First 20 Models Simultaneous Run

General Imports

In [ ]:

```python
import pandas as pd
import os
import matplotlib.pyplot as plt
import numpy as np
from sklearn.model_selection import StratifiedShuffleSplit
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import cross_validate
from sklearn.model_selection import KFold

from sklearn.utils import all_estimators
```

Automatically Importing All Regressions

In [ ]:

```python
estimators = all_estimators(type_filter='regressor')

all_regs = []
for name, RegressorClass in estimators:
    try:
        if name != 'DummyRegressor' and name != 'GaussianProcessRegressor':
            print('Appending', name)
            reg = RegressorClass()
            all_regs.append(reg)
    except Exception as e:
        print(e)
```

```
Appending ARDRegression
Appending AdaBoostRegressor
Appending BaggingRegressor
Appending BayesianRidge
Appending CCA
Appending DecisionTreeRegressor
Appending ElasticNet
Appending ElasticNetCV
Appending ExtraTreeRegressor
Appending ExtraTreesRegressor
Appending GammaRegressor
Appending GradientBoostingRegressor
Appending HistGradientBoostingRegressor
Appending HuberRegressor
Appending IsotonicRegression
Appending KNeighborsRegressor
Appending KernelRidge
Appending Lars
Appending LarsCV
Appending Lasso
Appending LassoCV
Appending LassoLars
Appending LassoLarsCV
Appending LassoLarsIC
Appending LinearRegression
Appending LinearSVR
Appending MLPRegressor
Appending MultiOutputRegressor
__init__() missing 1 required positional argument: 'estimator'
Appending MultiTaskElasticNet
Appending MultiTaskElasticNetCV
Appending MultiTaskLasso
Appending MultiTaskLassoCV
Appending NuSVR
Appending OrthogonalMatchingPursuit
Appending OrthogonalMatchingPursuitCV
Appending PLSCanonical
Appending PLSRegression
Appending PassiveAggressiveRegressor
Appending PoissonRegressor
Appending QuantileRegressor
Appending RANSACRegressor
Appending RadiusNeighborsRegressor
Appending RandomForestRegressor
Appending RegressorChain
__init__() missing 1 required positional argument: 'base_estimator'
Appending Ridge
Appending RidgeCV
Appending SGDRegressor
Appending SVR
Appending StackingRegressor
__init__() missing 1 required positional argument: 'estimators'
Appending TheilSenRegressor
Appending TransformedTargetRegressor
Appending TweedieRegressor
Appending VotingRegressor
__init__() missing 1 required positional argument: 'estimators'
```

Load and Describe Data

In [ ]:
```
def load_pp_data():
    csv_path = r"C:\Users\18123\OneDrive\Documents\IUBloomington\Machine-Learning-Proj
    return pd.read_csv(csv_path)

pp = load_pp_data()
print(pp.describe())
```

```
                AT            V           AP           RH           PE
count  9568.000000  9568.000000  9568.000000  9568.000000  9568.000000
mean     19.651231    54.305804  1013.259078    73.308978   454.365009
std       7.452473    12.707893     5.938784    14.600269    17.066995
min       1.810000    25.360000   992.890000    25.560000   420.260000
25%      13.510000    41.740000  1009.100000    63.327500   439.750000
50%      20.345000    52.080000  1012.940000    74.975000   451.550000
75%      25.720000    66.540000  1017.260000    84.830000   468.430000
max      37.110000    81.560000  1033.300000   100.160000   495.760000
```

Train/Test Split and Preprocess Data

In [ ]:
```
pp["AT_cat"] = pd.cut(pp["AT"],bins=[0.,10.,20.,30.,np.inf],labels=[1,2,3,4])

split = StratifiedShuffleSplit(n_splits=1,test_size=0.2,random_state=42)
for train_index, test_index in split.split(pp,pp["AT_cat"]):
    train_set = pp.loc[train_index]
    test_set = pp.loc[test_index]

for set_ in(train_set,test_set):
    set_.drop("AT_cat",axis=1,inplace=True)

pptrain = train_set.copy()
pptest = test_set.copy()

pptrain_attrib = pptrain.drop("PE",axis=1)
pptrain_labels = pptrain["PE"].copy()
pptest_attrib = pptest.drop("PE",axis=1)
pptest_labels = pptest["PE"].copy()

scaler = StandardScaler()
scaler.fit_transform(pptrain_attrib)
```

