
ai4water-experiments

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EXPERIMENTS

The basic purpose of the experiments module of ai4water is comparison. It can be used for following scenarios

- 1) **Comparison between different machine learning algorithms for a classification or regression task.**
This can be done using MLRegressionExperiments or MLClassificationExperiments class.
- 2) **Comparison between different neural network architectures for a classification or a regression task.**
This can be done using DLRegressionExperiments or DLClassificationExperiments classes.
- 3) **Test a single algorithm in different scenarios e.g., by applying different transformations on a feature and compare the results**
A use case is shown with TransformationExperiments class.
- 4) **Optimize the hyperparameters of multiple models. This can be done by setting run_type to optimize**
in experiment.fit method.

All the classes inherit from Experiments class.

1.1 Machine learning algorithms for classification

```
# import site
# site.addsitedir("D:\\mytools\\AI4Water")
from ai4water.datasets import MtropicsLaos
from ai4water.experiments import MLClassificationExperiments
```

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/experimental/enable_hist_gradient_boosting.py:17:
↳ UserWarning: Since version 1.0, it is not needed to import enable_hist_gradient_
↳ boosting anymore. HistGradientBoostingClassifier and HistGradientBoostingRegressor are
↳ now stable and can be normally imported from sklearn.ensemble.
"Since version 1.0, "
```

```
dataset = MtropicsLaos()

#data = dataset.make_classification(lookback_steps=1)

#print(data.shape)
```

```
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```

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```

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100% of 0.04 MB downloaded
0% of 0.1 MB downloaded
100% of 0.1 MB downloaded
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/rain_guage.zip
↳ to /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/
↳ lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/rain_guage
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/hydro.zip to /
↳ home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/hydro
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/suro.zip to /
↳ home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/suro
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/subs1.zip to /
↳ home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/subs1
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/surf_feat.zip
↳ to /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/
↳ lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/surf_feat
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/pcp.zip to /
↳ home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/pcp
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/weather_station.
↳ zip to /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/weather_station
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/
↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/soilmap.zip to /
↳ home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/soilmap
unzipping /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/

```

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```

↳ latest/lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/lu.zip to /home/
↳ docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/data/MtropicsLaos/lu
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/mtropics.py:817: UserWarning: preprocessing
↳ of shapefiles can not be done because no fiona installation is found.
    warnings.warn("preprocessing of shapefiles can not be done because no fiona
↳ installation is found.")

```

```
inputs = data.columns.tolist()[0:-1] outputs = data.columns.tolist()[-1:]
```

```

exp = MLClassificationExperiments(
    input_features=inputs, output_features=outputs, epochs=5, save=False
)

```

```

exp.fit(data=data,
        exclude=['LinearDiscriminantAnalysis'])

```

```
exp.plot_cv_scores(data=data)
```

```
exp.compare_precision_recall_curves(data[inputs].values, data[outputs].values)
```

Total running time of the script: (0 minutes 56.972 seconds)

1.2 Neural Networks for classification

```

from ai4water.hyperopt import Categorical
from ai4water.datasets import MtropicsLaos
from ai4water.experiments import DLClassificationExperiments

```

```
dataset = MtropicsLaos()
```

```
#lookback = 5
```

```
#data = dataset.make_classification(lookback_steps=lookback)
```

```
#print(data.shape)
```

```

    Not downloading the data since the directory
    /home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/
↳ lib/python3.7/site-packages/ai4water/datasets/data/MtropicsLaos already exists.
    Use overwrite=True to remove previously saved files and download again
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/datasets/mtropics.py:817: UserWarning: preprocessing
↳ of shapefiles can not be done because no fiona installation is found.
    warnings.warn("preprocessing of shapefiles can not be done because no fiona
↳ installation is found.")

