Rebuttal additional experiments

Anonymous Author(s)
Affiliation
Address
email

Contents

1 Benchmark datasets

Table 1 gather the datasets information.

2 Overall Benchmark performances

2.1 Regression

Table 2 presents the overall performance comparison of the models over the 16 regression datasets.

We see that the model Ensemble-MLR performs better than all the GBDT models in terms of Friedman ranks and percentiles statistics. Our conclusion and discussion of the advantages of the MLR method in the submitted manuscript remain valid.

See Section 4 for the dataset-wise performance

Submitted to 35th Conference on Neural Information Processing Systems (NeurIPS 2021). Do not distribute.

Table 1: Benchmark datasets. # Num. and # Cat. denote the initial number of numerical and categorical features respectively. We denote by d the number of features after the pre-processing and one-hot encoding.

Description	Task	n	d	# Num.	# Cat.	Field	Link
Concrete Slump Test -2	Reg	103	8	8	0	Construction Materials	https://archive.ics.uci.edu/ml/datasets/Concrete+Slump+Test
Concrete Slump Test -3	Reg	103	8	8	0	Construction Materials	https://archive.ics.uci.edu/ml/datasets/Concrete+Slump+Test
Concrete Slump Test -1	Reg	103	8	8	0	Construction Materials	https://archive.ics.uci.edu/ml/datasets/Concrete+Slump+Test
Servo	Reg	168	24	2	4	Control Engineering	https://archive.ics.uci.edu/ml/datasets/Servo
Computer Hardware	Reg	210	7	7	0	Computer	https://archive.ics.uci.edu/ml/datasets/Computer+Hardware
Yacht Hydrodynamics	Reg	308	33	5	3	Hydromechanics	http://archive.ics.uci.edu/ml/datasets/yacht+hydrodynamics
QSAR aquatic toxicity	Reg	546	34	8	3	Earth and Environmental Sciences	https://archive.ics.uci.edu/ml/datasets/QSAR+aquatic+toxicity
QSAR Bioconcentration classes	Reg	779	25	8	4	Life and Environmental Sciences	https://archive.ics.uci.edu/ml/datasets/QSAR+Bioconcentratio
QSAR fish toxicity	Reg	909	18	6	2	Life and Environmental Sciences	https://archive.ics.uci.edu/ml/datasets/QSAR+fish+toxicity
insurance	Reg	1338	15	3	4	insurance	https://www.kaggle.com/mirichoi0218/insurance
Communities and Crime	Reg	1994	108	99	2	Social sciences	http://archive.ics.uci.edu/ml/datasets/communities+and+crime
Abalone R	Reg	4178	11	7	1	Biology	https://archive.ics.uci.edu/ml/datasets/abalone
squark automotive CLV training	Reg	8099	77	7	16	Marketing	https://www.kaggle.com/arashnic/marketing-seris-customer-li
Seoul Bike Sharing Demand	Reg	8760	15	9	3	Computer	https://archive.ics.uci.edu/ml/datasets/Seoul+Bike+Sharing+D
Electrical Grid Stability Simu	Reg	10000	12	12	0	Power Grid	https://archive.ics.uci.edu/ml/datasets/Electrical+Grid+Stabili
blr real estate prices	Reg	13320	2	2	0	Real Estate	https://www.kaggle.com/amitabhajoy/bengaluru-house-price-c
Cervical Cancer Behavior Risk	Classif	72	149	19	14	Medicine	https://archive.ics.uci.edu/ml/datasets/Cervical+Cancer+Beha
Post-Operative Patient	Classif	91	32	0	8	Medicine	https://archive.ics.uci.edu/ml/datasets/Post-Operative+Patient
Breast Cancer Coimbra	Classif	116	9	9	0	Medicine	https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Coimbr
Heart failure clinical records	Classif	299	12	7	5	Medicine	https://archive.ics.uci.edu/ml/datasets/Heart+failure+clinical+
Ionosphere	Classif	352	34	32	2	Earth and Communication systems	http://archive.ics.uci.edu/ml/datasets/Ionosphere
Congressional Voting Records	Classif	436	64	0	16	Political science	https://archive.ics.uci.edu/ml/datasets/congressional+voting+r
Cylinder Bands	Classif	541	111	1	19	Manufacturing quality control	https://archive.ics.uci.edu/ml/datasets/Cylinder+Bands
Credit Approval	Classif	691	42	4	8	Finance	https://archive.ics.uci.edu/ml/datasets/credit+approval
Tic-Tac-Toe Endgame	Classif	959	36	0	9	Game	https://archive.ics.uci.edu/ml/datasets/Tic-Tac-Toe+Endgame
QSAR biodegradation	Classif	1056	141	41	15	Chemometrics	https://archive.ics.uci.edu/ml/datasets/QSAR+biodegradation
Chess (King-Rook vs. King-Pawn	Classif	3196	102	0	36	Game	https://archive.ics.uci.edu/ml/machine-learning-databases/ches
Mushroom	Classif	8125	125	0	21	Life	https://archive.ics.uci.edu/ml/datasets/mushroom
Electrical Grid Stability Simu	Classif	10000	12	12	0	Power Grid	https://archive.ics.uci.edu/ml/datasets/Electrical+Grid+Stabili
MAGIC Gamma Telescope	Classif	19021	10	10	0	Earth Science	https://archive.ics.uci.edu/ml/datasets/magic+gamma+telescop
Adult	Classif	32561	34	6	5	Social sciences	https://archive.ics.uci.edu/ml/datasets/adult
Internet Firewall Data	Classif	65532	11	11	0	Digital Forensic and Security	https://archive.ics.uci.edu/ml/datasets/Internet+Firewall+Data

2.2 Classification

Table 3 and Table 4 present presents the overall performance of the classification models over the 16 classification datasets.

See Section 5 for the dataset-wise performance

3 HPO for MLR and GBDT

We study the impact of HPO on performance. Due to time limitation, we compared 4 methods (RF, CatBoost, XgBoost and MLR) as well as their bagging and ensemble versions on 9 regression datasets. For each dataset, we ran 10 repetitions.

We are currently running this new experiment, preliminary results for 9 regression datasets are presented here. The experiment will include eventually all the datasets.

We used the Optuna library (Akiba et al., 2019) to tune HP, running 50 step of hyperparameter search with 5 fold cross validation to evaluate candidates. The hyperparameter search spaces were set as prescribed in their original papers for XGB and Catboost. See for instance the following reference for more details:

Shwartz-Ziv and Armon. Tabular Data: Deep Learning is Not All You Need. arXiv:2106.03253.

Table 5 summarizes the overall performance on 9 regression datasets.

Predictably, applying ensemble strategies to RF, XgBoost, CatBoost marginally improve their performances. Ensemble-MLR performs significantly better than ensemble of HPO-RF, HPO-XgBoost, HPO-CatBoost on 1 dataset. Ensemble of HPO-CatBoost performs significantly better than the other methods on 1 dataset. On the remaining datasets, all the methods have similar performances.

So far, These preliminary results confirm what we claim in our contribution section:

"MLR is not tied with any of the well-known class of methods. Thus they should be a great addition to the stack of models aggregated by meta-learners."