Out[ ]:
```
array([[ 1.1978498 ,  0.96554795,  0.37377565, -2.67409022],
       [ 0.64009018, -1.03750958, -1.88469509, -2.35340963],
       [-1.82211612, -1.45609422, -0.36887464,  1.17611946],
       ...,
       [-1.07754063, -0.84989538,  0.57724148,  0.20454577],
       [-0.67971691, -0.96104497,  0.78748951,  0.87314098],
       [ 0.89545   ,  0.56351752, -0.13658448, -1.12107019]])
```

Simultaneous Run

In [ ]:
```
def run(model):
    print(f"checking {model}")
    try:
        cv_outer = KFold(n_splits=10, shuffle=True, random_state=2)
        cv_output_dict = cross_validate(model, pptrain_attrib, pptrain_labels, scoring
        return cv_output_dict
    except:
        pass

def comparison(modellst):
    cv_data = []
    errors = []
    passed_models = []
    for i in range(len(modellst)):
        x = run(modellst[i])
        if type(x) == dict:
            cv_data += [x]
        else:
            errors += [i]
    for j in range(len(modellst)):
        if j not in errors:
            passed_models += [modellst[j]]
    return vizualize(cv_data, passed_models)

def vizualize(cv_data, modellst):
    return box_rmse(cv_data, modellst, 'train'), box_rmse(cv_data, modellst, 'test'),

def runtime(cv_data, modellst):
    timefig = plt.figure(constrained_layout=True)
    df = pd.DataFrame()
    for i,j in zip(cv_data,modellst):
        df[j] = list(i[('fit_time')])
    sorted_index = df.median().sort_values(ascending=False).index
    df_sorted=df[sorted_index]
    # sns.boxplot(data=df_sorted, orient='h')
    df_sorted.boxplot(vert=False,grid=False,color='purple')
    plt.xlabel('Run Time')
    plt.ylabel('Models')
    return timefig


