | 0.4999 | 0.9338 | 0.0551 | 0.9819 | 181.6943 | 0.9761 | 26.2854 | 0.9343 | 62.3040 |
| | 40 | 0.9397 | 33.6287 | 0.9750 | 0.4787 | 0.9544 | 0.4932 | 0.9126 | 0.0557 | 0.9779 | 230.3123 | 0.9691 | 35.8542 | 0.9161 | 83.1780 |
| | Average | 0.9762 | 31.9909 | 0.9851 | 0.5132 | 0.9716 | 0.5130 | 0.9446 | 0.0551 | 0.9856 | 141.3095 | 0.9804 | 23.3357 | 0.9463 | 51.5453 |
| | Improvement | | | -0.8993% | -6133.5188% | 0.4749% | -6136.4471% | 3.3500% | -57926.0603% | -0.9453% | 77.3611% | -0.4261% | -37.0904% | 3.1587% | 37.9362% |
| MNAR | 10 | 0.9858 | 30.7079 | 0.9856 | 0.5842 | 0.9801 | 0.5456 | 0.9594 | 0.0527 | 0.9855 | 71.1881 | 0.9785 | 9.1088 | 0.9545 | 20.5060 |
| | 20 | 0.9841 | 33.3990 | 0.9842 | 0.5459 | 0.9734 | 0.5559 | 0.9386 | 0.0606 | 0.9843 | 108.2583 | 0.9735 | 18.3066 | 0.9315 | 41.5383 |
| | 30 | 0.9779 | 32.1922 | 0.9778 | 0.5261 | 0.9625 | 0.5366 | 0.9169 | 0.0555 | 0.9774 | 106.6329 | 0.9650 | 27.0596 | 0.9081 | 63.0438 |
| | 40 | 0.9724 | 32.9312 | 0.9725 | 0.5138 | 0.9524 | 0.5141 | 0.8978 | 0.0580 | 0.9728 | 233.7685 | 0.9581 | 35.3758 | 0.8878 | 93.7699 |
| | Average | 0.9800 | 32.3076 | 0.9800 | 0.5425 | 0.9671 | 0.5380 | 0.9282 | 0.0567 | 0.9800 | 129.9619 | 0.9688 | 22.4627 | 0.9205 | 54.7145 |
| | Improvement | | | 0.0023% | -5855.1517% | 1.3393% | -5904.6646% | 5.5907% | -56857.3145% | 0.0032% | 75.1408% | 1.1631% | -43.8277% | 6.4735% | 40.9525% |

**diamond dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 101.0032 | 2.6069 | 72.8991 | 1.6260 | 78.9682 | 2.0134 | 244.5781 | 6.8884 | 72.2514 | 1.6273 | 209.3922 | 6.3899 | 264.1510 | 6.3899 |
| | 20 | 120.8799 | 4.4398 | 89.2497 | 2.8328 | 107.6249 | 3.8002 | 329.5868 | 12.5258 | 87.6253 | 2.8197 | 267.2512 | 11.0523 | 347.1115 | 11.0523 |
| | 30 | 152.2259 | 6.5527 | 109.2525 | 4.1803 | 129.0315 | 5.6581 | 404.7863 | 19.2656 | 105.2668 | 4.2002 | 317.5627 | 16.0619 | 408.3108 | 16.0619 |
| | 40 | 164.3456 | 8.4003 | 120.0828 | 5.2812 | 141.4826 | 7.1788 | 441.0608 | 24.0260 | 115.3154 | 5.2868 | 347.2996 | 19.5140 | 456.0786 | 19.5140 |
| | Average | 134.6137 | 5.4999 | 97.8710 | 3.4801 | 114.2768 | 4.6626 | 355.0030 | 15.6765 | 95.1147 | 3.4835 | 285.3764 | 13.2545 | 368.9130 | 13.2545 |
| | Improvement | | | -37.5419% | -58.0402% | -17.7961% | -17.9576% | 62.0810% | 64.9159% | -41.5277% | -57.8866% | 52.8294% | 58.5051% | 63.5107% | 58.5051% |
| MCAR | 10 | 72.5144 | 1.8581 | 49.0874 | 1.1468 | 67.4255 | 1.8995 | 199.2656 | 5.9039 | 49.0492 | 1.1465 | 139.6341 | 3.5968 | 198.9860 | 3.5968 |
| | 20 | 101.5740 | 3.4455 | 71.5346 | 2.2170 | 99.4080 | 3.6861 | 290.1797 | 11.2887 | 71.6860 | 2.2280 | 211.0028 | 7.5645 | 276.4177 | 7.5645 |
| | 30 | 116.4119 | 4.9716 | 77.1239 | 3.0875 | 111.9811 | 5.1549 | 331.7866 | 15.5206 | 77.0833 | 3.0915 | 242.9656 | 10.4521 | 337.9391 | 10.4521 |
| | 40 | 137.3338 | 6.8048 | 99.5925 | 4.3413 | 137.1644 | 7.1531 | 403.6053 | 21.9801 | 100.0655 | 4.3599 | 287.4212 | 14.0811 | 388.8220 | 14.0811 |
| | Average | 106.9585 | 4.2700 | 74.3346 | 2.6981 | 103.9948 | 4.4734 | 306.2093 | 13.6733 | 74.4710 | 2.7065 | 220.2559 | 8.9236 | 300.5412 | 8.9236 |
| | Improvement | | | -43.8879% | -58.2561% | -2.8499% | 4.5471% | 65.0701% | 68.7715% | -43.6243% | -57.7687% | 51.4390% | 52.1498% | 64.4114% | 52.1498% |
| MNAR | 10 | 123.5239 | 3.2356 | 84.9549 | 2.0420 | 95.8549 | 2.4745 | 305.8729 | 8.5648 | 84.4494 | 2.0325 | 263.1455 | 8.3526 | 318.0494 | 8.3526 |
| | 20 | 160.5637 | 5.7477 | 115.4022 | 3.8476 | 132.6064 | 4.8847 | 390.5811 | 15.3451 | 114.4403 | 3.8199 | 328.4192 | 14.3094 | 400.6977 | 14.3094 |
| | 30 | 170.2514 | 6.9299 | 108.0425 | 4.2801 | 128.8031 | 5.7474 | 421.4267 | 19.6646 | 105.9981 | 4.2430 | 348.2505 | 17.3390 | 443.3272 | 17.3390 |
| | 40 | 184.9283 | 8.5098 | 132.9336 | 5.5825 | 155.4493 | 7.5250 | 444.0787 | 23.7202 | 130.2582 | 5.5673 | 363.7296 | 20.4535 | 468.7460 | 20.4535 |
| | Average | 159.8168 | 6.1058 | 110.3333 | 3.9381 | 128.1785 | 5.1579 | 390.4898 | 16.8237 | 108.7865 | 3.9157 | 325.8862 | 15.1137 | 407.7051 | 15.1137 |
| | Improvement | | | -44.8491% | -55.0451% | -24.6831% | -18.3773% | 59.0727% | 63.7073% | -46.9087% | -55.9316% | 50.9593% | 59.6010% | 60.8009% | 59.6010% |

# BNG (10000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9911 | 0.3447 | 0.9915 | 1.2896 | 0.9839 | 1.2272 | 0.9809 | 0.2244 | 0.9915 | 30.2953 | 0.9885 | 3.7232 | 0.9812 | 3.9575 |
| | 20 | 0.9830 | 0.3370 | 0.9831 | 1.1883 | 0.9684 | 1.1390 | 0.9664 | 0.1839 | 0.9833 | 44.5601 | 0.9785 | 7.2897 | 0.9646 | 7.8242 |
| | 30 | 0.9774 | 0.5520 | 0.9776 | 1.1425 | 0.9575 | 1.1345 | 0.9513 | 0.1858 | 0.9780 | 39.0810 | 0.9706 | 10.7572 | 0.9524 | 12.1003 |
| | 40 | 0.9687 | 0.3758 | 0.9687 | 1.0530 | 0.9421 | 1.0047 | 0.9318 | 0.1692 | 0.9693 | 32.6560 | 0.9595 | 14.9404 | 0.9370 | 17.1817 |
| | Average | 0.9800 | 0.4024 | 0.9803 | 1.1683 | 0.9630 | 1.1263 | 0.9576 | 0.1908 | 0.9805 | 36.6481 | 0.9743 | 9.1776 | 0.9588 | 10.2659 |
| | Improvement | | | -0.0219% | 65.5595% | 1.7688% | 64.2752% | 2.3403% | -110.9013% | -0.0497% | 98.9020% | 0.5907% | 95.6156% | 2.2152% | 96.0804% |
| MCAR | 10 | 0.9920 | 0.3234 | 0.9923 | 1.2720 | 0.9847 | 2.3865 | 0.9835 | 0.1993 | 0.9923 | 41.0366 | 0.9896 | 4.5100 | 0.9847 | 7.3372 |
| | 20 | 0.9833 | 0.3343 | 0.9837 | 1.9328 | 0.9694 | 1.3583 | 0.9645 | 0.1872 | 0.9837 | 28.9751 | 0.9787 | 10.4274 | 0.9668 | 11.1855 |
| | 30 | 0.9778 | 0.3508 | 0.9786 | 1.1750 | 0.9553 | 1.3009 | 0.9512 | 0.3116 | 0.9786 | 53.4051 | 0.9548 | 15.0100 | 0.9713 | 18.1199 |
| | 40 | 0.9670 | 0.3767 | 0.9679 | 1.1752 | 0.9404 | 1.2177 | 0.9305 | 0.1861 | 0.9679 | 57.5804 | 0.9583 | 22.8230 | 0.9364 | 18.8771 |
| | Average | 0.9800 | 0.3463 | 0.9806 | 1.3888 | 0.9624 | 1.5658 | 0.9574 | 0.2211 | 0.9806 | 45.2493 | 0.9703 | 13.1926 | 0.9648 | 13.8799 |
| | Improvement | | | -0.0633% | 75.0643% | 1.8235% | 77.8843% | 2.3563% | -56.6580% | -0.0659% | 99.2347% | 0.9942% | 97.3751% | 1.5750% | 97.5050% |
| MNAR | 10 | 0.9851 | 0.3235 | 0.9857 | 1.7790 | 0.9779 | 1.6347 | 0.9770 | 0.2407 | 0.9857 | 37.4221 | 0.9822 | 5.2709 | 0.9720 | 4.4426 |
| | 20 | 0.9763 | 0.3375 | 0.9770 | 1.4255 | 0.9628 | 1.2835 | 0.9590 | 0.1713 | 0.9771 | 52.0264 | 0.9708 | 9.2126 | 0.9521 | 10.7959 |
| | 30 | 0.9670 | 0.4871 | 0.9680 | 2.0511 | 0.9487 | 1.6238 | 0.9378 | 0.2614 | 0.9682 | 47.6253 | 0.9590 | 15.1539 | 0.9343 | 15.6495 |
| | 40 | 0.9608 | 0.5324 | 0.9615 | 1.8038 | 0.9344 | 1.6575 | 0.9247 | 0.2765 | 0.9620 | 69.0471 | 0.9513 | 22.2049 | 0.9174 | 26.4042 |
| | Average | 0.9723 | 0.4201 | 0.9730 | 1.7649 | 0.9559 | 1.5499 | 0.9496 | 0.2375 | 0.9733 | 51.5302 | 0.9658 | 12.9606 | 0.9439 | 14.3230 |
| | Improvement | | | -0.0746% | 76.1951% | 1.7124% | 72.8929% | 2.3881% | -76.9095% | -0.0990% | 99.1847% | 0.6688% | 96.7584% | 3.0032% | 97.0668% |