Table 2: Overall performance comparison for the regression task over 16 regression datasets. P90, P95, P98: the number of datasets a model achieves 90%, 95%, 98% or more of the maximum test R^2-score respectively, divided by the total number of datasets. PMA: average percentage of the maximum test R^2-score.

	method	mean R^2-score	F.Rank	PMA	P90	P95	P98
1	Ensemble-MLR	0.738±0	7.713±4.42	0.956±0.059	0.88	0.67	0.54
2	CATBOOST	0.719±0.082	8.406±6.863	0.912±0.204	0.82	0.74	0.54
3	XGBOOST	0.7±0.113	10.088±6.899	0.873±0.325	0.79	0.59	0.39
4	xgb	0.699±0.121	10.287±7.079	0.87±0.367	0.78	0.59	0.41
5	XRF	0.719±0.065	10.394±6.782	0.918±0.155	0.79	0.59	0.41
6	RF	0.71±0.078	11.137±7.229	0.908±0.165	0.74	0.61	0.42
7	LGBM	0.706±0.08	12.306±6.9	0.907±0.151	0.76	0.59	0.34
8	NuSVM	0.706±0.056	13.75±6.735	0.903±0.164	0.79	0.48	0.22
9	MLP	0.666±0.174	13.806±6.778	0.827±0.364	0.59	0.51	0.38
10	FASTAI	-1.5*$10^8 \pm 7.2 * 10^8$	14.031±7.858	-2.25*$10^8 \pm 1.06 * 10^9$	0.66	0.48	0.30
11	MARS	0.677±0.066	16.156±5.42	0.861±0.167	0.54	0.35	0.16
12	Kernel	0.645±0.102	17.169±5.125	0.82±0.196	0.49	0.27	0.14
13	Lasso	0.656±0.095	17.306±5.554	0.837±0.182	0.52	0.29	0.14
14	Enet	0.655±0.097	17.337±5.568	0.836±0.184	0.52	0.29	0.14
15	Ridge	0.655±0.092	17.831±5.34	0.836±0.174	0.49	0.28	0.15
16	CART	0.512±0.237	20.438±5.595	0.578±0.57	0.34	0.19	0.12
17	Intercept	-0.023±0.211	24.669±0.982	-0.031±0.075	0.00	0.00	0.00

3.1 MLR

The list of hyperparameters and their search spaces for MLR:

- min batch size: float $16/n_{train}$
- Max runtime: $[6]$
- depth: integer in [1,5]
- width: integer logarithmic scale $[16, 4096]$
- ridge init: logarithmic scale $[1e-1, 1e7]$
- Learning rate: logarithmic scale $[\max(e^{-2}/width, e^{-5}], \max(e^{1}/width, e^{-5})]$
- max_{iter}: integer $\max(\min(width * e^{-5})^{1/2}, 10), 300)$

3.2 CATBOOST

The list of hyperparameters and their search spaces for Catboost:

- Learning rate: Log-Uniform distribution $[e^{-5}, 1]$
- Random strength: Discrete uniform distribution $[1, 20]$
- Max size: Discrete uniform distribution $[0, 25]$
- L2 leaf regularization: Log-Uniform distribution $[1, 10]$
- Bagging temperature: Uniform distribution $[0, 1]$
- Leaf estimation iterations: Discrete uniform distribution $[1, 20]$

3.3 XGBoost

The list of hyperparameters and their search spaces for XGBoost:

- Eta: Log-Uniform distribution $[e^{-7}, 1]$
- Max depth: Discrete uniform distribution $[1, 10]$
- Subsample: Uniform distribution $[0.2, 1]$

Table 3: Overall test Accuracy for the classification task over the 16 classification datasets

	method	ACC
1	CATBOOST	0.887±0.0284
2	XRF	0.8772±0.0282
3	Top5_MLR	0.8759±0.0337
4	MLR1_bagging	0.8743±0.0314
5	MLR2_bagging	0.8741±0.034
6	Ensemble-MLR	0.8738±0.0332
7	RF	0.8731±0.0291
8	xgb	0.873±0.0294
9	XGBOOST	0.8696±0.0355
10	MLR1	0.8683±0.0277
11	MLR2	0.8679±0.028
12	Best_MLR	0.8676±0.0386
13	MLR3	0.8662±0.0361
14	MLR4	0.8648±0.0332
15	Bagging	0.8616±0.0309
16	Ridge	0.8594±0.0313
17	Enet	0.8555±0.032
18	LAS	0.8547±0.0328
19	ADABoost	0.8499±0.0289
20	LinearRidge	0.8437±0.0374
21	CART	0.8352±0.0355
22	XCART	0.8024±0.0395
23	QDA	0.7232±0.0561
24	Class prob.	0.5935±0.0413
25	FASTAI	0.5647±0.0687
26	LGBM	0.4055±0.146

- Colsample bytree: Uniform distribution $[0.2, 1]$
- Colsample bylevel: Uniform distribution $[0.2, 1]$
- Min child weight: Log-Uniform distribution $[e^{-16}, e^{5}]$
- Alpha: Uniform choice {0, Log-Uniform distribution $[e^{-16}, e^{2}]$}
- Lambda: Uniform choice {0, Log-Uniform distribution $[e^{-16}, e^{2}]$}
- Gamma: Uniform choice {0, Log-Uniform distribution $[e^{-16}, e^{2}]$}

3.4 RF

The list of hyperparameters and their search spaces for RF:

- $n_{estimators}$: 100
- Max features: ["auto","sqrt","log2"]
- Max depth: log scale $[2, 100]$
- Max leaf nodes: log scale $[2, 1024]$
- Max samples leaf: log scale $[1, 16]$
- Boostrap: ["True", "False"]
- max samples: ["max samples", 0.05, 1.]

4 Dataset-wise regression benchmark performances

For each dataset, we provide the R2-test score performance table of all the models in the benchmark.

Table 4: Overall test AUC for the classification task over the 16 classification datasets

	method	AUC
1	CATBOOST	0.9152±0.0313
2	MLR1_bagging	0.9052±0.0279
3	RF	0.9049±0.0266
4	XRF	0.9048±0.0242
5	XGBOOST	0.9043±0.0391
6	Ensemble-MLR	0.9043±0.0272
7	xgb	0.9036±0.0396
8	Top5_MLR	0.9032±0.0282
9	MLR2_bagging	0.9025±0.0269
10	LGBM	0.9022±0.0306
11	MLR1	0.8975±0.0271
12	MLR3	0.894±0.034
13	Best_MLR	0.8935±0.0357
14	MLR2	0.8935±0.0268
15	MLR4	0.8893±0.0371
16	ADABoost	0.8875±0.0359
17	Enet	0.8871±0.0272
18	Ridge	0.8864±0.0349
19	Bagging	0.8854±0.0467
20	LAS	0.8806±0.0307
21	LinearRidge	0.878±0.0409
22	FASTAI	0.8426±0.0532
23	CART	0.813±0.0403
24	XCART	0.7752±0.0482
25	QDA	0.7717±0.0515
26	Class prob.	0.4989±0.005

Table 5: Overall impact of HPO and Ensemble on R2-test performance for the regression task over 9 regression datasets

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.741±0.046	0.744±0.045	0.747±0.041
2	MLR	0.736±0.04	0.755±0.035	0.756±0.034
3	RF	0.736±0.036	0.737±0.036	0.739±0.035
4	XGB	0.729±0.039	0.735±0.038	0.74±0.034

5 Dataset-wise classification benchmark performances

For each dataset, we provide the ACC and ACU test performance table of all the models in the benchmark in Tables 24-39

6 Dataset-wise HPO and Ensemble performances

Tables 40-49 contains the datawise performances of HPO CatBoost, XGBoost, RF and MLR.

	method	mean.R2.score	F.Rank	PMA	P90	P95	P98
1	Ensemble-CatBoost	0.747±0.048	1.8±0.941	0.939±0.211	0.90	0.90	0.85
2	Ensemble-MLR	0.756±0.047	2.526±1.228	0.977±0.073	0.95	0.93	0.85
3	Ensemble-XgBoost	0.74±0.036	2.737±1.034	0.936±0.155	0.87	0.82	0.69
4	Ensemble-RF	0.739±0	2.937±0.92	0.952±0.102	0.87	0.80	0.63