def box_rmse(cv_data, modellst, data_split):
    RMSEfig = plt.figure(constrained_layout=True)
    df = pd.DataFrame()
    for i,j in zip(cv_data,modellst):
        df[j] = list(np.sqrt(i[data_split+'_neg_mean_squared_error']*-1))
    sorted_index = df.median().sort_values(ascending=False).index
    df_sorted=df[sorted_index]
    # sns.boxplot(data=df_sorted, orient='h')
    df_sorted.boxplot(vert=False,grid=False,color='purple')
    plt.xlabel(f'{data_split} Root Mean Squared Error (Lower is better)')
    return RMSEfig

def box_r2(cv_data, modellst, data_split):
    R2fig = plt.figure(constrained_layout=True)
    df = pd.DataFrame()
    for i,j in zip(cv_data,modellst):
        df[j] = list(i[data_split+'_r2'])
    sorted_index = df.median().sort_values().index
    df_sorted=df[sorted_index]
    # sns.boxplot(data=df_sorted, orient='h')
    df_sorted.boxplot(vert=False,grid=False,color='purple')
    plt.xlabel(f'{data_split} R-Squared Score (Higher is better)')
    return R2fig

def box_mae(cv_data, modellst, data_split):
    MAEfig = plt.figure(constrained_layout=True)
    df = pd.DataFrame()
    for i,j in zip(cv_data,modellst):
        df[j] = list(i[data_split+'_neg_mean_absolute_error']*-1)
    sorted_index = df.median().sort_values(ascending=False).index
    df_sorted=df[sorted_index]
    # sns.boxplot(data=df_sorted, orient='h')
    df_sorted.boxplot(vert=False,grid=False,color='purple')
    plt.xlabel(f'{data_split} Mean Absolute Error (Lower is better)')
    return MAEfig

y = all_regs[0:20]
x = all_regs[0:3]
comparison(y)
plt.show()
```

```
checking ARDRegression()
checking AdaBoostRegressor()
checking BaggingRegressor()