# BNG (10000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 1.6002 | 0.0605 | 1.5851 | 0.0600 | 2.1849 | 0.0843 | 2.1776 | 0.0846 | 1.5860 | 0.0602 | 1.6376 | 0.0638 | 2.1117 | 0.0638 |
| | 20 | 2.3533 | 0.1248 | 2.3588 | 0.1241 | 3.2198 | 0.1688 | 3.1313 | 0.1677 | 2.3537 | 0.1242 | 2.3877 | 0.1264 | 3.2295 | 0.1264 |
| | 30 | 2.6117 | 0.1773 | 2.6126 | 0.1780 | 3.9147 | 0.2623 | 3.7456 | 0.2544 | 2.6056 | 0.1772 | 2.6372 | 0.1796 | 3.6394 | 0.1796 |
| | 40 | 3.1230 | 0.2258 | 3.1570 | 0.2278 | 4.2257 | 0.3161 | 4.5241 | 0.3394 | 3.1190 | 0.2272 | 3.1372 | 0.2265 | 4.3123 | 0.2265 |
| | Average | 2.4220 | 0.1471 | 2.4284 | 0.1475 | 3.3863 | 0.2079 | 3.3946 | 0.2115 | 2.4161 | 0.1472 | 2.4499 | 0.1491 | 3.3232 | 0.1491 |
| | Improvement | | | 0.2605% | 0.2842% | 28.4751% | 29.2445% | 28.6509% | 30.4710% | -0.2464% | 0.0960% | 1.1380% | 1.3220% | 27.1176% | 1.3220% |
| MCAR | 10 | 1.5574 | 0.0594 | 1.5374 | 0.0586 | 2.1162 | 0.0837 | 2.2734 | 0.0859 | 1.5371 | 0.0586 | 1.5753 | 0.0600 | 2.0276 | 0.0600 |
| | 20 | 2.3207 | 0.1186 | 2.3055 | 0.1172 | 3.1546 | 0.1673 | 3.0669 | 0.1654 | 2.3066 | 0.1173 | 2.3141 | 0.1180 | 3.1392 | 0.1180 |
| | 30 | 2.5308 | 0.1552 | 2.5522 | 0.1565 | 3.6878 | 0.2304 | 3.6546 | 0.2409 | 2.5480 | 0.1561 | 2.5515 | 0.1577 | 3.5564 | 0.1577 |
| | 40 | 3.4022 | 0.2442 | 3.3506 | 0.2405 | 4.4117 | 0.3299 | 4.7656 | 0.3562 | 3.3467 | 0.2402 | 3.4167 | 0.2463 | 4.5486 | 0.2463 |
| | Average | 2.4528 | 0.1443 | 2.4364 | 0.1432 | 3.3426 | 0.2028 | 3.4401 | 0.2121 | 2.4346 | 0.1431 | 2.4644 | 0.1455 | 3.3180 | 0.1455 |
| | Improvement | | | -0.6708% | -0.7865% | 26.6207% | 28.8347% | 28.7014% | 31.9397% | -0.7450% | -0.9000% | 0.4723% | 0.7893% | 26.0760% | 0.7893% |
| MNAR | 10 | 2.4897 | 0.0883 | 2.4755 | 0.0876 | 2.9861 | 0.1077 | 2.6853 | 0.1008 | 2.4777 | 0.0877 | 2.5159 | 0.0913 | 3.2141 | 0.0913 |
| | 20 | 2.9674 | 0.1395 | 2.9503 | 0.1371 | 3.6844 | 0.1821 | 3.5093 | 0.1699 | 2.9469 | 0.1370 | 2.9632 | 0.1412 | 3.8741 | 0.1412 |
| | 30 | 3.3941 | 0.2015 | 3.3797 | 0.1973 | 4.2438 | 0.2613 | 4.0642 | 0.2624 | 3.3745 | 0.1972 | 3.4224 | 0.2052 | 4.7587 | 0.2052 |
| | 40 | 3.6407 | 0.2552 | 3.6579 | 0.2535 | 4.7414 | 0.3448 | 4.8969 | 0.3656 | 3.6486 | 0.2528 | 3.6781 | 0.2596 | 4.9443 | 0.2596 |
| | Average | 3.1230 | 0.1711 | 3.1158 | 0.1689 | 3.9139 | 0.2240 | 3.7889 | 0.2247 | 3.1119 | 0.1687 | 3.1449 | 0.1743 | 4.1978 | 0.1743 |
| | Improvement | | | -0.2289% | -1.3327% | 20.2081% | 23.5994% | 17.5765% | 23.8289% | -0.3547% | -1.4598% | 0.6972% | 1.8448% | 25.6046% | 1.8448% |

## BNG (15000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9918 | 0.4565 | 0.9921 | 1.8828 | 0.9842 | 1.7639 | 0.9830 | 0.2220 | 0.9922 | 74.2948 | 0.9895 | 10.6167 | 0.9829 | 10.0512 |
| | 20 | 0.9842 | 0.4933 | 0.9849 | 2.1622 | 0.9701 | 3.8716 | 0.9668 | 0.3156 | 0.9850 | 63.0566 | 0.9800 | 17.5294 | 0.9675 | 19.6446 |
| | 30 | 0.9773 | 0.5467 | 0.9780 | 2.8796 | 0.9572 | 2.2821 | 0.9515 | 0.2684 | 0.9782 | 71.7609 | 0.9702 | 30.1089 | 0.9529 | 30.0275 |
| | 40 | 0.9682 | 0.5569 | 0.9687 | 2.1310 | 0.9422 | 2.5601 | 0.9338 | 0.3336 | 0.9691 | 87.7444 | 0.9591 | 37.9306 | 0.9367 | 45.8879 |
| | Average | 0.9803 | 0.5133 | 0.9810 | 2.2639 | 0.9634 | 2.6194 | 0.9588 | 0.2849 | 0.9811 | 74.2142 | 0.9747 | 24.0464 | 0.9600 | 26.4028 |
| | Improvement | -0.0622% | 77.3253% | 1.7562% | 80.4028% | 2.2497% | -80.1744% | -0.0799% | 99.3083% | 0.5777% | 97.8652% | 2.1196% | 98.0558% | | |
| MCAR | 10 | 0.9926 | 0.4522 | 0.9927 | 1.9819 | 0.9854 | 2.0753 | 0.9829 | 0.3285 | 0.9927 | 73.3636 | 0.9902 | 7.6275 | 0.9849 | 10.5580 |
| | 20 | 0.9845 | 0.4810 | 0.9850 | 1.4528 | 0.9697 | 1.4781 | 0.9680 | 0.1976 | 0.9850 | 64.1001 | 0.9802 | 20.8390 | 0.9684 | 28.8348 |
| | 30 | 0.9764 | 0.5200 | 0.9772 | 1.6435 | 0.9563 | 1.4798 | 0.9484 | 0.2179 | 0.9772 | 91.0866 | 0.9699 | 24.1670 | 0.9534 | 29.8058 |
| | 40 | 0.9693 | 0.5560 | 0.9704 | 1.5565 | 0.9411 | 1.6117 | 0.9337 | 0.2125 | 0.9704 | 125.2856 | 0.9604 | 39.9540 | 0.9376 | 43.4232 |
| | Average | 0.9807 | 0.5023 | 0.9813 | 1.6587 | 0.9631 | 1.6613 | 0.9583 | 0.2391 | 0.9813 | 88.4589 | 0.9752 | 23.1469 | 0.9611 | 28.1555 |
| | Improvement | -0.0651% | 69.7178% | 1.8249% | 69.7647% | 2.3389% | -110.0741% | -0.0653% | 99.4322% | 0.5636% | 97.8300% | 2.0395% | 98.2160% | | |
| MNAR | 10 | 0.9854 | 0.4561 | 0.9861 | 1.7135 | 0.9790 | 1.6614 | 0.9746 | 0.2891 | 0.9861 | 64.4663 | 0.9823 | 8.9253 | 0.9723 | 9.5650 |
| | 20 | 0.9749 | 0.4935 | 0.9761 | 1.7028 | 0.9620 | 1.6211 | 0.9557 | 0.2111 | 0.9763 | 52.7038 | 0.9695 | 16.4145 | 0.9501 | 21.4797 |
| | 30 | 0.9677 | 0.5113 | 0.9685 | 1.8748 | 0.9483 | 2.2800 | 0.9401 | 0.2532 | 0.9689 | 68.3413 | 0.9604 | 23.7467 | 0.9335 | 28.5009 |
| | 40 | 0.9616 | 0.5590 | 0.9626 | 1.5636 | 0.9331 | 1.5876 | 0.9268 | 0.2051 | 0.9632 | 90.5235 | 0.9540 | 31.2380 | 0.9193 | 36.0534 |
| | Average | 0.9724 | 0.5050 | 0.9733 | 1.7137 | 0.9556 | 1.7875 | 0.9493 | 0.2397 | 0.9736 | 69.0087 | 0.9665 | 20.0811 | 0.9438 | 23.8997 |
| | Improvement | -0.0936% | 70.5310% | 1.7577% | 71.7487% | 2.4354% | -110.7173% | -0.1239% | 99.2682% | 0.6066% | 97.4852% | 3.0311% | 97.8870% | | |