Table 6: Ensemble of methods, overall performance comparison for the regression task over 9 regression datasets

	method	mean.R2.score	F.Rank	PMA	P90	P95	P98
1	Bagging-CatBoost	0.744±0.054	1.853±0.956	0.921±0.293	0.90	0.90	0.86
2	Bagging-MLR	0.755±0.05	2.526±1.228	0.981±0.042	0.94	0.93	0.86
3	Bagging-XgBoost	0.735±0.047	2.695±1.011	0.916±0.268	0.85	0.83	0.69
4	Bagging-RF	0.737±0	2.926±0.981	0.948±0.122	0.84	0.79	0.67

Table 7: Bagging of methods, overall performance comparison for the regression task over the 9 regression datasets

	method	R2
1	CATBOOST	0.524±0.098
2	XRF	0.5±0.101
3	MLR2_bagging	0.495±0.068
4	Ensemble-MLR	0.494±0.07
5	XGBOOST	0.489±0.088
6	LGBM	0.482±0.087
7	Top5_MLR	0.482±0.075
8	MLR1_bagging	0.481±0.075
9	xgb	0.479±0.076
10	NuSVM	0.478±0.088
11	RF	0.475±0.093
12	MLR4	0.47±0.087
13	Best_MLR	0.462±0.1
14	MLR2	0.459±0.071
15	MLR3	0.458±0.09
16	MLR1	0.448±0.081
17	LAS	0.446±0.057
18	Enet	0.441±0.06
19	Ridge	0.421±0.072
20	MARS	0.408±0.11
21	Kernel	0.318±0.155
22	MLP	0.27±0.319
23	CART	0.07±0.118
24	FASTAI	-888326445.962±1226426418.478
25	Intercept	-0.005±0.006

Table 8: QSAR aquatic toxicity

	method	R2
1	CATBOOST	0.632±0.05
2	XRF	0.622±0.049
3	RF	0.619±0.054
4	LGBM	0.612±0.046
5	NuSVM	0.611±0.041
6	xgb	0.606±0.051
7	XGBOOST	0.602±0.051
8	Ensemble-MLR	0.602±0.042
9	MLR2_bagging	0.602±0.039
10	Top5_MLR	0.599±0.043
11	MLR1_bagging	0.598±0.044
12	Best_MLR	0.598±0.041
13	MLR1	0.59±0.043
14	MLR2	0.586±0.037
15	MLR3	0.582±0.043
16	MLR4	0.579±0.046
17	MLP	0.576±0.047
18	Ridge	0.57±0.055
19	LAS	0.569±0.054
20	Enet	0.569±0.053
21	MARS	0.564±0.066
22	Kernel	0.562±0.044
23	CART	0.342±0.09
24	FASTAI	-81850246.21±175833485.896
25	Intercept	-0.009±0.012

Table 9: QSAR fish toxicity

	method	R2
1	CATBOOST	0.733±0.051
2	RF	0.731±0.049
3	xgb	0.725±0.048
4	XGBOOST	0.725±0.047
5	XRF	0.722±0.051
6	LGBM	0.713±0.054
7	Ensemble-MLR	0.686±0.043
8	MLR2_bagging	0.683±0.048
9	Top5_MLR	0.682±0.045
10	MLR1_bagging	0.682±0.042
11	MLR1	0.672±0.042
12	NuSVM	0.672±0.042
13	MLR4	0.67±0.051
14	MARS	0.67±0.042
15	MLR2	0.668±0.049
16	Best_MLR	0.668±0.048
17	MLR3	0.666±0.051
18	LAS	0.665±0.049
19	Enet	0.665±0.048
20	Ridge	0.659±0.043
21	Kernel	0.609±0.122
22	MLP	0.559±0.169
23	CART	0.52±0.06
24	FASTAI	-1288226651.558±2256805003.815
25	Intercept	-0.006±0.008

Table 10: QSAR Bioconcentration classes

	method	R2
1	CATBOOST	0.924±0.005
2	XRF	0.92±0.004
3	LGBM	0.919±0.005
4	RF	0.915±0.006
5	FASTAI	0.906±0.006
6	MLR3	0.901±0.008
7	xgb	0.899±0.005
8	XGBOOST	0.899±0.005
9	MLR4	0.893±0.008
10	MLP	0.89±0.007
11	Top5_MLR	0.882±0.008
12	MLR2_bagging	0.882±0.007
13	Best_MLR	0.879±0.008
14	MLR2	0.878±0.008
15	Ensemble-MLR	0.87±0.008
16	MLR1_bagging	0.851±0.009
17	MLR1	0.85±0.009
18	NuSVM	0.846±0.009
19	CART	0.837±0.01
20	MARS	0.738±0.013
21	Enet	0.73±0.012
22	Kernel	0.73±0.012
23	LAS	0.73±0.012
24	Ridge	0.73±0.012
25	Intercept	-0.001±0.001

Table 11: Seoul Bike Sharing Demand

	method	R2
1	CATBOOST	0.965±0.002
2	FASTAI	0.964±0.002
3	MLR3	0.963±0.002
4	MLR2_bagging	0.961±0.002
5	Top5_MLR	0.96±0.002
6	Best_MLR	0.958±0.002
7	MLR2	0.958±0.002
8	NuSVM	0.958±0.002
9	MLR4	0.955±0.002
10	MLP	0.954±0.003
11	Ensemble-MLR	0.952±0.002
12	LGBM	0.947±0.002
13	MLR1_bagging	0.938±0.003
14	MLR1	0.937±0.003
15	XRF	0.918±0.003
16	xgb	0.906±0.003
17	XGBOOST	0.906±0.003
18	RF	0.899±0.005
19	MARS	0.781±0.009
20	CART	0.716±0.016
21	Enet	0.648±0.017
22	Kernel	0.648±0.017
23	LAS	0.648±0.017
24	Ridge	0.648±0.017
25	Intercept	-0.001±0.001

Table 12: Electrical Grid Stability Simu

	method	R2
1	CATBOOST	0.878±0.044
2	xgb	0.863±0.043
3	XGBOOST	0.857±0.045
4	Ensemble-MLR	0.857±0.035
5	MLR2_bagging	0.856±0.047
6	Top5_MLR	0.856±0.034
7	MLR3	0.854±0.043
8	MLR1_bagging	0.85±0.031
9	RF	0.847±0.061
10	MLR4	0.842±0.049
11	MLR2	0.839±0.046
12	MLR1	0.836±0.031
13	Best_MLR	0.832±0.062
14	NuSVM	0.83±0.047
15	Ridge	0.816±0.053
16	Kernel	0.812±0.053
17	LAS	0.812±0.053
18	Enet	0.812±0.052
19	XRF	0.807±0.085
20	LGBM	0.803±0.056
21	MARS	0.798±0.091
22	CART	0.797±0.093
23	MLP	0.797±0.088
24	FASTAI	-83785006.191±264951455.96
25	Intercept	-0.073±0.074