checking BayesianRidge()
checking CCA()
checking DecisionTreeRegressor()
checking ElasticNet()
checking ElasticNetCV()
checking ExtraTreeRegressor()
checking ExtraTreesRegressor()
checking GammaRegressor()
checking GradientBoostingRegressor()
checking HistGradientBoostingRegressor()
checking HuberRegressor()
```

```
c:\Users\18123\AppData\Local\Programs\Python\Python38\lib\site-packages\sklearn\linea
r_model\_huber.py:335: ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)
```

```
checking IsotonicRegression()
checking KNeighborsRegressor()
checking KernelRidge()
checking Lars()
checking LarsCV()
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```
c:\Users\18123\AppData\Local\Programs\Python\Python38\lib\site-packages\sklearn\linea
r_model\_base.py:133: FutureWarning: The default of 'normalize' will be set to False
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If you wish to scale the data, use Pipeline with a StandardScaler in a preprocessing
stage. To reproduce the previous behavior:

from sklearn.pipeline import make_pipeline

model = make_pipeline(StandardScaler(with_mean=False), Lars())

If you wish to pass a sample_weight parameter, you need to pass it as a fit parameter
to each step of the pipeline as follows:

kwargs = {s[0] + '__sample_weight': sample_weight for s in model.steps}
model.fit(X, y, **kwargs)


  warnings.warn(
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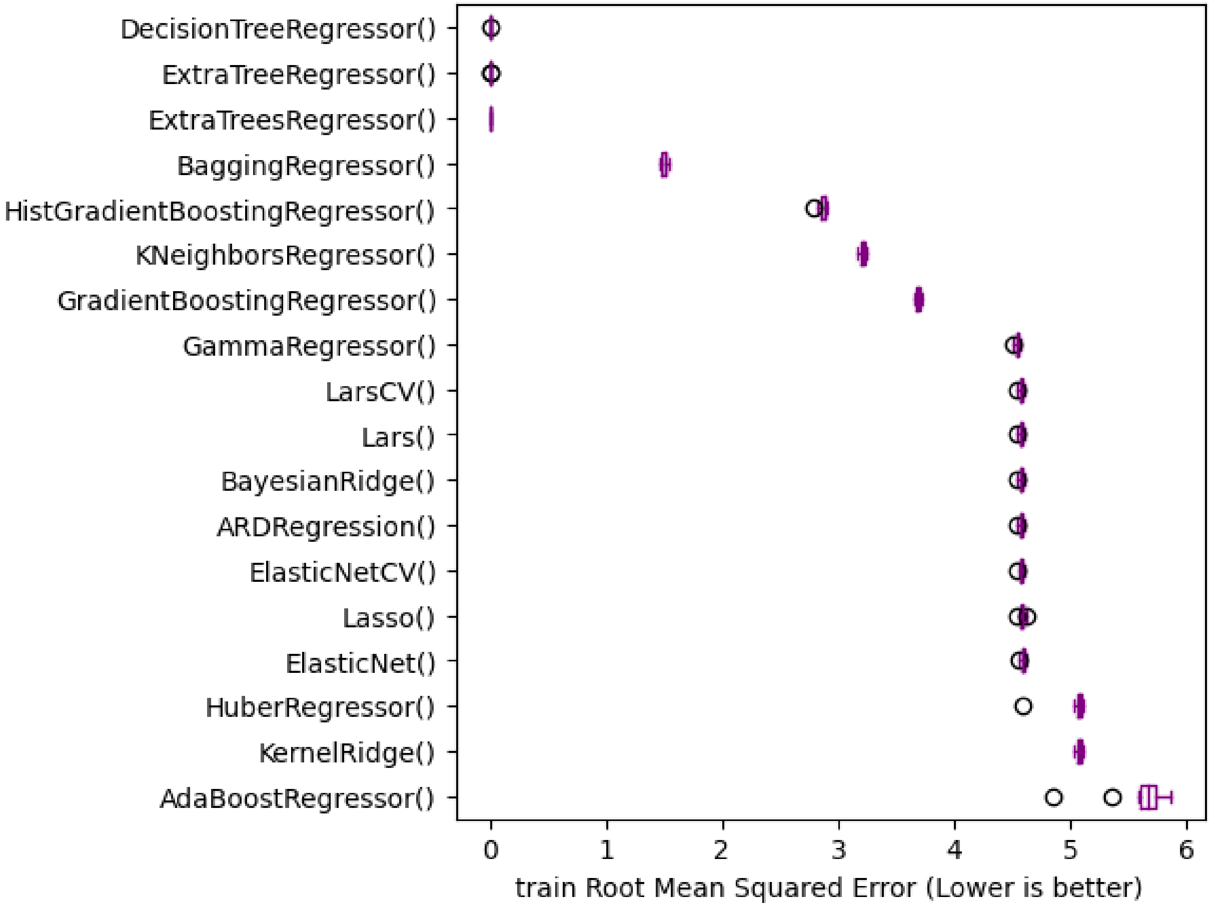
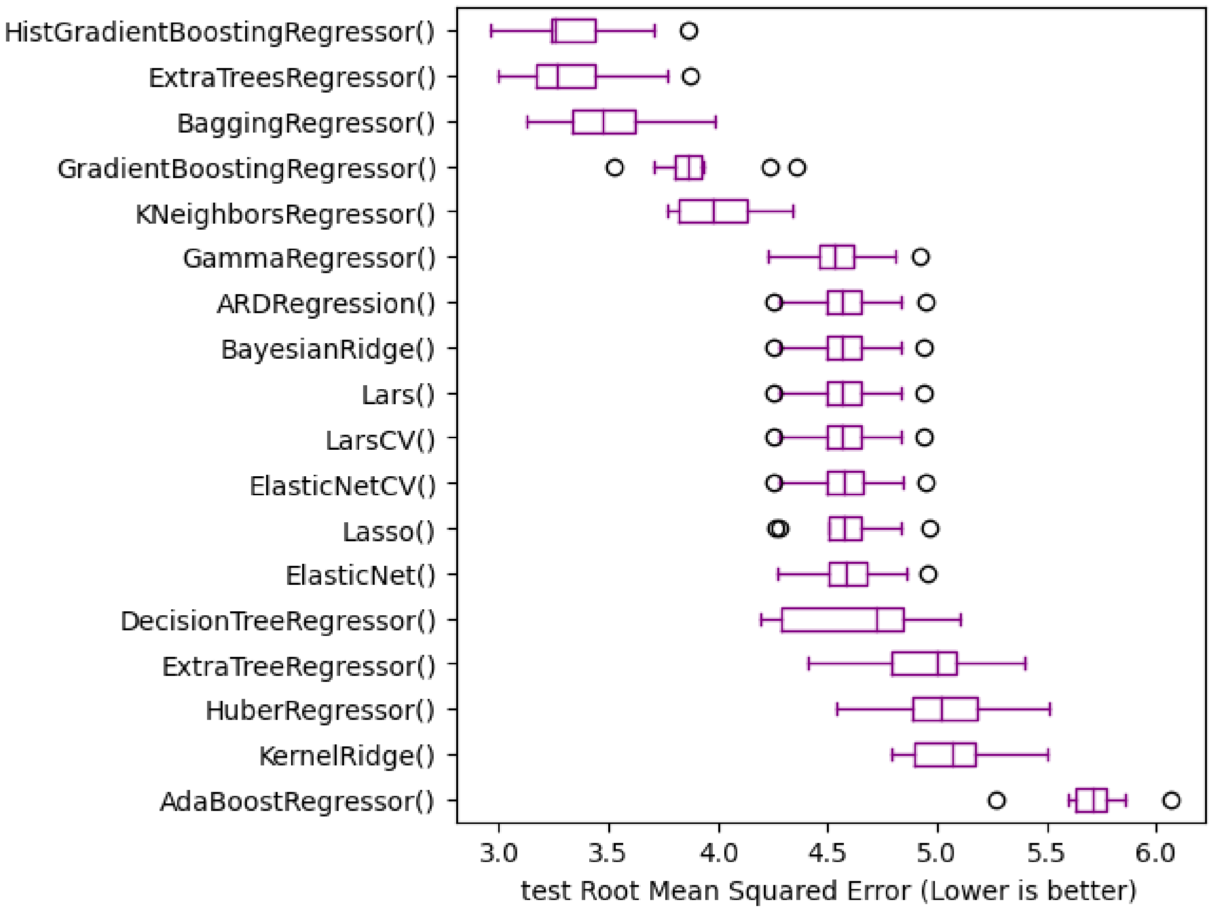
kwargs = {s[0] + '__sample_weight': sample_weight for s in model.steps}
model.fit(X, y, **kwargs)


  warnings.warn(
checking Lasso()
```