## BNG (15000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 1.6189 | 0.0575 | 2.1668 | 0.1095 | 3.0763 | 0.1583 | 3.0118 | 0.1618 | 2.1558 | 0.1095 | 2.2016 | 0.1132 | 2.9889 | 0.1132 |
| | 20 | 2.1835 | 0.1117 | 1.6103 | 0.0570 | 2.4019 | 0.0869 | 2.2551 | 0.0837 | 1.6069 | 0.0570 | 1.6398 | 0.0592 | 2.3120 | 0.0592 |
| | 30 | 2.6780 | 0.1676 | 2.6656 | 0.1646 | 3.7752 | 0.2357 | 3.7128 | 0.2381 | 2.6665 | 0.1655 | 2.6801 | 0.1678 | 3.7386 | 0.1678 |
| | 40 | 2.9302 | 0.2187 | 2.9333 | 0.2176 | 4.1995 | 0.3158 | 4.2176 | 0.3188 | 2.9214 | 0.2174 | 2.9547 | 0.2220 | 3.9911 | 0.2220 |
| | Average | 2.3527 | 0.1389 | 2.3440 | 0.1372 | 3.3632 | 0.1992 | 3.2993 | 0.2006 | 2.3376 | 0.1374 | 2.3691 | 0.1406 | 3.2576 | 0.1406 |
| | Improvement | -0.3704% | -1.2413% | 30.0471% | 30.2665% | 28.6922% | 30.7768% | -0.6422% | -1.1033% | 0.6918% | 1.1892% | 27.7802% | 1.1892% | | |
| MCAR | 10 | 1.5600 | 0.0582 | 1.5534 | 0.0570 | 2.3244 | 0.0877 | 2.1286 | 0.0850 | 1.5534 | 0.0569 | 1.5775 | 0.0578 | 2.0434 | 0.0578 |
| | 20 | 2.2623 | 0.1167 | 2.2278 | 0.1137 | 3.1324 | 0.1637 | 3.1424 | 0.1647 | 2.2296 | 0.1138 | 2.2816 | 0.1160 | 3.1693 | 0.1160 |
| | 30 | 2.7726 | 0.1795 | 2.7498 | 0.1764 | 3.8610 | 0.2534 | 3.9783 | 0.2625 | 2.7490 | 0.1761 | 2.7993 | 0.1801 | 3.7387 | 0.1801 |
| | 40 | 3.1073 | 0.2295 | 3.0737 | 0.2248 | 4.3668 | 0.3233 | 4.3889 | 0.3308 | 3.0755 | 0.2249 | 3.1157 | 0.2293 | 4.3536 | 0.2293 |
| | Average | 2.4255 | 0.1460 | 2.4012 | 0.1430 | 3.4211 | 0.2070 | 3.4095 | 0.2108 | 2.4019 | 0.1429 | 2.4435 | 0.1458 | 3.3263 | 0.1458 |
| | Improvement | -1.0148% | -2.1056% | 29.1016% | 29.4909% | 28.8600% | 30.7339% | -0.9854% | -2.1422% | 0.7367% | -0.1155% | 27.0790% | -0.1155% | | |
| MNAR | 10 | 2.3661 | 0.0783 | 2.3553 | 0.0781 | 2.8256 | 0.0953 | 3.0953 | 0.1073 | 2.3549 | 0.0781 | 2.3859 | 0.0816 | 3.0663 | 0.0816 |
| | 20 | 2.8539 | 0.1401 | 2.8404 | 0.1376 | 3.5698 | 0.1773 | 3.5253 | 0.1824 | 2.8353 | 0.1373 | 2.8725 | 0.1430 | 3.8572 | 0.1430 |
| | 30 | 3.3621 | 0.1989 | 3.3474 | 0.1971 | 4.2218 | 0.2591 | 4.4296 | 0.2740 | 3.3448 | 0.1968 | 3.3833 | 0.2050 | 4.5327 | 0.2050 |
| | 40 | 3.5776 | 0.2506 | 3.5565 | 0.2473 | 4.7763 | 0.3523 | 4.7567 | 0.3573 | 3.5520 | 0.2465 | 3.5989 | 0.2548 | 4.8669 | 0.2548 |
| | Average | 3.0399 | 0.1670 | 3.0249 | 0.1650 | 3.8484 | 0.2210 | 3.9517 | 0.2302 | 3.0218 | 0.1647 | 3.0601 | 0.1711 | 4.0808 | 0.1711 |
| | Improvement | -0.4965% | -1.1934% | 21.0084% | 24.4399% | 23.0745% | 27.4812% | -0.5999% | -1.3896% | 0.6614% | 2.4067% | 25.5068% | 2.4067% | | |

## BNG (20000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9918 | 0.4565 | 0.9921 | 1.8828 | 0.9842 | 1.7639 | 0.9830 | 0.2220 | 0.9922 | 74.2948 | 0.9895 | 10.6167 | 0.9829 | 10.0512 |
| | 20 | 0.9842 | 0.4933 | 0.9849 | 2.1622 | 0.9701 | 3.8716 | 0.9668 | 0.3156 | 0.9850 | 63.0566 | 0.9800 | 17.5294 | 0.9675 | 19.6446 |
| | 30 | 0.9773 | 0.5467 | 0.9780 | 2.8796 | 0.9572 | 2.2821 | 0.9515 | 0.2684 | 0.9782 | 71.7609 | 0.9702 | 30.1089 | 0.9529 | 30.0275 |
| | 40 | 0.9682 | 0.5569 | 0.9687 | 2.1310 | 0.9422 | 2.5601 | 0.9338 | 0.3336 | 0.9691 | 87.7444 | 0.9591 | 37.9306 | 0.9367 | 45.8879 |
| | Average | 0.9803 | 0.5133 | 0.9810 | 2.2639 | 0.9634 | 2.6194 | 0.9588 | 0.2849 | 0.9811 | 74.2142 | 0.9747 | 24.0464 | 0.9600 | 26.4028 |
| | Improvement | | | -0.0622% | 77.3253% | 1.7562% | 80.4028% | 2.2497% | -80.1744% | -0.0799% | 99.3083% | 0.5777% | 97.8652% | 2.1196% | 98.0558% |
| MCAR | 10 | 0.9926 | 0.4522 | 0.9927 | 1.9819 | 0.9854 | 2.0753 | 0.9829 | 0.3285 | 0.9927 | 73.3636 | 0.9902 | 7.6275 | 0.9849 | 10.5580 |
| | 20 | 0.9845 | 0.4810 | 0.9850 | 1.4528 | 0.9697 | 1.4781 | 0.9680 | 0.1976 | 0.9850 | 64.1001 | 0.9802 | 20.8390 | 0.9684 | 28.8348 |
| | 30 | 0.9764 | 0.5200 | 0.9772 | 1.6435 | 0.9563 | 1.4798 | 0.9484 | 0.2179 | 0.9772 | 91.0866 | 0.9699 | 24.1670 | 0.9534 | 29.8058 |
| | 40 | 0.9693 | 0.5560 | 0.9704 | 1.5565 | 0.9411 | 1.6117 | 0.9337 | 0.2125 | 0.9704 | 125.2856 | 0.9604 | 39.9540 | 0.9376 | 43.4232 |
| | Average | 0.9807 | 0.5023 | 0.9813 | 1.6587 | 0.9631 | 1.6613 | 0.9583 | 0.2391 | 0.9813 | 88.4589 | 0.9752 | 23.1469 | 0.9611 | 28.1555 |
| | Improvement | | | -0.0651% | 69.7178% | 1.8249% | 69.7647% | 2.3389% | -110.0741% | -0.0653% | 99.4322% | 0.5636% | 97.8300% | 2.0395% | 98.2160% |
| MNAR | 10 | 0.9854 | 0.4561 | 0.9861 | 1.7135 | 0.9790 | 1.6614 | 0.9746 | 0.2891 | 0.9861 | 64.4663 | 0.9823 | 8.9253 | 0.9723 | 9.5650 |
| | 20 | 0.9749 | 0.4935 | 0.9761 | 1.7028 | 0.9620 | 1.6211 | 0.9557 | 0.2111 | 0.9763 | 52.7038 | 0.9695 | 16.4145 | 0.9501 | 21.4797 |
| | 30 | 0.9677 | 0.5113 | 0.9685 | 1.8748 | 0.9483 | 2.2800 | 0.9401 | 0.2532 | 0.9689 | 68.3413 | 0.9604 | 23.7467 | 0.9335 | 28.5009 |
| | 40 | 0.9616 | 0.5590 | 0.9626 | 1.5636 | 0.9331 | 1.5876 | 0.9268 | 0.2051 | 0.9632 | 90.5235 | 0.9540 | 31.2380 | 0.9193 | 36.0534 |
| | Average | 0.9724 | 0.5050 | 0.9733 | 1.7137 | 0.9556 | 1.7875 | 0.9493 | 0.2397 | 0.9736 | 69.0087 | 0.9665 | 20.0811 | 0.9438 | 23.8997 |
| | Improvement | | | -0.0936% | 70.5310% | 1.7577% | 71.7487% | 2.4354% | -110.7173% | -0.1239% | 99.2682% | 0.6066% | 97.4852% | 3.0311% | 97.8870% |