Table 13: Servo

	method	R2
1	Top5_MLR	0.968±0.014
2	MLR2_bagging	0.967±0.017
3	Ensemble-MLR	0.963±0.019
4	MLP	0.957±0.027
5	Best_MLR	0.956±0.015
6	MLR3	0.954±0.025
7	MLR2	0.954±0.018
8	MLR1_bagging	0.953±0.028
9	MARS	0.943±0.029
10	FASTAI	0.941±0.024
11	MLR1	0.94±0.029
12	MLR4	0.935±0.032
13	NuSVM	0.911±0.022
14	XRF	0.893±0.037
15	Enet	0.891±0.046
16	Kernel	0.891±0.046
17	LAS	0.891±0.046
18	Ridge	0.89±0.047
19	XGBOOST	0.836±0.053
20	CATBOOST	0.836±0.043
21	xgb	0.829±0.052
22	LGBM	0.794±0.048
23	RF	0.776±0.064
24	CART	0.613±0.246
25	Intercept	-0.095±0.158

Table 14: Concrete Slump Test -1

	method	R2
1	MLR3	0.505±0.171
2	Ensemble-MLR	0.503±0.143
3	Best_MLR	0.502±0.178
4	MLR2_bagging	0.502±0.156
5	Top5_MLR	0.494±0.153
6	MLR1_bagging	0.492±0.135
7	MLR1	0.455±0.133
8	MLR2	0.453±0.159
9	MARS	0.451±0.132
10	XRF	0.45±0.169
11	MLR4	0.425±0.245
12	FASTAI	0.415±0.197
13	NuSVM	0.415±0.161
14	RF	0.414±0.184
15	MLP	0.407±0.188
16	LGBM	0.402±0.155
17	Kernel	0.395±0.112
18	Enet	0.392±0.096
19	LAS	0.392±0.094
20	Ridge	0.383±0.108
21	CATBOOST	0.375±0.172
22	xgb	0.331±0.265
23	XGBOOST	0.308±0.271
24	CART	0.088±0.478
25	Intercept	-0.051±0.049

Table 15: Concrete Slump Test -2

	method	R2
1	MLR1_bagging	0.447±0.141
2	Top5_MLR	0.424±0.169
3	Ensemble-MLR	0.422±0.154
4	MLR1	0.399±0.132
5	Best_MLR	0.379±0.226
6	MLR2_bagging	0.377±0.177
7	MLR2	0.313±0.171
8	FASTAI	0.299±0.277
9	XRF	0.284±0.21
10	RF	0.284±0.202
11	MLR3	0.274±0.21
12	NuSVM	0.269±0.164
13	MARS	0.266±0.198
14	LGBM	0.255±0.17
15	MLP	0.23±0.207
16	MLR4	0.226±0.149
17	Kernel	0.209±0.146
18	CATBOOST	0.208±0.202
19	Ridge	0.189±0.139
20	LAS	0.166±0.142
21	Enet	0.154±0.124
22	XGBOOST	0.125±0.328
23	xgb	0.11±0.379
24	CART	-0.156±0.446
25	Intercept	-0.072±0.08

Table 16: Concrete Slump Test -3

	method	R2
1	Top5_MLR	0.988±0.008
2	MLR2_bagging	0.987±0.008
3	Best_MLR	0.986±0.011
4	Ensemble-MLR	0.986±0.008
5	FASTAI	0.986±0.008
6	XRF	0.986±0.008
7	MLR3	0.985±0.008
8	MLR4	0.985±0.007
9	MLR2	0.984±0.008
10	MLP	0.982±0.009
11	MLR1_bagging	0.982±0.008
12	MLR1	0.981±0.008
13	XGBOOST	0.979±0.01
14	xgb	0.978±0.01
15	CATBOOST	0.977±0.017
16	RF	0.973±0.011
17	MARS	0.97±0.019
18	LGBM	0.963±0.01
19	Kernel	0.946±0.028
20	Ridge	0.945±0.027
21	NuSVM	0.943±0.054
22	Enet	0.943±0.027
23	LAS	0.942±0.028
24	CART	0.935±0.05
25	Intercept	-0.03±0.027

Table 17: Computer Hardware

	method	R2
1	xgb	0.988±0.007
2	XGBOOST	0.987±0.008
3	CATBOOST	0.984±0.011
4	RF	0.98±0.009
5	XRF	0.98±0.008
6	FASTAI	0.972±0.019
7	CART	0.971±0.017
8	MLR2_bagging	0.968±0.021
9	LGBM	0.966±0.019
10	Top5_MLR	0.965±0.022
11	MLR3	0.965±0.02
12	Ensemble-MLR	0.964±0.021
13	MLP	0.964±0.02
14	Enet	0.963±0.02
15	Kernel	0.963±0.02
16	LAS	0.963±0.02
17	Ridge	0.963±0.02
18	Best_MLR	0.962±0.02
19	MLR2	0.962±0.02
20	MARS	0.962±0.019
21	MLR4	0.96±0.021
22	MLR1_bagging	0.958±0.021
23	MLR1	0.952±0.021
24	NuSVM	0.922±0.025
25	Intercept	-0.015±0.016

Table 18: Yacht Hydrodynamics

	method	R2
1	MLR1_bagging	0.571±0.017
2	Ensemble-MLR	0.566±0.035
3	Top5_MLR	0.566±0.035
4	MLR1	0.566±0.023
5	MLR2_bagging	0.553±0.065
6	NuSVM	0.55±0.009
7	Best_MLR	0.548±0.086
8	XGBOOST	0.545±0.016
9	MLR2	0.543±0.078
10	CATBOOST	0.543±0.022
11	xgb	0.54±0.018
12	MLR4	0.538±0.078
13	MARS	0.534±0.043
14	Enet	0.531±0.015
15	RF	0.53±0.026
16	LGBM	0.528±0.025
17	LAS	0.527±0.021
18	MLR3	0.523±0.163
19	Ridge	0.523±0.029
20	XRF	0.522±0.023
21	Kernel	0.496±0.119
22	MLP	0.391±0.555
23	CART	0.119±0.054
24	FASTAI	-12369089.738±29314154.7
25	Intercept	-0.001±0.001

Table 19: Abalone R

	method	R2
1	Ensemble-MLR	0.69±0.029
2	MLR1_bagging	0.689±0.03
3	MLR2_bagging	0.689±0.029
4	Top5_MLR	0.685±0.029
5	MLR3	0.68±0.03
6	MLR4	0.68±0.027
7	Kernel	0.679±0.033
8	MLR1	0.679±0.031
9	Ridge	0.679±0.031
10	Enet	0.677±0.029
11	MLR2	0.677±0.029
12	LAS	0.676±0.029
13	CATBOOST	0.676±0.028
14	Best_MLR	0.675±0.035
15	XGBOOST	0.672±0.032
16	XRF	0.672±0.024
17	LGBM	0.668±0.028
18	MARS	0.667±0.031
19	xgb	0.667±0.031
20	NuSVM	0.665±0.025
21	RF	0.664±0.026
22	FASTAI	0.619±0.037
23	MLP	0.518±0.051
24	CART	0.298±0.083
25	Intercept	-0.003±0.004

Table 20: Communities and Crime

	method	R2
1	XGBOOST	0.848±0.03
2	xgb	0.847±0.03
3	Ensemble-MLR	0.843±0.025
4	MLR2_bagging	0.842±0.026
5	MLR1_bagging	0.842±0.024
6	Top5_MLR	0.841±0.025
7	MLR1	0.839±0.024
8	MLP	0.837±0.028
9	MLR2	0.837±0.026
10	Best_MLR	0.837±0.025
11	NuSVM	0.836±0.034
12	MLR3	0.833±0.033
13	MLR4	0.832±0.028
14	RF	0.824±0.032
15	CATBOOST	0.822±0.03
16	LGBM	0.822±0.03
17	FASTAI	0.805±0.033
18	XRF	0.798±0.033
19	Kernel	0.774±0.027
20	Ridge	0.774±0.027
21	Enet	0.774±0.026
22	LAS	0.774±0.026
23	MARS	0.77±0.026
24	CART	0.69±0.047
25	Intercept	-0.004±0.007