HistGradientBoostingRegressor()
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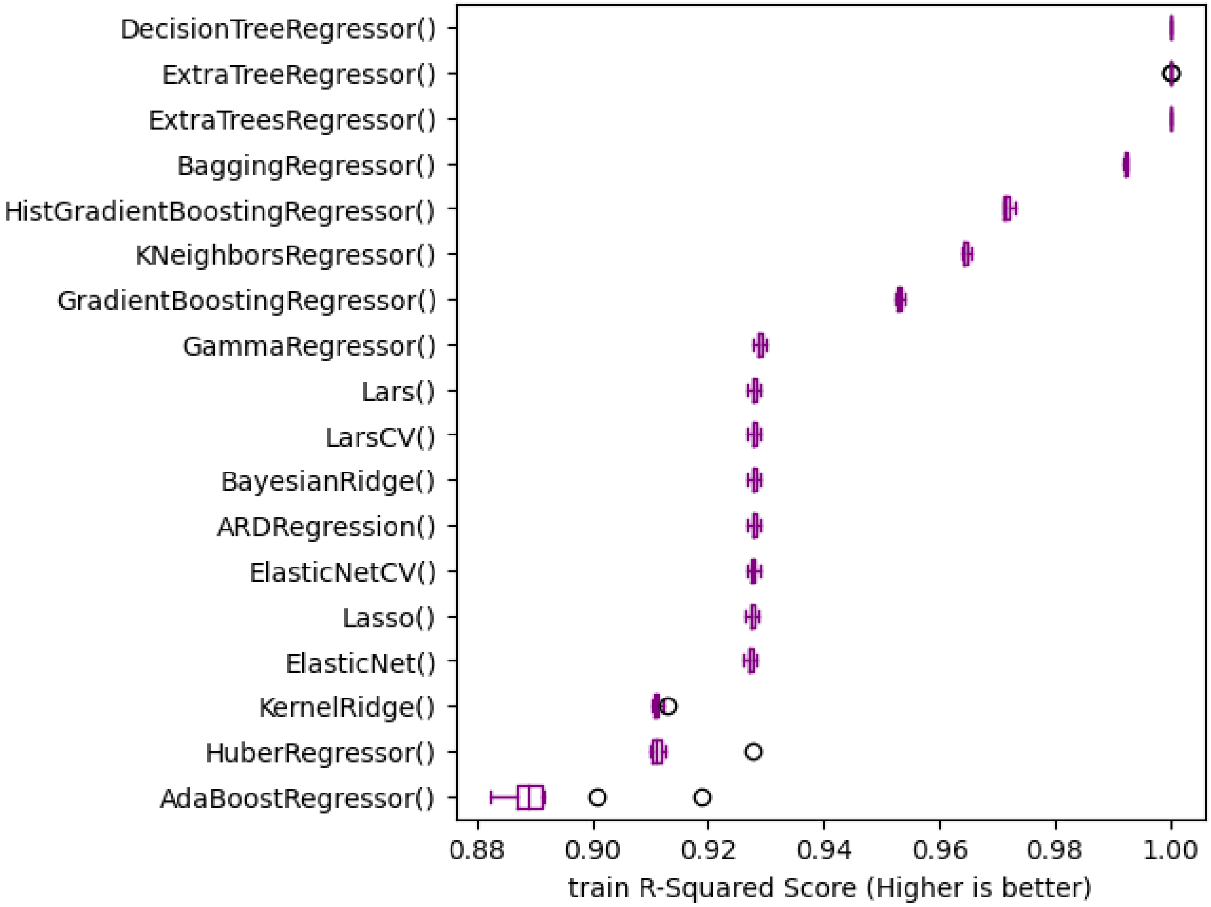
3.0
3.5
4.0
4.5
5.0
5.5
6.0