## BNG (20000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 1.4716 | 0.0571 | 1.4792 | 0.0575 | 2.1623 | 0.0803 | 2.0586 | 0.0804 | 1.4822 | 0.0576 | 1.4772 | 0.0571 | 2.0690 | 0.0571 |
| | 20 | 2.1139 | 0.1109 | 2.0981 | 0.1095 | 2.9079 | 0.1548 | 3.0964 | 0.1668 | 2.1024 | 0.1098 | 2.1337 | 0.1127 | 2.8824 | 0.1127 |
| | 30 | 2.7321 | 0.1728 | 2.7061 | 0.1697 | 3.8559 | 0.2438 | 3.8176 | 0.2494 | 2.7101 | 0.1702 | 2.7470 | 0.1741 | 3.6813 | 0.1741 |
| | 40 | 3.1700 | 0.2358 | 3.1603 | 0.2337 | 4.3239 | 0.3284 | 4.4148 | 0.3380 | 3.1365 | 0.2322 | 3.1924 | 0.2386 | 4.3704 | 0.2386 |
| | Average | 2.3719 | 0.1441 | 2.3609 | 0.1426 | 3.3125 | 0.2018 | 3.3469 | 0.2087 | 2.3578 | 0.1424 | 2.3876 | 0.1456 | 3.2508 | 0.1456 |
| | Improvement | | | -0.4662% | -1.1057% | 28.3957% | 28.5796% | 29.1301% | 30.9246% | -0.5984% | -1.1963% | 0.6562% | 1.0277% | 27.0360% | 1.0277% |
| MCAR | 10 | 1.5491 | 0.0551 | 1.5261 | 0.0536 | 2.1373 | 0.0765 | 2.1220 | 0.0798 | 1.5264 | 0.0536 | 1.5606 | 0.0561 | 2.0783 | 0.0561 |
| | 20 | 2.2497 | 0.1149 | 2.2394 | 0.1135 | 3.1132 | 0.1598 | 3.1474 | 0.1686 | 2.2395 | 0.1135 | 2.2742 | 0.1165 | 3.0531 | 0.1165 |
| | 30 | 2.7722 | 0.1743 | 2.7498 | 0.1711 | 3.8385 | 0.2432 | 3.8919 | 0.2514 | 2.7487 | 0.1711 | 2.7900 | 0.1742 | 3.7134 | 0.1742 |
| | 40 | 3.2298 | 0.2320 | 3.2046 | 0.2283 | 4.4028 | 0.3247 | 4.5116 | 0.3354 | 3.2047 | 0.2281 | 3.2419 | 0.2327 | 4.4955 | 0.2327 |
| | Average | 2.4502 | 0.1441 | 2.4299 | 0.1416 | 3.3730 | 0.2011 | 3.4182 | 0.2088 | 2.4298 | 0.1416 | 2.4667 | 0.1449 | 3.3351 | 0.1449 |
| | Improvement | | | -0.8332% | -1.7482% | 27.3576% | 28.3342% | 28.3195% | 30.9933% | -0.8379% | -1.7758% | 0.6682% | 0.5383% | 26.5328% | 0.5383% |
| MNAR | 10 | 2.5999 | 0.0917 | 2.5907 | 0.0899 | 3.2223 | 0.1132 | 3.0843 | 0.1131 | 2.5873 | 0.0898 | 2.6172 | 0.0939 | 3.4066 | 0.0939 |
| | 20 | 2.8665 | 0.1453 | 2.8560 | 0.1418 | 3.6511 | 0.1860 | 3.5948 | 0.1861 | 2.8569 | 0.1418 | 2.8842 | 0.1482 | 3.8681 | 0.1482 |
| | 30 | 3.1589 | 0.1984 | 3.1661 | 0.1953 | 4.1117 | 0.2631 | 4.1706 | 0.2693 | 3.1471 | 0.1943 | 3.1963 | 0.2034 | 4.5200 | 0.2034 |
| | 40 | 3.4973 | 0.2455 | 3.4847 | 0.2427 | 4.6391 | 0.3317 | 4.6809 | 0.3458 | 3.4701 | 0.2420 | 3.5105 | 0.2480 | 4.8555 | 0.2480 |
| | Average | 3.0307 | 0.1702 | 3.0244 | 0.1674 | 3.9061 | 0.2235 | 3.8827 | 0.2286 | 3.0154 | 0.1670 | 3.0521 | 0.1734 | 4.1625 | 0.1734 |
| | Improvement | | | -0.2081% | -1.6583% | 22.4113% | 23.8530% | 21.9437% | 25.5392% | -0.5067% | -1.9132% | 0.7018% | 1.8219% | 27.1920% | 1.8219% |

## BNG (50000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9919 | 2.1223 | 0.9923 | 2.5828 | 0.9852 | 2.8120 | 0.9829 | 0.2991 | 0.9923 | 139.8180 | 0.9895 | 39.8343 | 0.9827 | 69.8524 |
| | 20 | 0.9834 | 1.8846 | 0.9839 | 2.4411 | 0.9694 | 2.7868 | 0.9658 | 0.2160 | 0.9840 | 338.7035 | 0.9793 | 80.2408 | 0.9661 | 128.3386 |
| | 30 | 0.9759 | 2.0436 | 0.9765 | 2.4475 | 0.9558 | 2.4370 | 0.9487 | 0.2252 | 0.9768 | 462.1832 | 0.9697 | 105.6518 | 0.9505 | 180.7764 |
| | 40 | 0.9680 | 2.5546 | 0.9685 | 2.4593 | 0.9422 | 2.3289 | 0.9319 | 0.2362 | 0.9691 | 455.8960 | 0.9594 | 151.5706 | 0.9349 | 244.5915 |
| | Average | 0.9798 | 2.1513 | 0.9803 | 2.4827 | 0.9631 | 2.5912 | 0.9574 | 0.2441 | 0.9805 | 349.1502 | 0.9745 | 94.3244 | 0.9586 | 155.8897 |
| | Improvement | | | -0.0496% | 13.3483% | 1.7317% | 16.9755% | 2.3465% | -781.2251% | -0.0737% | 99.3838% | 0.5505% | 97.7192% | 2.2168% | 98.6200% |
| MCAR | 10 | 0.9927 | 1.4067 | 0.9929 | 2.5333 | 0.9861 | 2.5827 | 0.9838 | 0.2295 | 0.9929 | 201.4858 | 0.9906 | 43.2263 | 0.9848 | 66.2909 |
| | 20 | 0.9845 | 1.6316 | 0.9850 | 2.8486 | 0.9705 | 3.8138 | 0.9661 | 0.2791 | 0.9850 | 268.6171 | 0.9805 | 96.3127 | 0.9690 | 165.3247 |
| | 30 | 0.9765 | 2.0706 | 0.9775 | 2.6206 | 0.9563 | 2.6543 | 0.9495 | 0.2510 | 0.9775 | 751.3455 | 0.9708 | 135.5775 | 0.9532 | 261.9530 |
| | 40 | 0.9684 | 2.5311 | 0.9692 | 2.4359 | 0.9399 | 2.5002 | 0.9343 | 0.2567 | 0.9692 | 508.1519 | 0.9607 | 164.9656 | 0.9376 | 399.7990 |
| | Average | 0.9805 | 1.9100 | 0.9811 | 2.6096 | 0.9632 | 2.8877 | 0.9585 | 0.2541 | 0.9811 | 432.4001 | 0.9756 | 110.0206 | 0.9611 | 223.3419 |
| | Improvement | | | -0.0627% | 26.8090% | 1.8023% | 33.8583% | 2.3021% | -651.8110% | -0.0632% | 99.5583% | 0.4996% | 98.2640% | 2.0158% | 99.1448% |
| MNAR | 10 | 0.9851 | 1.4567 | 0.9859 | 2.9748 | 0.9786 | 3.0659 | 0.9758 | 0.2437 | 0.9859 | 294.5022 | 0.9827 | 44.3005 | 0.9722 | 96.4161 |
| | 20 | 0.9750 | 1.6492 | 0.9761 | 2.4930 | 0.9618 | 2.5971 | 0.9569 | 0.2378 | 0.9762 | 237.6230 | 0.9703 | 72.6356 | 0.9506 | 124.8703 |
| | 30 | 0.9677 | 2.5047 | 0.9687 | 2.8585 | 0.9468 | 2.6719 | 0.9418 | 0.2440 | 0.9690 | 566.9482 | 0.9606 | 129.2861 | 0.9341 | 196.5222 |
| | 40 | 0.9612 | 2.5122 | 0.9623 | 3.6041 | 0.9336 | 2.8932 | 0.9262 | 0.3417 | 0.9628 | 552.4126 | 0.9525 | 170.6084 | 0.9179 | 349.0920 |
| | Average | 0.9722 | 2.0307 | 0.9732 | 2.9826 | 0.9552 | 2.8070 | 0.9502 | 0.2668 | 0.9735 | 412.8715 | 0.9665 | 104.2076 | 0.9437 | 191.7251 |
| | Improvement | | | -0.1023% | 31.9152% | 1.7829% | 27.6562% | 2.3229% | -661.1278% | -0.1278% | 99.5082% | 0.5912% | 98.0513% | 3.0264% | 98.9408% |