Table 21: Insurance

	method	R2
1	RF	0.909±0.006
2	LGBM	0.905±0.008
3	CATBOOST	0.904±0.008
4	xgb	0.903±0.007
5	XGBOOST	0.902±0.007
6	XRF	0.902±0.006
7	Ensemble-MLR	0.898±0.006
8	MLR2_bagging	0.898±0.006
9	Enet	0.897±0.007
10	Kernel	0.897±0.007
11	LAS	0.897±0.007
12	MARS	0.896±0.008
13	Ridge	0.896±0.007
14	MLR1_bagging	0.896±0.006
15	Top5_MLR	0.896±0.006
16	Best_MLR	0.892±0.006
17	MLR1	0.891±0.006
18	MLR2	0.89±0.006
19	MLR3	0.889±0.006
20	MLR4	0.883±0.007
21	FASTAI	0.878±0.008
22	NuSVM	0.871±0.014
23	CART	0.827±0.017
24	MLP	0.807±0.01
25	Intercept	-0.001±0.003

Table 22: squark automotive CLV training

	method	R2
1	Intercept	0±0
2	Best_MLR	0.522±0.013
3	MLR3	0.522±0.013
4	XGBOOST	0.522±0.013
5	MLR2_bagging	0.522±0.012
6	MLR2	0.522±0.012
7	xgb	0.522±0.012
8	LGBM	0.521±0.013
9	MLP	0.521±0.013
10	MLR4	0.521±0.013
11	NuSVM	0.521±0.012
12	Top5_MLR	0.521±0.012
13	RF	0.52±0.013
14	Ensemble-MLR	0.52±0.012
15	CART	0.519±0.013
16	CATBOOST	0.519±0.013
17	XRF	0.519±0.013
18	MLR1_bagging	0.515±0.012
19	MLR1	0.514±0.012
20	FASTAI	0.513±0.018
21	MARS	0.416±0.014
22	Kernel	0.396±0.031
23	LAS	0.396±0.031
24	Ridge	0.396±0.031
25	Enet	0.395±0.03

Table 23: blr real estate prices

Table 24: Breast Cancer Coimbra

	method	ACC	AUC
1	XRF	0.733±0.063	0.83±0.038
2	xgb	0.729±0.066	0.824±0.048
3	Top5_MLR	0.713±0.101	0.808±0.07
4	MLR1_bagging	0.713±0.084	0.813±0.063
5	Ensemble-MLR	0.708±0.096	0.809±0.059
6	MLR1	0.705±0.082	0.791±0.059
7	Enet	0.704±0.107	0.782±0.081
8	ADABoost	0.704±0.063	0.764±0.09
9	CATBOOST	0.704±0.06	0.822±0.06
10	LAS	0.7±0.125	0.775±0.085
11	MLR2_bagging	0.7±0.092	0.8±0.062
12	Ridge	0.696±0.123	0.779±0.07
13	XGBOOST	0.696±0.068	0.798±0.073
14	CART	0.688±0.091	0.69±0.09
15	MLR2	0.685±0.077	0.774±0.054
16	Best_MLR	0.679±0.108	0.781±0.037
17	MLR4	0.675±0.07	0.804±0.057
18	Bagging	0.675±0.047	0.773±0.065
19	RF	0.667±0.065	0.785±0.074
20	LinearRidge	0.662±0.122	0.754±0.12
21	MLR3	0.658±0.094	0.774±0.051
22	FASTAI	0.629±0.112	0.745±0.096
23	QDA	0.625±0.081	0.749±0.045
24	XCART	0.575±0.1	0.574±0.085
25	Class prob.	0.496±0.123	0.5±0
26	LGBM	-0.191±0.224	0.801±0.067

	method	ACC	AUC
1	MLR1_bagging	0.907±0.064	0.932±0.086
2	XRF	0.9±0.079	0.909±0.096
3	CATBOOST	0.893±0.064	0.911±0.103
4	Ridge	0.88±0.069	0.877±0.133
5	Top5_MLR	0.873±0.08	0.931±0.072
6	Ensemble-MLR	0.867±0.089	0.933±0.088
7	RF	0.867±0.077	0.917±0.102
8	Enet	0.86±0.091	0.896±0.099
9	Bagging	0.853±0.108	0.795±0.279
10	LinearRidge	0.853±0.103	0.842±0.154
11	MLR2_bagging	0.853±0.098	0.921±0.09
12	ADABoost	0.853±0.053	0.9±0.087
13	XGBOOST	0.847±0.122	0.851±0.19
14	MLR1	0.832±0.071	0.878±0.098
15	Best_MLR	0.827±0.084	0.841±0.212
16	MLR4	0.82±0.114	0.799±0.179
17	MLR2	0.819±0.088	0.863±0.119
18	MLR3	0.807±0.124	0.85±0.126
19	xgb	0.807±0.086	0.825±0.215
20	XCART	0.793±0.119	0.714±0.189
21	LAS	0.793±0.08	0.808±0.145
22	CART	0.78±0.126	0.709±0.192
23	Class prob.	0.773±0.11	0.5±0
24	QDA	0.567±0.079	0.498±0.152
25	FASTAI	0.52±0.201	0.521±0.217
26	LGBM	-0.616±0.939	0.784±0.139

Table 25: Cervical Cancer Behavior Risk

	method	ACC	AUC
1	CATBOOST	0.873±0.048	0.923±0.037
2	RF	0.873±0.042	0.919±0.038
3	xgb	0.842±0.051	0.896±0.039
4	XGBOOST	0.842±0.047	0.902±0.036
5	ADABoost	0.835±0.046	0.873±0.033
6	XRF	0.832±0.049	0.898±0.045
7	Bagging	0.828±0.054	0.882±0.042
8	Ridge	0.827±0.065	0.871±0.039
9	LAS	0.825±0.067	0.869±0.041
10	LinearRidge	0.825±0.067	0.87±0.035
11	Enet	0.82±0.061	0.871±0.039
12	MLR3	0.808±0.059	0.851±0.054
13	Ensemble-MLR	0.807±0.073	0.858±0.043
14	MLR2_bagging	0.805±0.077	0.855±0.04
15	MLR1_bagging	0.798±0.071	0.863±0.043
16	CART	0.797±0.049	0.763±0.051
17	Top5_MLR	0.795±0.078	0.856±0.044
18	MLR1	0.794±0.069	0.848±0.04
19	MLR4	0.793±0.06	0.839±0.057
20	MLR2	0.793±0.058	0.841±0.04
21	Best_MLR	0.792±0.08	0.84±0.046
22	QDA	0.75±0.068	0.78±0.065
23	Class prob.	0.702±0.058	0.5±0
24	XCART	0.7±0.038	0.638±0.063
25	FASTAI	0.483±0.056	0.777±0.054
26	LGBM	0.339±0.171	0.916±0.038