test Root Mean Squared Error (Lower is better)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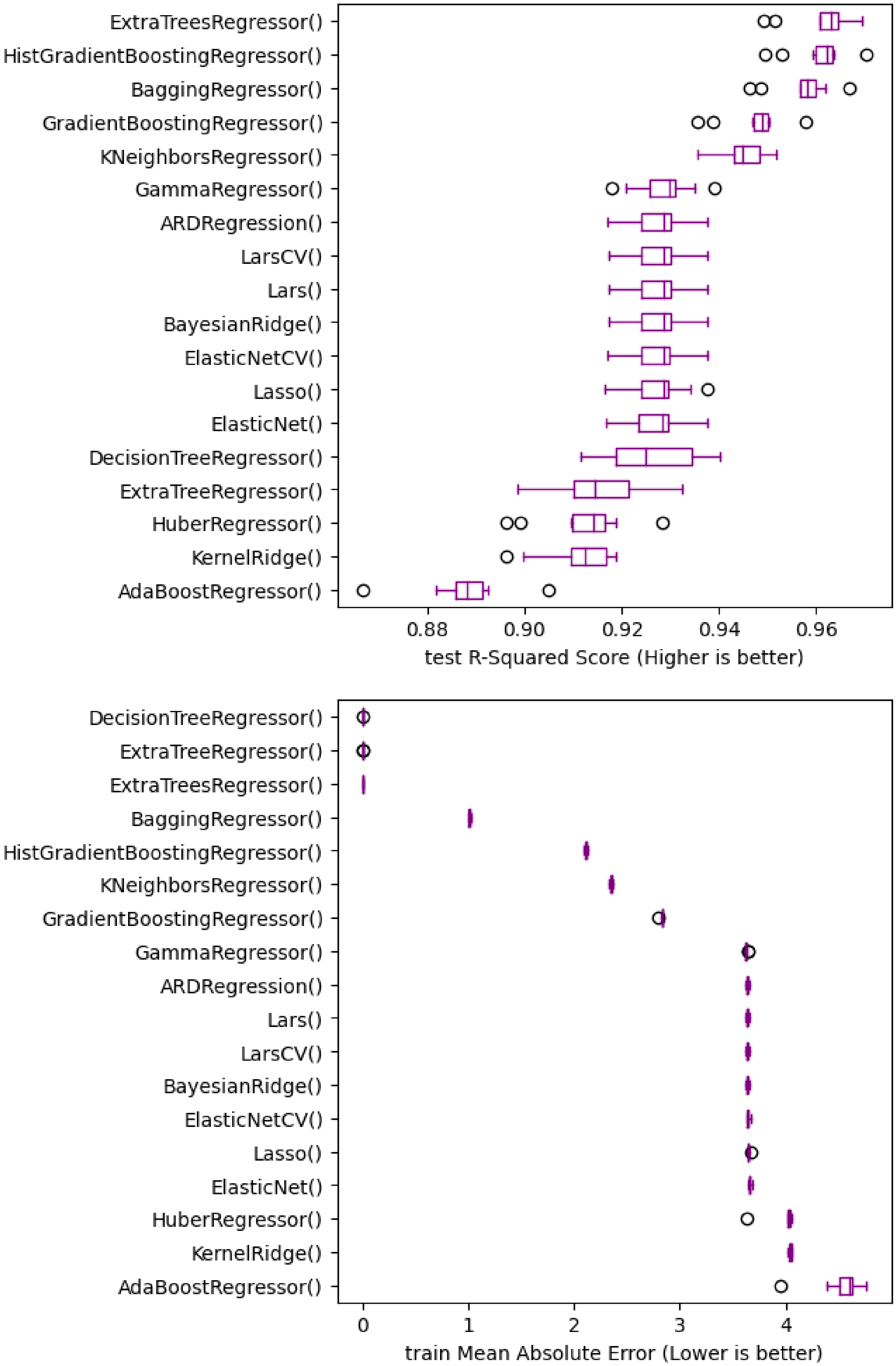
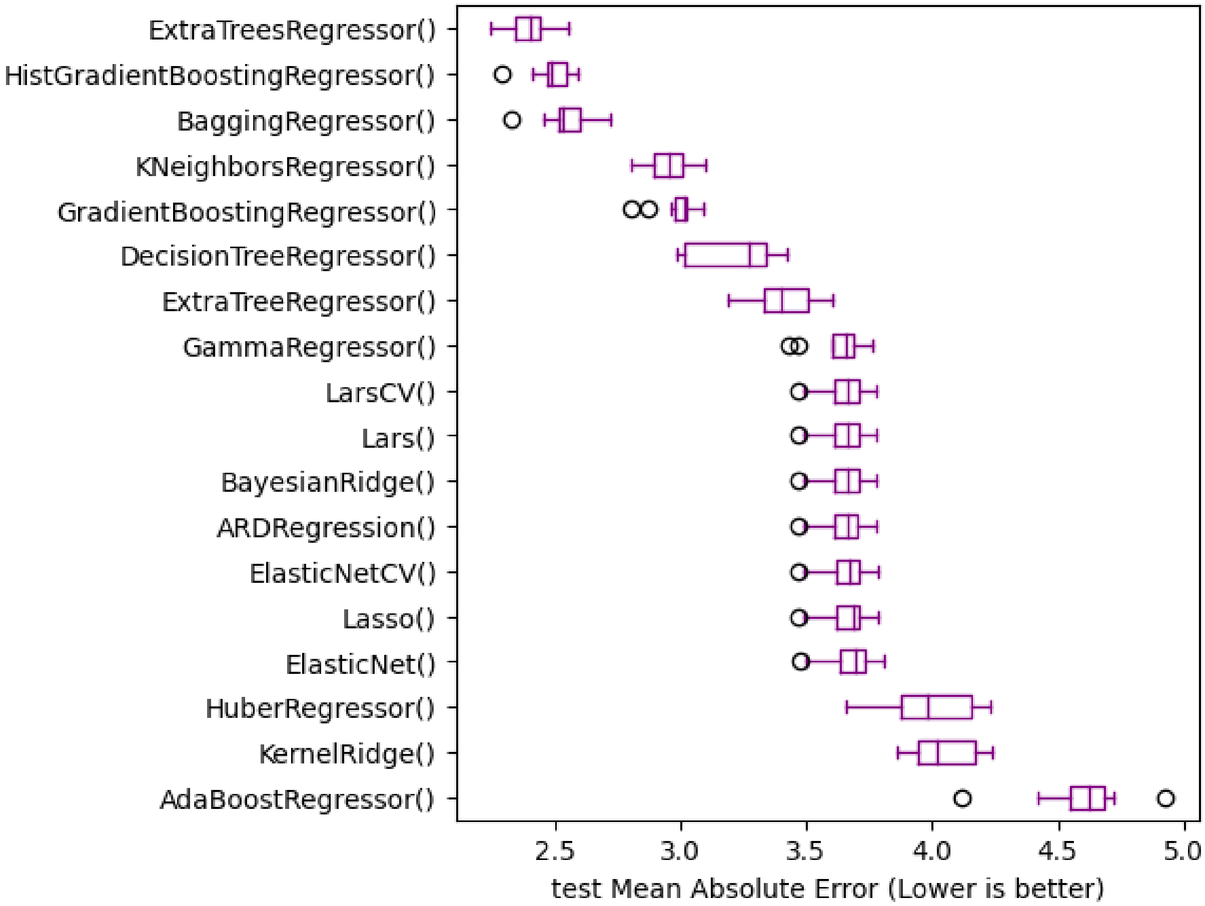