## BNG (50000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 1.6866 | 0.0608 | 1.6729 | 0.0603 | 2.2384 | 0.0829 | 2.2303 | 0.0846 | 1.6687 | 0.0602 | 1.6846 | 0.0612 | 2.2649 | 0.0612 |
| | 20 | 2.3274 | 0.1212 | 2.3173 | 0.1198 | 3.2338 | 0.1700 | 3.2458 | 0.1736 | 2.3134 | 0.1201 | 2.3402 | 0.1218 | 3.2444 | 0.1218 |
| | 30 | 2.7054 | 0.1727 | 2.6860 | 0.1704 | 3.7373 | 0.2426 | 3.8286 | 0.2515 | 2.6763 | 0.1707 | 2.7290 | 0.1746 | 3.8069 | 0.1746 |
| | 40 | 3.1538 | 0.2320 | 3.1505 | 0.2294 | 4.3360 | 0.3208 | 4.4382 | 0.3366 | 3.1291 | 0.2291 | 3.1694 | 0.2339 | 4.3674 | 0.2339 |
| | Average | 2.4683 | 0.1467 | 2.4567 | 0.1450 | 3.3864 | 0.2041 | 3.4357 | 0.2116 | 2.4469 | 0.1450 | 2.4808 | 0.1479 | 3.4209 | 0.1479 |
| | Improvement | | | -0.4714% | -1.1726% | 27.1117% | 28.1330% | 28.1584% | 30.6729% | -0.8748% | -1.1340% | 0.5052% | 0.8220% | 27.8471% | 0.8220% |
| MCAR | 10 | 1.5351 | 0.0566 | 1.5210 | 0.0556 | 2.2345 | 0.0811 | 2.3050 | 0.0849 | 1.5213 | 0.0556 | 1.5381 | 0.0566 | 2.1010 | 0.0566 |
| | 20 | 2.2704 | 0.1174 | 2.2515 | 0.1151 | 3.1718 | 0.1655 | 3.2558 | 0.1718 | 2.2506 | 0.1151 | 2.2830 | 0.1177 | 3.0448 | 0.1177 |
| | 30 | 2.6733 | 0.1696 | 2.6475 | 0.1665 | 3.8136 | 0.2469 | 3.8038 | 0.2486 | 2.6467 | 0.1664 | 2.6963 | 0.1707 | 3.7020 | 0.1707 |
| | 40 | 3.1709 | 0.2312 | 3.1437 | 0.2267 | 4.4648 | 0.3288 | 4.4442 | 0.3326 | 3.1435 | 0.2266 | 3.1911 | 0.2319 | 4.3810 | 0.2319 |
| | Average | 2.4124 | 0.1437 | 2.3909 | 0.1410 | 3.4212 | 0.2056 | 3.4522 | 0.2095 | 2.3905 | 0.1409 | 2.4271 | 0.1442 | 3.3072 | 0.1442 |
| | Improvement | | | -0.8993% | -1.9383% | 29.4849% | 30.0947% | 30.1192% | 31.4031% | -0.9166% | -1.9879% | 0.6053% | 0.3496% | 27.0547% | 0.3496% |
| MNAR | 10 | 2.3119 | 0.0839 | 2.2983 | 0.0819 | 2.8251 | 0.1033 | 2.7615 | 0.1039 | 2.2966 | 0.0818 | 2.3254 | 0.0856 | 2.9898 | 0.0856 |
| | 20 | 3.0249 | 0.1479 | 3.0071 | 0.1451 | 3.6904 | 0.1842 | 3.7001 | 0.1896 | 2.9979 | 0.1449 | 3.0446 | 0.1514 | 4.1194 | 0.1514 |
| | 30 | 3.2833 | 0.1978 | 3.2660 | 0.1948 | 4.1362 | 0.2597 | 4.2032 | 0.2652 | 3.2616 | 0.1946 | 3.2965 | 0.2021 | 4.4322 | 0.2021 |
| | 40 | 3.4363 | 0.2423 | 3.4262 | 0.2391 | 4.6475 | 0.3365 | 4.6804 | 0.3432 | 3.4055 | 0.2380 | 3.4575 | 0.2472 | 4.9690 | 0.2472 |
| | Average | 3.0141 | 0.1680 | 2.9994 | 0.1652 | 3.8248 | 0.2209 | 3.8363 | 0.2255 | 2.9904 | 0.1648 | 3.0310 | 0.1716 | 4.1276 | 0.1716 |
| | Improvement | | | -0.4903% | -1.6734% | 21.1961% | 23.9696% | 21.4326% | 25.5099% | -0.7926% | -1.9086% | 0.5578% | 2.1000% | 26.9771% | 2.1000% |

## Poker (10000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9900 | 0.3675 | 0.9900 | 1.0194 | 0.9795 | 0.9539 | 0.9786 | 0.1763 | 0.9900 | 15.9496 | 0.9884 | 12.1584 | 0.9815 | 4.0817 |
| | 20 | 0.9791 | 0.3845 | 0.9789 | 0.9440 | 0.9597 | 0.8969 | 0.9602 | 0.1604 | 0.9790 | 15.9565 | 0.9762 | 46.5574 | 0.9640 | 14.6513 |
| | 30 | 0.9690 | 0.4172 | 0.9684 | 1.8841 | 0.9396 | 2.9231 | 0.9408 | 0.1645 | 0.9690 | 28.4135 | 0.9656 | 38.2120 | 0.9446 | 12.5210 |
| | 40 | 0.9593 | 0.3989 | 0.9582 | 1.6469 | 0.9203 | 1.0628 | 0.9244 | 0.2267 | 0.9592 | 32.1885 | 0.9540 | 61.2929 | 0.9251 | 20.7124 |
| | Average | 0.9743 | 0.3920 | 0.9739 | 1.3736 | 0.9498 | 1.4592 | 0.9510 | 0.1820 | 0.9743 | 23.1270 | 0.9711 | 39.5552 | 0.9538 | 12.9916 |
| | Improvement | | | 0.0442% | 71.4618% | 2.5826% | 73.1351% | 2.4543% | -115.4346% | 0.0031% | 98.3050% | 0.3357% | 99.0090% | 2.1497% | 96.9826% |
| MCAR | 10 | 0.9892 | 0.3456 | 0.9892 | 1.2723 | 0.9785 | 1.2258 | 0.9791 | 0.1867 | 0.9892 | 32.4028 | 0.9876 | 19.2451 | 0.9794 | 4.8784 |
| | 20 | 0.9798 | 0.3870 | 0.9798 | 1.2034 | 0.9610 | 1.1676 | 0.9600 | 0.1950 | 0.9797 | 26.4226 | 0.9765 | 31.0067 | 0.9631 | 10.3761 |
| | 30 | 0.9694 | 0.3809 | 0.9694 | 0.9218 | 0.9389 | 0.9663 | 0.9415 | 0.1657 | 0.9694 | 25.5615 | 0.9660 | 45.9757 | 0.9427 | 16.0704 |
| | 40 | 0.9586 | 0.4022 | 0.9585 | 0.9192 | 0.9162 | 0.8728 | 0.9195 | 0.1680 | 0.9585 | 21.4625 | 0.9533 | 55.8802 | 0.9216 | 18.9255 |
| | Average | 0.9742 | 0.3789 | 0.9742 | 1.0792 | 0.9487 | 1.0581 | 0.9501 | 0.1789 | 0.9742 | 26.4623 | 0.9709 | 38.0269 | 0.9517 | 12.5626 |
| | Improvement | | | 0.0019% | 64.8872% | 2.6957% | 64.1876% | 2.5447% | -111.8676% | 0.0017% | 98.5680% | 0.3476% | 99.0035% | 2.3644% | 96.9836% |
| MNAR | 10 | 0.9878 | 0.3506 | 0.9879 | 1.0198 | 0.9781 | 0.8953 | 0.9776 | 0.1696 | 0.9879 | 8.0444 | 0.9864 | 15.2337 | 0.9738 | 4.1131 |
| | 20 | 0.9768 | 0.3673 | 0.9766 | 0.8882 | 0.9559 | 0.8546 | 0.9578 | 0.1901 | 0.9767 | 16.5785 | 0.9721 | 35.5230 | 0.9475 | 13.7313 |
| | 30 | 0.9654 | 0.3980 | 0.9652 | 1.0684 | 0.9354 | 0.8766 | 0.9353 | 0.1748 | 0.9653 | 28.5426 | 0.9609 | 45.5284 | 0.9238 | 16.1572 |
| | 40 | 0.9561 | 0.4085 | 0.9555 | 0.9918 | 0.9173 | 0.8922 | 0.9222 | 0.1631 | 0.9560 | 27.7872 | 0.9489 | 56.6891 | 0.9045 | 17.4976 |
| | Average | 0.9715 | 0.3811 | 0.9713 | 0.9921 | 0.9467 | 0.8797 | 0.9482 | 0.1744 | 0.9715 | 20.2382 | 0.9671 | 38.2686 | 0.9374 | 12.8748 |
| | Improvement | | | 0.0266% | 61.5846% | 2.6270% | 56.6767% | 2.4588% | -118.5243% | 0.0060% | 98.1169% | 0.4610% | 99.0041% | 3.6424% | 97.0399% |