Table 26: Heart failure clinical records

	method	ACC	AUC
1	CATBOOST	0.869±0.03	0.932±0.022
2	MLR1_bagging	0.866±0.032	0.924±0.022
3	Ensemble-MLR	0.865±0.031	0.926±0.021
4	MLR2_bagging	0.865±0.03	0.923±0.022
5	Top5_MLR	0.861±0.03	0.921±0.023
6	RF	0.86±0.029	0.933±0.022
7	xgb	0.857±0.03	0.924±0.025
8	XRF	0.857±0.028	0.922±0.019
9	MLR3	0.856±0.028	0.906±0.034
10	MLR1	0.854±0.023	0.914±0.023
11	Ridge	0.854±0.016	0.915±0.022
12	MLR4	0.853±0.033	0.907±0.025
13	LAS	0.853±0.017	0.917±0.021
14	MLR2	0.851±0.025	0.912±0.023
15	Best_MLR	0.85±0.034	0.909±0.028
16	XGBOOST	0.848±0.034	0.918±0.026
17	Enet	0.845±0.026	0.918±0.022
18	Bagging	0.843±0.019	0.902±0.024
19	ADABoost	0.842±0.026	0.905±0.026
20	LinearRidge	0.836±0.017	0.912±0.022
21	CART	0.794±0.025	0.77±0.032
22	XCART	0.791±0.023	0.768±0.026
23	Class prob.	0.658±0.03	0.5±0
24	FASTAI	0.568±0.038	0.862±0.026
25	QDA	0.556±0.029	0.657±0.012
26	LGBM	0.379±0.144	0.925±0.027

Table 27: QSAR biodegradation

	method	ACC	AUC
1	ADABoost	1±0	1±0
2	Bagging	1±0	1±0
3	CART	1±0	1±0
4	CATBOOST	1±0	1±0
5	RF	1±0	1±0
6	xgb	1±0	1±0
7	XGBOOST	1±0	1±0
8	XRF	1±0	1±0
9	LGBM	0.999±0.001	1±0
10	QDA	0.999±0	1±0
11	XCART	0.999±0	1±0
12	MLR3	0.998±0	1±0
13	LAS	0.997±0	1±0
14	MLR2_bagging	0.997±0	1±0
15	MLR2	0.997±0	1±0
16	MLR4	0.997±0	1±0
17	Ridge	0.997±0	1±0
18	Best_MLR	0.996±0.003	1±0
19	Ensemble-MLR	0.996±0.001	1±0
20	Top5_MLR	0.996±0.001	1±0
21	MLR1_bagging	0.992±0.001	1±0
22	MLR1	0.992±0.001	1±0
23	Enet	0.971±0.004	0.998±0
24	LinearRidge	0.923±0.002	0.996±0
25	Class prob.	0.514±0.006	0.5±0.004
26	FASTAI	0.483±0.13	0.67±0.206

Table 28: Internet Firewall Data

	method	ACC	AUC
1	MLR3	0.958±0.007	0.992±0.002
2	MLR2_bagging	0.956±0.004	0.993±0.001
3	Top5_MLR	0.956±0.004	0.993±0.001
4	CATBOOST	0.955±0.005	0.993±0.001
5	Ensemble-MLR	0.953±0.005	0.992±0.001
6	Best_MLR	0.953±0.004	0.992±0.001
7	MLR2	0.953±0.004	0.992±0.001
8	MLR4	0.949±0.007	0.989±0.002
9	MLR1_bagging	0.946±0.004	0.99±0.002
10	MLR1	0.943±0.005	0.989±0.002
11	XRF	0.923±0.007	0.984±0.002
12	xgb	0.92±0.007	0.977±0.003
13	RF	0.919±0.006	0.979±0.003
14	XGBOOST	0.915±0.006	0.976±0.003
15	Bagging	0.895±0.007	0.961±0.005
16	QDA	0.878±0.009	0.951±0.006
17	ADABoost	0.849±0.007	0.931±0.008
18	CART	0.846±0.008	0.832±0.008
19	LinearRidge	0.817±0.011	0.892±0.011
20	Enet	0.817±0.01	0.892±0.011
21	LAS	0.817±0.01	0.892±0.011
22	Ridge	0.816±0.011	0.892±0.011
23	XCART	0.764±0.013	0.742±0.014
24	LGBM	0.744±0.028	0.988±0.002
25	FASTAI	0.605±0.01	0.99±0.002
26	Class prob.	0.535±0.011	0.497±0.009

Table 29: Electrical Grid Stability Simu

	method	ACC	AUC
1	Class prob.	0.689±0.091	0.5±0
2	Ridge	0.689±0.091	0.492±0.174
3	Enet	0.684±0.093	0.473±0.075
4	LAS	0.684±0.093	0.476±0.066
5	LinearRidge	0.653±0.145	0.453±0.2
6	QDA	0.653±0.145	0.484±0.179
7	Best_MLR	0.647±0.129	0.432±0.14
8	CATBOOST	0.642±0.126	0.45±0.196
9	MLR1	0.639±0.085	0.449±0.126
10	Top5_MLR	0.632±0.129	0.395±0.156
11	MLR2	0.624±0.087	0.403±0.11
12	MLR3	0.621±0.138	0.439±0.162
13	MLR4	0.621±0.102	0.42±0.152
14	XRF	0.616±0.119	0.468±0.117
15	xgb	0.611±0.114	0.448±0.209
16	MLR1_bagging	0.605±0.114	0.426±0.144
17	XGBOOST	0.6±0.163	0.484±0.194
18	ADABoost	0.6±0.114	0.458±0.19
19	MLR2_bagging	0.6±0.112	0.396±0.136
20	Ensemble-MLR	0.6±0.106	0.403±0.141
21	RF	0.595±0.134	0.413±0.112
22	CART	0.568±0.135	0.443±0.131
23	Bagging	0.563±0.14	0.427±0.21
24	XCART	0.558±0.139	0.433±0.171
25	FASTAI	0.484±0.158	0.579±0.138
26	LGBM	-0.724±0.372	0.461±0.128

Table 30: Post-Operative Patient

	method	ACC	AUC
1	CATBOOST	0.957±0.015	0.992±0.006
2	xgb	0.955±0.017	0.989±0.009
3	XGBOOST	0.953±0.015	0.983±0.015
4	LinearRidge	0.952±0.02	0.992±0.007
5	MLR1_bagging	0.952±0.017	0.991±0.004
6	RF	0.952±0.014	0.989±0.007
7	XRF	0.952±0.014	0.987±0.009
8	MLR2_bagging	0.951±0.02	0.991±0.005
9	Enet	0.951±0.019	0.991±0.009
10	Ensemble-MLR	0.951±0.019	0.992±0.004
11	ADABoost	0.949±0.022	0.989±0.008
12	LAS	0.949±0.02	0.986±0.021
13	Top5_MLR	0.949±0.018	0.99±0.006
14	MLR4	0.949±0.017	0.98±0.019
15	Ridge	0.948±0.011	0.99±0.006
16	MLR1	0.947±0.016	0.986±0.005
17	MLR3	0.947±0.014	0.978±0.021
18	Bagging	0.945±0.014	0.973±0.02
19	MLR2	0.945±0.014	0.986±0.008
20	Best_MLR	0.94±0.023	0.986±0.008
21	CART	0.936±0.017	0.93±0.011
22	XCART	0.905±0.025	0.896±0.021
23	LGBM	0.804±0.058	0.989±0.005
24	QDA	0.798±0.104	0.849±0.081
25	FASTAI	0.644±0.039	0.966±0.019
26	Class prob.	0.632±0.053	0.5±0