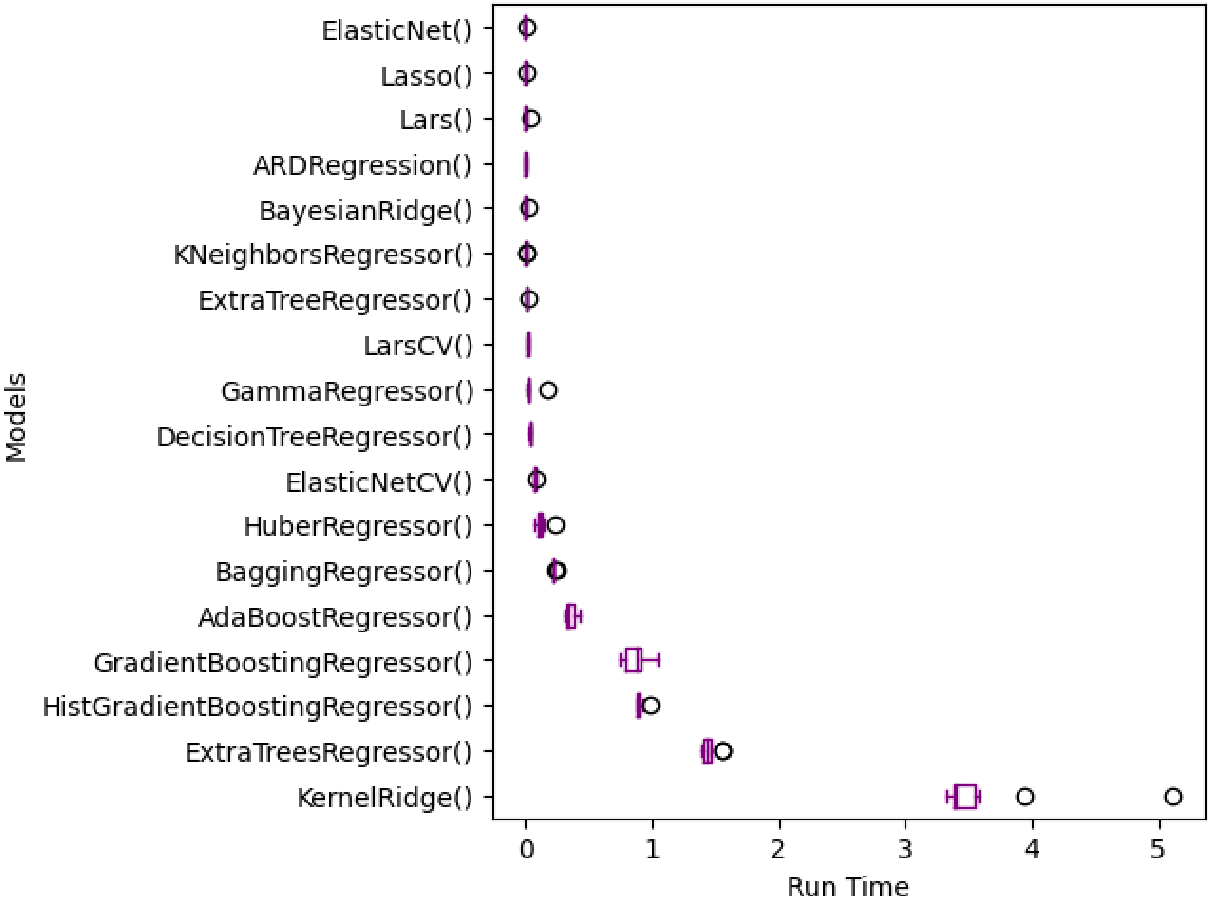
HuberRegressor()
AdaBoostRegressor()
0.88
0.90
0.92
0.94
0.96
0.98
1.00
train R-Squared Score (Higher is better)