## Poker (10000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.2689 | 0.0205 | 0.2699 | 0.0205 | 0.3850 | 0.0270 | 0.4017 | 0.0278 | 0.2691 | 0.0205 | 0.2748 | 0.0207 | 0.3722 | 0.0207 |
| | 20 | 0.4063 | 0.0443 | 0.4077 | 0.0444 | 0.5617 | 0.0559 | 0.5618 | 0.0564 | 0.4073 | 0.0444 | 0.4137 | 0.0445 | 0.5380 | 0.0445 |
| | 30 | 0.4755 | 0.0637 | 0.4798 | 0.0640 | 0.6807 | 0.0846 | 0.6824 | 0.0843 | 0.4761 | 0.0637 | 0.4834 | 0.0638 | 0.6479 | 0.0638 |
| | 40 | 0.5472 | 0.0832 | 0.5555 | 0.0838 | 0.7720 | 0.1105 | 0.7440 | 0.1067 | 0.5476 | 0.0832 | 0.5591 | 0.0831 | 0.7588 | 0.0831 |
| | Average | 0.4245 | 0.0529 | 0.4282 | 0.0532 | 0.5998 | 0.0695 | 0.5975 | 0.0688 | 0.4250 | 0.0530 | 0.4327 | 0.0530 | 0.5792 | 0.0530 |
| | Improvement | | | 0.8751% | 0.5203% | 29.2336% | 23.8817% | 28.9573% | 23.0761% | 0.1278% | 0.1130% | 1.9042% | 0.2066% | 26.7175% | 0.2066% |
| MCAR | 10 | 0.2875 | 0.0230 | 0.2874 | 0.0230 | 0.4030 | 0.0301 | 0.4032 | 0.0300 | 0.2873 | 0.0230 | 0.2917 | 0.0230 | 0.3999 | 0.0230 |
| | 20 | 0.4008 | 0.0431 | 0.4016 | 0.0433 | 0.5503 | 0.0554 | 0.5650 | 0.0567 | 0.4013 | 0.0432 | 0.4143 | 0.0429 | 0.5432 | 0.0429 |
| | 30 | 0.4727 | 0.0632 | 0.4730 | 0.0633 | 0.6865 | 0.0848 | 0.6635 | 0.0833 | 0.4730 | 0.0632 | 0.4798 | 0.0631 | 0.6556 | 0.0631 |
| | 40 | 0.5465 | 0.0840 | 0.5472 | 0.0841 | 0.7925 | 0.1133 | 0.7728 | 0.1111 | 0.5471 | 0.0841 | 0.5558 | 0.0841 | 0.7697 | 0.0841 |
| | Average | 0.4269 | 0.0533 | 0.4273 | 0.0534 | 0.6081 | 0.0709 | 0.6011 | 0.0703 | 0.4272 | 0.0534 | 0.4354 | 0.0533 | 0.5921 | 0.0533 |
| | Improvement | | | 0.0956% | 0.1480% | 29.7959% | 24.7905% | 28.9846% | 24.1563% | 0.0708% | 0.1103% | 1.9512% | -0.1300% | 27.8984% | -0.1300% |
| MNAR | 10 | 0.3074 | 0.0242 | 0.3066 | 0.0242 | 0.4043 | 0.0291 | 0.4316 | 0.0304 | 0.3068 | 0.0242 | 0.3128 | 0.0254 | 0.4444 | 0.0254 |
| | 20 | 0.4156 | 0.0462 | 0.4185 | 0.0465 | 0.5840 | 0.0599 | 0.5641 | 0.0577 | 0.4167 | 0.0463 | 0.4292 | 0.0477 | 0.6371 | 0.0477 |
| | 30 | 0.5104 | 0.0686 | 0.5145 | 0.0690 | 0.7073 | 0.0878 | 0.6926 | 0.0863 | 0.5121 | 0.0687 | 0.5218 | 0.0721 | 0.7580 | 0.0721 |
| | 40 | 0.5606 | 0.0859 | 0.5645 | 0.0866 | 0.7882 | 0.1122 | 0.7645 | 0.1092 | 0.5612 | 0.0861 | 0.5769 | 0.0902 | 0.8460 | 0.0902 |
| | Average | 0.4485 | 0.0562 | 0.4510 | 0.0565 | 0.6209 | 0.0723 | 0.6132 | 0.0709 | 0.4492 | 0.0563 | 0.4602 | 0.0589 | 0.6714 | 0.0589 |
| | Improvement | | | 0.5540% | 0.5299% | 27.7672% | 22.1546% | 26.8559% | 20.6530% | 0.1531% | 0.1149% | 2.5333% | 4.4485% | 33.1935% | 4.4485% |

## Poker (15000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9897 | 0.5036 | 0.9898 | 1.3386 | 0.9802 | 1.2146 | 0.9798 | 0.1594 | 0.9898 | 37.2067 | 0.9884 | 26.0576 | 0.9821 | 9.3903 |
| | 20 | 0.9799 | 0.5250 | 0.9798 | 1.4835 | 0.9616 | 1.4063 | 0.9610 | 0.2035 | 0.9799 | 54.5248 | 0.9774 | 46.6886 | 0.9628 | 16.3687 |
| | 30 | 0.9686 | 0.5554 | 0.9678 | 1.0812 | 0.9395 | 1.0687 | 0.9404 | 0.1991 | 0.9686 | 37.3244 | 0.9651 | 71.0682 | 0.9411 | 26.6531 |
| | 40 | 0.9584 | 0.5728 | 0.9575 | 1.0966 | 0.9202 | 1.0875 | 0.9174 | 0.1759 | 0.9584 | 53.5351 | 0.9539 | 96.7071 | 0.9233 | 35.6581 |
| | Average | 0.9742 | 0.5392 | 0.9737 | 1.2500 | 0.9504 | 1.1943 | 0.9496 | 0.1845 | 0.9742 | 45.6477 | 0.9712 | 60.1304 | 0.9523 | 22.0176 |
| | Improvement | | | 0.0452% | 56.8626% | 2.5036% | 54.8508% | 2.5821% | -192.3202% | -0.0008% | 98.8188% | 0.3076% | 99.1033% | 2.2915% | 97.5510% |
| MCAR | 10 | 0.9897 | 0.4834 | 0.9897 | 1.0508 | 0.9788 | 1.4210 | 0.9798 | 0.1574 | 0.9898 | 24.8769 | 0.9883 | 25.3689 | 0.9801 | 8.0119 |
| | 20 | 0.9796 | 0.5306 | 0.9796 | 1.3245 | 0.9592 | 1.1356 | 0.9582 | 0.1824 | 0.9796 | 29.2526 | 0.9772 | 50.5244 | 0.9627 | 19.3499 |
| | 30 | 0.9694 | 0.5405 | 0.9694 | 1.1097 | 0.9411 | 1.0999 | 0.9407 | 0.1587 | 0.9694 | 31.8635 | 0.9660 | 72.7674 | 0.9450 | 25.8027 |
| | 40 | 0.9575 | 0.5691 | 0.9576 | 0.9585 | 0.9179 | 0.9738 | 0.9196 | 0.1630 | 0.9576 | 34.8016 | 0.9528 | 99.0582 | 0.9222 | 31.3562 |
| | Average | 0.9741 | 0.5309 | 0.9741 | 1.1109 | 0.9492 | 1.1576 | 0.9496 | 0.1654 | 0.9741 | 30.1987 | 0.9711 | 61.9297 | 0.9525 | 21.1302 |
| | Improvement | | | -0.0036% | 52.2078% | 2.6132% | 54.1366% | 2.5804% | -221.0596% | -0.0031% | 98.2420% | 0.3066% | 99.1427% | 2.2633% | 97.4875% |
| MNAR | 10 | 0.9873 | 0.4826 | 0.9873 | 1.1299 | 0.9781 | 1.0877 | 0.9763 | 0.1618 | 0.9873 | 49.1954 | 0.9856 | 31.3337 | 0.9724 | 9.6735 |
| | 20 | 0.9765 | 0.5072 | 0.9764 | 1.3432 | 0.9550 | 1.2737 | 0.9563 | 0.1711 | 0.9765 | 48.4343 | 0.9734 | 58.8080 | 0.9475 | 18.9581 |
| | 30 | 0.9657 | 0.5314 | 0.9655 | 1.1363 | 0.9357 | 0.9695 | 0.9359 | 0.1694 | 0.9657 | 50.4105 | 0.9611 | 74.1775 | 0.9229 | 23.8163 |
| | 40 | 0.9560 | 0.5733 | 0.9554 | 1.1380 | 0.9170 | 1.0270 | 0.9188 | 0.1696 | 0.9559 | 50.7848 | 0.9503 | 100.0812 | 0.9044 | 37.4225 |
| | Average | 0.9714 | 0.5236 | 0.9711 | 1.1868 | 0.9464 | 1.0895 | 0.9468 | 0.1680 | 0.9714 | 49.7063 | 0.9676 | 66.1001 | 0.9368 | 22.4676 |
| | Improvement | | | 0.0241% | 55.8807% | 2.6348% | 51.9374% | 2.5918% | -211.6968% | 0.0019% | 98.9466% | 0.3908% | 99.2078% | 3.6936% | 97.6694% |

## Poker (15000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.2784 | 0.0214 | 0.2788 | 0.0214 | 0.3932 | 0.0274 | 0.3935 | 0.0281 | 0.2788 | 0.0214 | 0.2837 | 0.0215 | 0.3692 | 0.0215 |
| | 20 | 0.3886 | 0.0422 | 0.3906 | 0.0424 | 0.5440 | 0.0554 | 0.5548 | 0.0564 | 0.3891 | 0.0423 | 0.3982 | 0.0423 | 0.5443 | 0.0423 |
| | 30 | 0.4772 | 0.0637 | 0.4823 | 0.0642 | 0.6779 | 0.0839 | 0.6752 | 0.0834 | 0.4768 | 0.0637 | 0.4857 | 0.0634 | 0.6625 | 0.0634 |
| | 40 | 0.5488 | 0.0844 | 0.5550 | 0.0848 | 0.7743 | 0.1106 | 0.7848 | 0.1125 | 0.5486 | 0.0844 | 0.5586 | 0.0846 | 0.7532 | 0.0846 |
| | Average | 0.4233 | 0.0529 | 0.4267 | 0.0532 | 0.5974 | 0.0693 | 0.6021 | 0.0701 | 0.4233 | 0.0530 | 0.4316 | 0.0530 | 0.5823 | 0.0530 |
| | Improvement | | | 0.8009% | 0.4702% | 29.1442% | 23.6055% | 29.7014% | 24.5132% | 0.0167% | 0.0383% | 1.9258% | 0.0383% | 27.3108% | 0.0383% |
| MCAR | 10 | 0.2856 | 0.0225 | 0.2852 | 0.0225 | 0.4052 | 0.0297 | 0.3967 | 0.0288 | 0.2851 | 0.0225 | 0.2903 | 0.0224 | 0.3935 | 0.0224 |
| | 20 | 0.3869 | 0.0421 | 0.3864 | 0.0421 | 0.5455 | 0.0559 | 0.5616 | 0.0566 | 0.3867 | 0.0421 | 0.3959 | 0.0423 | 0.5319 | 0.0423 |
| | 30 | 0.4744 | 0.0630 | 0.4744 | 0.0630 | 0.6719 | 0.0834 | 0.6695 | 0.0830 | 0.4745 | 0.0630 | 0.4833 | 0.0630 | 0.6412 | 0.0630 |
| | 40 | 0.5576 | 0.0863 | 0.5574 | 0.0863 | 0.8073 | 0.1157 | 0.7910 | 0.1142 | 0.5573 | 0.0863 | 0.5668 | 0.0860 | 0.7725 | 0.0860 |
| | Average | 0.4261 | 0.0535 | 0.4258 | 0.0535 | 0.6075 | 0.0712 | 0.6047 | 0.0706 | 0.4259 | 0.0535 | 0.4341 | 0.0534 | 0.5848 | 0.0534 |
| | Improvement | | | -0.0623% | -0.0166% | 29.8531% | 24.8535% | 29.5297% | 24.3136% | -0.0554% | -0.0115% | 1.8344% | -0.1224% | 27.1313% | -0.1224% |
| MNAR | 10 | 0.3104 | 0.0246 | 0.3102 | 0.0246 | 0.4092 | 0.0298 | 0.4329 | 0.0313 | 0.3103 | 0.0246 | 0.3176 | 0.0255 | 0.4633 | 0.0255 |
| | 20 | 0.4230 | 0.0469 | 0.4240 | 0.0470 | 0.5894 | 0.0602 | 0.5738 | 0.0582 | 0.4232 | 0.0469 | 0.4363 | 0.0496 | 0.6346 | 0.0496 |
| | 30 | 0.5041 | 0.0683 | 0.5057 | 0.0686 | 0.7047 | 0.0875 | 0.6960 | 0.0869 | 0.5039 | 0.0683 | 0.5168 | 0.0718 | 0.7652 | 0.0718 |
| | 40 | 0.5660 | 0.0875 | 0.5698 | 0.0881 | 0.7953 | 0.1141 | 0.7834 | 0.1125 | 0.5664 | 0.0876 | 0.5792 | 0.0914 | 0.8523 | 0.0914 |
| | Average | 0.4509 | 0.0569 | 0.4524 | 0.0571 | 0.6246 | 0.0729 | 0.6215 | 0.0722 | 0.4510 | 0.0569 | 0.4625 | 0.0596 | 0.6788 | 0.0596 |
| | Improvement | | | 0.3400% | 0.4152% | 27.8172% | 21.9968% | 27.4553% | 21.2849% | 0.0183% | 0.0436% | 2.5050% | 4.5794% | 33.5798% | 4.5794% |