Table 31: Congressional Voting Records

	method	ACC	AUC
1	CATBOOST	0.988±0.007	0.998±0.003
2	XRF	0.986±0.01	0.999±0.001
3	RF	0.982±0.01	0.998±0.002
4	MLR3	0.982±0.007	0.998±0.002
5	LinearRidge	0.981±0.007	0.994±0.005
6	Ridge	0.981±0.007	0.993±0.005
7	MLR2_bagging	0.981±0.006	0.999±0
8	MLR2	0.981±0.004	0.997±0.003
9	MLR1_bagging	0.98±0.007	0.999±0
10	MLR4	0.98±0.007	0.997±0.004
11	Ensemble-MLR	0.98±0.006	0.999±0
12	LAS	0.98±0.006	0.994±0.005
13	Top5_MLR	0.98±0.005	0.999±0.001
14	MLR1	0.98±0.004	0.997±0.002
15	XGBOOST	0.979±0.009	0.993±0.007
16	Enet	0.978±0.007	0.991±0.006
17	xgb	0.976±0.008	0.988±0.004
18	Best_MLR	0.975±0.013	0.996±0.006
19	Bagging	0.974±0.015	0.99±0.006
20	LGBM	0.952±0.017	0.997±0.005
21	CART	0.94±0.012	0.936±0.014
22	ADABoost	0.834±0.039	0.935±0.029
23	XCART	0.833±0.036	0.815±0.045
24	QDA	0.569±0.084	0.7±0.075
25	Class prob.	0.542±0.032	0.489±0.043
26	FASTAI	0.491±0.032	0.995±0.007

Table 32: Tic-Tac-Toe Endgame

	method	ACC	AUC
1	CATBOOST	0.855±0.025	0.932±0.021
2	XGBOOST	0.853±0.025	0.921±0.023
3	Ridge	0.852±0.029	0.912±0.027
4	Ensemble-MLR	0.852±0.028	0.913±0.024
5	LinearRidge	0.85±0.034	0.912±0.027
6	MLR1_bagging	0.85±0.026	0.914±0.024
7	MLR2_bagging	0.85±0.026	0.911±0.025
8	MLR2	0.85±0.025	0.907±0.024
9	RF	0.85±0.025	0.912±0.019
10	xgb	0.85±0.025	0.925±0.023
11	LAS	0.848±0.033	0.906±0.03
12	Enet	0.848±0.029	0.911±0.028
13	Best_MLR	0.848±0.025	0.911±0.028
14	Top5_MLR	0.848±0.024	0.913±0.025
15	MLR1	0.847±0.023	0.91±0.023
16	XRF	0.844±0.026	0.886±0.022
17	MLR3	0.843±0.028	0.899±0.025
18	Bagging	0.842±0.026	0.907±0.023
19	MLR4	0.842±0.022	0.898±0.029
20	ADABoost	0.837±0.025	0.901±0.028
21	XCART	0.801±0.05	0.801±0.051
22	CART	0.799±0.026	0.801±0.027
23	FASTAI	0.656±0.052	0.866±0.021
24	QDA	0.636±0.082	0.708±0.045
25	Class prob.	0.556±0.031	0.5±0
26	LGBM	0.359±0.102	0.919±0.026

Table 33: Credit Approval

	method	ACC	AUC
1	XRF	0.942±0.024	0.992±0.006
2	RF	0.937±0.028	0.983±0.012
3	MLR2_bagging	0.931±0.033	0.985±0.012
4	CATBOOST	0.927±0.033	0.981±0.017
5	xgb	0.927±0.032	0.971±0.021
6	Top5_MLR	0.923±0.035	0.981±0.016
7	MLR3	0.923±0.024	0.973±0.023
8	MLR2	0.922±0.027	0.976±0.015
9	Best_MLR	0.921±0.04	0.969±0.029
10	Ensemble-MLR	0.918±0.033	0.98±0.016
11	QDA	0.918±0.026	0.957±0.02
12	XGBOOST	0.917±0.032	0.967±0.02
13	Bagging	0.914±0.032	0.958±0.031
14	MLR4	0.91±0.031	0.965±0.022
15	ADABoost	0.907±0.037	0.94±0.033
16	MLR1_bagging	0.906±0.033	0.973±0.02
17	MLR1	0.905±0.028	0.962±0.022
18	Enet	0.877±0.031	0.916±0.029
19	LAS	0.873±0.032	0.909±0.022
20	CART	0.869±0.036	0.858±0.041
21	XCART	0.868±0.038	0.855±0.043
22	Ridge	0.868±0.037	0.904±0.031
23	LinearRidge	0.856±0.034	0.902±0.037
24	LGBM	0.707±0.087	0.974±0.021
25	FASTAI	0.663±0.072	0.972±0.023
26	Class prob.	0.635±0.032	0.5±0

Table 34: Ionosphere

	method	ACC	AUC
1	XGBOOST	0.783±0.031	0.844±0.031
2	xgb	0.783±0.023	0.85±0.03
3	CATBOOST	0.78±0.028	0.847±0.029
4	MLR2_bagging	0.777±0.032	0.838±0.028
5	Top5_MLR	0.772±0.023	0.836±0.027
6	Ensemble-MLR	0.769±0.032	0.837±0.028
7	MLR1_bagging	0.764±0.035	0.834±0.029
8	MLR2	0.749±0.025	0.819±0.023
9	LAS	0.748±0.027	0.824±0.034
10	RF	0.748±0.023	0.819±0.026
11	Bagging	0.748±0.021	0.812±0.034
12	XRF	0.748±0.017	0.793±0.023
13	MLR1	0.745±0.024	0.817±0.024
14	MLR3	0.742±0.045	0.819±0.034
15	Best_MLR	0.739±0.06	0.812±0.027
16	LinearRidge	0.739±0.019	0.821±0.023
17	Enet	0.739±0.016	0.826±0.026
18	MLR4	0.734±0.055	0.809±0.036
19	Ridge	0.733±0.025	0.825±0.029
20	ADABoost	0.727±0.014	0.806±0.033
21	CART	0.724±0.033	0.736±0.035
22	XCART	0.696±0.022	0.709±0.03
23	QDA	0.65±0.061	0.665±0.062
24	Class prob.	0.571±0.047	0.5±0
25	FASTAI	0.552±0.046	0.755±0.029
26	LGBM	0.006±0.147	0.823±0.027

Table 35: Cylinder Bands

	method	ACC	AUC
1	CATBOOST	0.995±0.003	1±0
2	Bagging	0.995±0.002	0.999±0.001
3	CART	0.995±0.002	0.995±0.002
4	MLR2_bagging	0.994±0.003	0.999±0.001
5	Ensemble-MLR	0.993±0.003	0.999±0.001
6	MLR3	0.993±0.003	0.999±0.001
7	Top5_MLR	0.993±0.003	0.999±0.001
8	MLR1_bagging	0.992±0.004	0.999±0.001
9	MLR2	0.992±0.003	0.999±0.001
10	MLR4	0.992±0.003	0.998±0.002
11	RF	0.992±0.003	0.999±0.001
12	Best_MLR	0.991±0.004	0.999±0.001
13	XRF	0.991±0.004	0.999±0.001
14	MLR1	0.99±0.003	0.998±0.001
15	LGBM	0.98±0.008	1±0
16	xgb	0.978±0.004	0.998±0.001
17	LAS	0.975±0.006	0.996±0.001
18	Ridge	0.975±0.006	0.995±0.002
19	ADABoost	0.965±0.007	0.994±0.003
20	XCART	0.963±0.013	0.963±0.013
21	Enet	0.959±0.008	0.992±0.002
22	XGBOOST	0.953±0.008	0.996±0.001
23	LinearRidge	0.937±0.009	0.984±0.003
24	FASTAI	0.73±0.048	0.997±0.004
25	QDA	0.621±0.047	0.757±0.047
26	Class prob.	0.523±0.013	0.5±0