ExtraTreesRegressor()
HistGradientBoostingRegressor()
BaggingRegressor()
GradientBoostingRegressor()
KNeighborsRegressor()
GammaRegressor()
ARDRegression()
LarsCV()
Lars()
BayesianRidge()
ElasticNetCV()
Lasso()
ElasticNet()
DecisionTreeRegressor()
ExtraTreeRegressor()
HuberRegressor()
KernelRidge()
AdaBoostRegressor()
0.88
0.90
0.92
0.94
0.96
test R-Squared Score (Higher is better)
DecisionTreeRegressor()
ExtraTreeRegressor()
ExtraTreesRegressor()
BaggingRegressor()
HistGradientBoostingRegressor()
KNeighborsRegressor()
GradientBoostingRegressor()
GammaRegressor()
ARDRegression()
Lars()
LarsCV()
BayesianRidge()
ElasticNetCV()
Lasso()
ElasticNet()
HuberRegressor()
KernelRidge()
AdaBoostRegressor()
0
1
2
3
4
train Mean Absolute Error (Lower is better)


ExtraTreesRegressor()
HistGradientBoostingRegressor()
BaggingRegressor()
KNeighborsRegressor()
GradientBoostingRegressor()
DecisionTreeRegressor()
ExtraTreeRegressor()
GammaRegressor()
LarsCV()
Lars()
BayesianRidge()
ARDRegression()
ElasticNetCV()
Lasso()
ElasticNet()
HuberRegressor()
KernelRidge()
AdaBoostRegressor()
2.5
3.0
3.5
4.0
4.5
5.0
test Mean Absolute Error (Lower is better)


Models
ElasticNet()
Lasso()
Lars()
ARDRegression()
BayesianRidge()
KNeighborsRegressor()
ExtraTreeRegressor()
LarsCV()
GammaRegressor()
DecisionTreeRegressor()
ElasticNetCV()
HuberRegressor()
BaggingRegressor()
AdaBoostRegressor()
GradientBoostingRegressor()
HistGradientBoostingRegressor()
ExtraTreesRegressor()
KernelRidge()
0
1
2
3
4
5
Run Time