**Poker (20000) dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9898 | 0.6832 | 0.9898 | 0.3990 | 0.9806 | 0.4580 | 0.9805 | 0.0601 | 0.9898 | 10.8926 | 0.9888 | 10.2978 | 0.9812 | 3.9383 |
| | 20 | 0.9798 | 0.7026 | 0.9796 | 0.4130 | 0.9616 | 0.4940 | 0.9602 | 0.0635 | 0.9797 | 11.5804 | 0.9779 | 20.9923 | 0.9625 | 8.1352 |
| | 30 | 0.9687 | 0.7337 | 0.9682 | 0.3482 | 0.9373 | 0.3545 | 0.9378 | 0.0515 | 0.9686 | 15.9105 | 0.9656 | 31.9854 | 0.9418 | 11.7474 |
| | 40 | 0.9586 | 0.7827 | 0.9577 | 0.3542 | 0.9182 | 0.4447 | 0.9188 | 0.0655 | 0.9586 | 16.4187 | 0.9544 | 41.3792 | 0.9241 | 15.8793 |
| | Average | 0.9742 | 0.7255 | 0.9738 | 0.3786 | 0.9494 | 0.4378 | 0.9493 | 0.0601 | 0.9742 | 13.7005 | 0.9717 | 26.1637 | 0.9524 | 9.9251 |
| | Improvement | | | 0.0404% | -91.6435% | 2.6108% | -65.7320% | 2.6245% | -1106.6029% | 0.0027% | 94.7043% | 0.2593% | 97.2269% | 2.2948% | 92.6899% |
| MCAR | 10 | 0.9896 | 0.6310 | 0.9896 | 0.4061 | 0.9792 | 0.3772 | 0.9791 | 0.0519 | 0.9896 | 8.9112 | 0.9884 | 11.1145 | 0.9807 | 3.8607 |
| | 20 | 0.9796 | 0.6831 | 0.9796 | 0.3621 | 0.9616 | 0.3714 | 0.9609 | 0.0513 | 0.9796 | 11.1416 | 0.9775 | 23.3743 | 0.9615 | 7.8454 |
| | 30 | 0.9692 | 0.7033 | 0.9692 | 0.4694 | 0.9399 | 0.4079 | 0.9402 | 0.0526 | 0.9692 | 29.4215 | 0.9657 | 33.6645 | 0.9429 | 12.1653 |
| | 40 | 0.9585 | 0.7852 | 0.9586 | 0.3694 | 0.9199 | 0.4669 | 0.9206 | 0.0693 | 0.9586 | 27.9498 | 0.9540 | 44.7118 | 0.9232 | 17.3149 |
| | Average | 0.9742 | 0.7006 | 0.9742 | 0.4017 | 0.9502 | 0.4058 | 0.9502 | 0.0563 | 0.9743 | 19.3560 | 0.9714 | 28.2163 | 0.9521 | 10.2966 |
| | Improvement | | | -0.0019% | -74.4060% | 2.5308% | -72.6389% | 2.5275% | -1144.9062% | -0.0030% | 96.3802% | 0.2896% | 97.5169% | 2.3234% | 93.1954% |
| MNAR | 10 | 0.9878 | 0.6209 | 0.9878 | 0.5030 | 0.9773 | 0.4839 | 0.9788 | 0.0571 | 0.9878 | 15.8798 | 0.9860 | 11.6762 | 0.9725 | 3.9738 |
| | 20 | 0.9766 | 0.6848 | 0.9766 | 0.4474 | 0.9562 | 0.4803 | 0.9575 | 0.0607 | 0.9766 | 10.4761 | 0.9731 | 21.6411 | 0.9470 | 7.6187 |
| | 30 | 0.9646 | 0.7172 | 0.9643 | 0.3747 | 0.9351 | 0.4346 | 0.9351 | 0.0559 | 0.9646 | 19.2315 | 0.9597 | 32.7227 | 0.9222 | 12.2369 |
| | 40 | 0.9551 | 0.7836 | 0.9547 | 0.4584 | 0.9176 | 0.4207 | 0.9171 | 0.0698 | 0.9551 | 16.4051 | 0.9495 | 44.0988 | 0.9009 | 15.8294 |
| | Average | 0.9710 | 0.7016 | 0.9708 | 0.4459 | 0.9465 | 0.4549 | 0.9471 | 0.0609 | 0.9710 | 15.4981 | 0.9671 | 27.5347 | 0.9357 | 9.9147 |
| | Improvement | | | 0.0220% | -57.3568% | 2.5892% | -54.2435% | 2.5248% | -1052.6493% | 0.0008% | 95.4729% | 0.4120% | 97.4519% | 3.7817% | 92.9234% |

**Poker (20000) dataset**

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.2811 | 0.0215 | 0.2814 | 0.0216 | 0.3956 | 0.0282 | 0.3909 | 0.0279 | 0.2812 | 0.0215 | 0.2849 | 0.0215 | 0.3775 | 0.0215 |
| | 20 | 0.3880 | 0.0419 | 0.3902 | 0.0420 | 0.5430 | 0.0547 | 0.5473 | 0.0551 | 0.3886 | 0.0420 | 0.3943 | 0.0419 | 0.5315 | 0.0419 |
| | 30 | 0.4871 | 0.0650 | 0.4906 | 0.0654 | 0.6891 | 0.0864 | 0.6971 | 0.0878 | 0.4871 | 0.0651 | 0.4942 | 0.0652 | 0.6750 | 0.0652 |
| | 40 | 0.5446 | 0.0832 | 0.5529 | 0.0842 | 0.7901 | 0.1127 | 0.7860 | 0.1115 | 0.5450 | 0.0833 | 0.5536 | 0.0833 | 0.7605 | 0.0833 |
| | Average | 0.4252 | 0.0529 | 0.4288 | 0.0533 | 0.6044 | 0.0705 | 0.6054 | 0.0706 | 0.4255 | 0.0530 | 0.4318 | 0.0530 | 0.5861 | 0.0530 |
| | Improvement | | | 0.8370% | 0.7684% | 29.6555% | 24.9661% | 29.7607% | 25.0693% | 0.0662% | 0.1273% | 1.5213% | 0.1602% | 27.4540% | 0.1602% |
| MCAR | 10 | 0.2766 | 0.0217 | 0.2761 | 0.0217 | 0.3918 | 0.0290 | 0.3955 | 0.0293 | 0.2761 | 0.0217 | 0.2816 | 0.0218 | 0.3883 | 0.0218 |
| | 20 | 0.3904 | 0.0422 | 0.3905 | 0.0422 | 0.5412 | 0.0548 | 0.5505 | 0.0549 | 0.3904 | 0.0422 | 0.3954 | 0.0421 | 0.5416 | 0.0421 |
| | 30 | 0.4750 | 0.0631 | 0.4750 | 0.0631 | 0.6724 | 0.0828 | 0.6661 | 0.0824 | 0.4748 | 0.0631 | 0.4837 | 0.0631 | 0.6531 | 0.0631 |
| | 40 | 0.5533 | 0.0851 | 0.5528 | 0.0851 | 0.7817 | 0.1121 | 0.7782 | 0.1119 | 0.5526 | 0.0850 | 0.5624 | 0.0849 | 0.7656 | 0.0849 |
| | Average | 0.4238 | 0.0530 | 0.4236 | 0.0530 | 0.5968 | 0.0697 | 0.5976 | 0.0696 | 0.4235 | 0.0530 | 0.4308 | 0.0530 | 0.5872 | 0.0530 |
| | Improvement | | | -0.0543% | -0.0098% | 28.9831% | 23.9063% | 29.0763% | 23.8361% | -0.0743% | -0.0336% | 1.6186% | -0.0783% | 27.8194% | -0.0783% |
| MNAR | 10 | 0.3065 | 0.0242 | 0.3060 | 0.0242 | 0.4152 | 0.0299 | 0.4086 | 0.0293 | 0.3058 | 0.0242 | 0.3142 | 0.0251 | 0.4522 | 0.0251 |
| | 20 | 0.4170 | 0.0462 | 0.4170 | 0.0462 | 0.5815 | 0.0592 | 0.5668 | 0.0577 | 0.4169 | 0.0461 | 0.4281 | 0.0490 | 0.6321 | 0.0490 |
| | 30 | 0.5057 | 0.0690 | 0.5082 | 0.0693 | 0.6960 | 0.0877 | 0.6940 | 0.0870 | 0.5058 | 0.0690 | 0.5187 | 0.0726 | 0.7630 | 0.0726 |
| | 40 | 0.5761 | 0.0891 | 0.5796 | 0.0897 | 0.7911 | 0.1144 | 0.7956 | 0.1142 | 0.5762 | 0.0891 | 0.5885 | 0.0930 | 0.8784 | 0.0930 |
| | Average | 0.4513 | 0.0571 | 0.4527 | 0.0573 | 0.6209 | 0.0728 | 0.6162 | 0.0720 | 0.4512 | 0.0571 | 0.4624 | 0.0599 | 0.6814 | 0.0599 |
| | Improvement | | | 0.3088% | 0.4147% | 27.3202% | 21.5744% | 26.7660% | 20.7502% | -0.0227% | 0.0254% | 2.3947% | 4.7059% | 33.7730% | 4.7059% |