Table 36: Chess (King-Rook vs. King-Pawn)

	method	ACC	AUC
1	Bagging	1±0.001	1±0.001
2	CART	1±0.001	1±0.001
3	LGBM	1±0.001	1±0
4	xgb	1±0.001	1±0
5	ADABoost	1±0	1±0
6	CATBOOST	1±0	1±0
7	LAS	1±0	1±0
8	LinearRidge	1±0	1±0
9	QDA	1±0	1±0
10	RF	1±0	1±0
11	XCART	1±0	1±0
12	XRF	1±0	1±0
13	Best_MLR	0.999±0.001	1±0
14	Enet	0.999±0.001	1±0
15	Ensemble-MLR	0.999±0.001	1±0
16	MLR1_bagging	0.999±0.001	1±0
17	MLR1	0.999±0.001	1±0
18	MLR2_bagging	0.999±0.001	1±0
19	MLR2	0.999±0.001	1±0
20	MLR3	0.999±0.001	1±0.001
21	Ridge	0.999±0.001	1±0
22	Top5_MLR	0.999±0.001	1±0
23	XGBOOST	0.999±0.001	1±0
24	MLR4	0.998±0.003	0.999±0.001
25	FASTAI	0.601±0.079	0.999±0.001
26	Class prob.	0.494±0.009	0.5±0.009

Table 37: Mushroom

	method	ACC	AUC
1	CATBOOST	0.89±0.005	0.941±0.003
2	RF	0.882±0.004	0.936±0.002
3	MLR2_bagging	0.876±0.004	0.927±0.003
4	XRF	0.876±0.004	0.935±0.003
5	MLR3	0.876±0.003	0.926±0.003
6	Best_MLR	0.875±0.004	0.927±0.003
7	MLR2	0.875±0.004	0.926±0.003
8	Top5_MLR	0.875±0.004	0.927±0.003
9	MLR4	0.875±0.003	0.925±0.004
10	Ensemble-MLR	0.874±0.005	0.925±0.003
11	xgb	0.873±0.004	0.925±0.004
12	XGBOOST	0.869±0.005	0.923±0.003
13	MLR1_bagging	0.869±0.004	0.921±0.003
14	MLR1	0.869±0.004	0.921±0.003
15	Bagging	0.868±0.004	0.916±0.004
16	ADABoost	0.841±0.005	0.895±0.004
17	CART	0.817±0.004	0.799±0.004
18	XCART	0.794±0.011	0.773±0.011
19	Ridge	0.791±0.005	0.839±0.006
20	Enet	0.79±0.005	0.839±0.006
21	LAS	0.79±0.005	0.839±0.006
22	QDA	0.784±0.005	0.873±0.005
23	LinearRidge	0.782±0.004	0.838±0.005
24	Class prob.	0.54±0.006	0.497±0.009
25	FASTAI	0.534±0.013	0.924±0.004
26	LGBM	0.487±0.015	0.937±0.002

Table 38: MAGIC Gamma Telescope

Table 39: Adult

	method	ACC	AUC
1	CATBOOST	0.866±0.004	0.922±0.003
2	xgb	0.862±0.004	0.917±0.003
3	XGBOOST	0.859±0.003	0.915±0.003
4	ADABoost	0.857±0.004	0.91±0.003
5	Ensemble-MLR	0.85±0.005	0.903±0.004
6	MLR2_bagging	0.85±0.005	0.903±0.004
7	Top5_MLR	0.85±0.005	0.903±0.004
8	MLR1_bagging	0.85±0.004	0.903±0.004
9	MLR1	0.85±0.004	0.902±0.004
10	Best_MLR	0.849±0.005	0.902±0.004
11	MLR2	0.849±0.005	0.902±0.004
12	MLR4	0.849±0.005	0.901±0.004
13	MLR3	0.849±0.004	0.901±0.004
14	RF	0.848±0.006	0.895±0.005
15	Enet	0.845±0.004	0.899±0.004
16	LAS	0.845±0.004	0.899±0.004
17	Ridge	0.845±0.004	0.899±0.004
18	Bagging	0.841±0.003	0.872±0.002
19	XRF	0.835±0.005	0.875±0.005
20	LinearRidge	0.834±0.004	0.885±0.004
21	CART	0.812±0.004	0.746±0.006
22	XCART	0.798±0.005	0.722±0.007
23	Class prob.	0.636±0.007	0.499±0.006
24	QDA	0.569±0.079	0.719±0.03
25	FASTAI	0.389±0.014	0.863±0.004
26	LGBM	0.262±0.023	0.921±0.003

Table 40: HPO and ensemble for regression dataset 0

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.165±0.241	0.176±0.234	0.215±0.187
2	MLR	0.276±0.2	0.375±0.165	0.385±0.161
3	RF	0.262±0.147	0.266±0.147	0.299±0.135
4	XGB	0.154±0.18	0.169±0.176	0.222±0.133

Table 41: HPO and ensemble for regression dataset 1

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.541±0.099	0.543±0.1	0.54±0.101
2	MLR	0.453±0.083	0.483±0.074	0.486±0.065
3	RF	0.481±0.075	0.485±0.076	0.491±0.08
4	XGB	0.488±0.099	0.501±0.098	0.502±0.09

Table 42: HPO and ensemble for regression dataset 2

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.978±0.019	0.979±0.018	0.98±0.015
2	MLR	0.988±0.007	0.992±0.007	0.993±0.006
3	RF	0.974±0.01	0.975±0.01	0.974±0.01
4	XGB	0.977±0.01	0.982±0.011	0.982±0.01

Table 43: HPO and ensemble for regression dataset 3

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.985±0.01	0.986±0.01	0.985±0.01
2	MLR	0.975±0.014	0.977±0.015	0.976±0.015
3	RF	0.978±0.012	0.978±0.012	0.978±0.013
4	XGB	0.986±0.007	0.988±0.008	0.987±0.008

Table 44: HPO and ensemble for regression dataset 4

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.686±0.026	0.689±0.026	0.689±0.026
2	MLR	0.675±0.029	0.684±0.028	0.686±0.028
3	RF	0.676±0.023	0.678±0.023	0.678±0.023
4	XGB	0.67±0.022	0.677±0.022	0.68±0.023

Table 45: HPO and ensemble for regression dataset 5

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.847±0.026	0.848±0.026	0.847±0.026
2	MLR	0.838±0.027	0.843±0.026	0.843±0.027
3	RF	0.846±0.029	0.847±0.029	0.847±0.029
4	XGB	0.835±0.024	0.839±0.024	0.835±0.023

Table 46: HPO and ensemble for regression dataset 6

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.909±0.007	0.909±0.007	0.91±0.007
2	MLR	0.893±0.007	0.898±0.006	0.898±0.007
3	RF	0.906±0.008	0.907±0.008	0.906±0.009
4	XGB	0.905±0.007	0.906±0.007	0.907±0.007

Table 47: HPO and ensemble for regression dataset 7

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.522±0.012	0.522±0.012	0.522±0.012
2	MLR	0.522±0.013	0.522±0.013	0.523±0.013
3	RF	0.522±0.013	0.522±0.013	0.522±0.013
4	XGB	0.518±0.014	0.518±0.014	0.518±0.014

Table 48: HPO and ensemble for regression dataset 8

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.924±0.005	0.926±0.006	0.926±0.005
2	MLR	0.903±0.007	0.914±0.007	0.913±0.007
3	RF	0.912±0.007	0.912±0.007	0.911±0.007
4	XGB	0.916±0.009	0.921±0.007	0.919±0.007

Table 49: HPO and ensemble for regression dataset 9

	method	R2	Bagging.R2	Ensemble.R2
1	CAT	0.856±0.015	0.86±0.015	0.858±0.017
2	MLR	0.839±0.011	0.863±0.01	0.857±0.016
3	RF	0.798±0.037	0.799±0.037	0.785±0.036
4	XGB	0.842±0.018	0.849±0.017	0.851±0.021