## Poker (50000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time | R2score | Time |
| MAR | 10 | 0.9899 | 1.6605 | 0.9899 | 2.4798 | 0.9801 | 2.6797 | 0.9802 | 0.2143 | 0.9899 | 90.6599 | 0.9888 | 187.6962 | 0.9811 | 110.8291 |
| | 20 | 0.9798 | 1.8920 | 0.9797 | 2.6871 | 0.9604 | 2.6295 | 0.9605 | 0.2651 | 0.9798 | 255.8185 | 0.9781 | 351.9243 | 0.9627 | 268.4075 |
| | 30 | 0.9691 | 2.3891 | 0.9687 | 3.2172 | 0.9413 | 2.8262 | 0.9393 | 0.2655 | 0.9691 | 420.8798 | 0.9661 | 538.7510 | 0.9428 | 415.5741 |
| | 40 | 0.9580 | 2.7037 | 0.9570 | 2.1785 | 0.9198 | 2.3664 | 0.9201 | 0.2890 | 0.9580 | 422.2767 | 0.9545 | 601.2418 | 0.9224 | 470.1809 |
| | Average | 0.9742 | 2.1613 | 0.9738 | 2.6407 | 0.9504 | 2.6254 | 0.9500 | 0.2585 | 0.9742 | 297.4087 | 0.9719 | 419.9033 | 0.9523 | 316.2479 |
| | Improvement | | | 0.0369% | 18.1520% | 2.5010% | 17.6775% | 2.5436% | -736.1104% | -0.0026% | 99.2733% | 0.2381% | 99.4853% | 2.3016% | 99.3166% |
| MCAR | 10 | 0.9899 | 1.6669 | 0.9899 | 2.3307 | 0.9803 | 2.3853 | 0.9806 | 0.2190 | 0.9899 | 213.3269 | 0.9888 | 150.1563 | 0.9814 | 83.9729 |
| | 20 | 0.9797 | 1.8784 | 0.9797 | 2.1586 | 0.9605 | 2.2078 | 0.9602 | 0.2189 | 0.9797 | 173.9603 | 0.9777 | 307.8480 | 0.9621 | 171.6573 |
| | 30 | 0.9689 | 2.2333 | 0.9689 | 2.3874 | 0.9383 | 2.1349 | 0.9382 | 0.3195 | 0.9689 | 198.1578 | 0.9664 | 461.0241 | 0.9431 | 264.0887 |
| | 40 | 0.9588 | 2.8884 | 0.9588 | 2.1434 | 0.9209 | 2.3212 | 0.9211 | 0.2832 | 0.9588 | 393.8678 | 0.9551 | 615.8898 | 0.9250 | 347.5806 |
| | Average | 0.9743 | 2.1668 | 0.9743 | 2.2550 | 0.9500 | 2.2623 | 0.9500 | 0.2601 | 0.9743 | 244.8282 | 0.9720 | 383.7296 | 0.9529 | 216.8249 |
| | Improvement | | | -0.0015% | 3.9135% | 2.5601% | 4.2234% | 2.5604% | -732.9311% | -0.0017% | 99.1150% | 0.2421% | 99.4353% | 2.2481% | 99.0007% |
| MNAR | 10 | 0.9877 | 1.6456 | 0.9877 | 2.7093 | 0.9781 | 2.4925 | 0.9782 | 0.2563 | 0.9877 | 155.3308 | 0.9856 | 153.5683 | 0.9729 | 91.0743 |
| | 20 | 0.9758 | 1.8099 | 0.9757 | 2.4931 | 0.9560 | 2.2347 | 0.9564 | 0.2201 | 0.9758 | 195.4248 | 0.9724 | 309.3917 | 0.9466 | 172.3143 |
| | 30 | 0.9654 | 2.6615 | 0.9652 | 2.5394 | 0.9370 | 2.2983 | 0.9359 | 0.2579 | 0.9654 | 156.1359 | 0.9608 | 464.3534 | 0.9240 | 261.2055 |
| | 40 | 0.9552 | 2.6091 | 0.9546 | 2.0955 | 0.9171 | 2.0401 | 0.9174 | 0.2242 | 0.9552 | 345.0276 | 0.9501 | 615.5183 | 0.9024 | 348.8495 |
| | Average | 0.9710 | 2.1815 | 0.9708 | 2.4593 | 0.9471 | 2.2664 | 0.9470 | 0.2396 | 0.9710 | 212.9798 | 0.9672 | 385.7079 | 0.9365 | 218.3609 |
| | Improvement | | | 0.0222% | 11.2973% | 2.5281% | 3.7454% | 2.5412% | -810.4256% | 0.0005% | 98.9757% | 0.3912% | 99.4344% | 3.6875% | 99.0010% |

## Poker (50000) dataset

| Mech | % missing value | CBRG | | Least Squares | | Stochastic | | Norm | | MICE | | Fast KNN | | EMI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE | MAE | RMSE |
| MAR | 10 | 0.2781 | 0.0215 | 0.2780 | 0.0215 | 0.3897 | 0.0280 | 0.3910 | 0.0282 | 0.2779 | 0.0215 | 0.2819 | 0.0215 | 0.3793 | 0.0215 |
| | 20 | 0.3888 | 0.0419 | 0.3898 | 0.0420 | 0.5540 | 0.0552 | 0.5473 | 0.0549 | 0.3884 | 0.0419 | 0.3931 | 0.0419 | 0.5301 | 0.0419 |
| | 30 | 0.4780 | 0.0635 | 0.4811 | 0.0638 | 0.6677 | 0.0825 | 0.6828 | 0.0849 | 0.4778 | 0.0635 | 0.4855 | 0.0635 | 0.6610 | 0.0635 |
| | 40 | 0.5567 | 0.0857 | 0.5639 | 0.0863 | 0.7844 | 0.1125 | 0.7815 | 0.1125 | 0.5566 | 0.0858 | 0.5644 | 0.0856 | 0.7720 | 0.0856 |
| | Average | 0.4254 | 0.0532 | 0.4282 | 0.0534 | 0.5989 | 0.0696 | 0.6007 | 0.0701 | 0.4252 | 0.0532 | 0.4312 | 0.0531 | 0.5856 | 0.0531 |
| | Improvement | | | 0.6487% | 0.4204% | 28.9728% | 23.5668% | 29.1768% | 24.1732% | -0.0522% | -0.0073% | 1.3542% | -0.0765% | 27.3557% | -0.0765% |
| MCAR | 10 | 0.2750 | 0.0209 | 0.2750 | 0.0209 | 0.3853 | 0.0272 | 0.3778 | 0.0270 | 0.2750 | 0.0209 | 0.2796 | 0.0209 | 0.3707 | 0.0209 |
| | 20 | 0.3899 | 0.0423 | 0.3899 | 0.0423 | 0.5445 | 0.0552 | 0.5555 | 0.0559 | 0.3899 | 0.0423 | 0.3953 | 0.0423 | 0.5409 | 0.0423 |
| | 30 | 0.4785 | 0.0637 | 0.4785 | 0.0638 | 0.6884 | 0.0853 | 0.6844 | 0.0851 | 0.4784 | 0.0638 | 0.4854 | 0.0638 | 0.6568 | 0.0638 |
| | 40 | 0.5495 | 0.0839 | 0.5494 | 0.0840 | 0.7690 | 0.1098 | 0.7733 | 0.1100 | 0.5494 | 0.0840 | 0.5559 | 0.0839 | 0.7582 | 0.0839 |
| | Average | 0.4232 | 0.0527 | 0.4232 | 0.0527 | 0.5968 | 0.0694 | 0.5977 | 0.0695 | 0.4232 | 0.0527 | 0.4290 | 0.0527 | 0.5817 | 0.0527 |
| | Improvement | | | -0.0048% | 0.0298% | 29.0839% | 24.0395% | 29.1976% | 24.1298% | -0.0079% | 0.0279% | 1.3592% | 0.0034% | 27.2424% | 0.0034% |
| MNAR | 10 | 0.3060 | 0.0241 | 0.3064 | 0.0241 | 0.4082 | 0.0297 | 0.4039 | 0.0294 | 0.3062 | 0.0241 | 0.3163 | 0.0257 | 0.4576 | 0.0257 |
| | 20 | 0.4289 | 0.0478 | 0.4294 | 0.0479 | 0.5809 | 0.0594 | 0.5791 | 0.0591 | 0.4288 | 0.0478 | 0.4403 | 0.0505 | 0.6444 | 0.0505 |
| | 30 | 0.5054 | 0.0683 | 0.5071 | 0.0685 | 0.6947 | 0.0867 | 0.6998 | 0.0870 | 0.5055 | 0.0683 | 0.5173 | 0.0717 | 0.7608 | 0.0717 |
| | 40 | 0.5749 | 0.0890 | 0.5782 | 0.0896 | 0.7988 | 0.1142 | 0.7948 | 0.1139 | 0.5748 | 0.0890 | 0.5860 | 0.0928 | 0.8636 | 0.0928 |
| | Average | 0.4538 | 0.0573 | 0.4553 | 0.0575 | 0.6207 | 0.0725 | 0.6194 | 0.0724 | 0.4538 | 0.0573 | 0.4650 | 0.0602 | 0.6816 | 0.0602 |
| | Improvement | | | 0.3254% | 0.3940% | 26.8853% | 20.9525% | 26.7378% | 20.8572% | 0.0002% | 0.0142% | 2.4069% | 4.7853% | 33.4227% | 4.7853% |