```

```
inputs = data.columns.tolist()[0:-1] outputs = data.columns.tolist()[-1:]
```

```

exp = DLClassificationExperiments(
    input_features=inputs, output_features=outputs, epochs=50, ts_args={"lookback": lookback}, save=False
)

```

```
exp.batch_size_space = Categorical(categories=[4, 8, 12, 16, 32],
    name="batch_size")
```

```
exp.fit(data=data,
    include=["MLP", "CNN", "LSTM", "TFT"])
```

```
#exp.compare_errors('accuracy', data=data)
```

Total running time of the script: (0 minutes 0.001 seconds)

1.3 Comparison of machine learning algorithms

```
from ai4water.datasets import busan_beach
from ai4water.utils.utils import get_version_info
from ai4water.experiments import MLRegressionExperiments

for k,v in get_version_info().items():
    print(f"{k} version: {v}")
```

```
python version: 3.7.9 (default, Oct 19 2020, 15:13:17)
[GCC 7.5.0]
os version: posix
ai4water version: 1.06
lightgbm version: 3.3.5
tcn version: 3.5.0
catboost version: 1.1.1
xgboost version: 1.6.2
easy_mpl version: 0.21.2
SeqMetrics version: 1.3.4
tensorflow version: 2.7.0
keras.api._v2.keras version: 2.7.0
numpy version: 1.21.1
pandas version: 1.3.4
matplotlib version: 3.5.3
h5py version: 3.8.0
joblib version: 1.2.0
```

```
data = busan_beach()
```

```
print(data)
```

	tide_cm	wat_temp_c	...	rel_hum	tetx_coppml
index			...		
2018-06-19 00:00:00	36.407149	19.321232	...	95.000000	NaN
2018-06-19 00:30:00	35.562515	19.320124	...	95.000000	NaN
2018-06-19 01:00:00	34.808016	19.319666	...	95.000000	NaN
2018-06-19 01:30:00	30.645216	19.320406	...	95.006667	NaN
2018-06-19 02:00:00	26.608980	19.326729	...	95.006667	NaN
...
2019-09-07 22:00:00	-3.989912	20.990612	...	88.170000	NaN
2019-09-07 22:30:00	-2.807042	21.012014	...	88.256667	NaN

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```

2019-09-07 23:00:00 -3.471326  20.831739  ...  87.833333      NaN
2019-09-07 23:30:00  0.707771  21.006086  ...  88.370000      NaN
2019-09-08 00:00:00  1.011731  20.896149  ...  87.700000      NaN

```

```
[1446 rows x 14 columns]
```

```

comparisons = MLRegressionExperiments(
    input_features=data.columns.tolist()[0:-1],
    output_features=data.columns.tolist()[-1:],
    split_random=True,
    verbosity=0,
    save=False,
)

```

```

comparisons.fit(data=data,
                run_type="dry_run")

```

```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)

```

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```

target shape: (66, 1)
running ARDRegression model
running AdaBoostRegressor model
running BaggingRegressor model
running BayesianRidge model
running CatBoostRegressor model
running DecisionTreeRegressor model
running DummyRegressor model
running ElasticNet model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_coordinate_descent.py:648:
↳ ConvergenceWarning: Objective did not converge. You might want to increase the number
↳ of iterations, check the scale of the features or consider increasing regularisation.
↳ Duality gap: 8.332e+14, tolerance: 2.710e+11
  coef_, l1_reg, l2_reg, X, y, max_iter, tol, rng, random, positive
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳ encountered in log
  log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳ encountered in log
  log_a = np.log(a)
running ElasticNetCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in true_divide
  zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in true_divide
  zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in true_divide
  zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)

```

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```

running ExtraTreeRegressor model
running ExtraTreesRegressor model
running GaussianProcessRegressor model
running GradientBoostingRegressor model
running HistGradientBoostingRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running HuberRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_huber.py:332: 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)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running KNeighborsRegressor model
running KernelRidge model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_ridge.py:197: UserWarning: Singular_
↳matrix in solving dual problem. Using least-squares solution instead.
    "Singular matrix in solving dual problem. Using "
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running LGBMRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log

```

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```

log_a = np.log(a)
running Lars model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default
of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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)

FutureWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
encountered in log
log_a = np.log(a)
running LarsCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default
of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), LarsCV())

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)

FutureWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
encountered in true_divide
zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/

```

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```

↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
running Lasso model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_coordinate_descent.py:648:_
↳ConvergenceWarning: Objective did not converge. You might want to increase the number_
↳of iterations, check the scale of the features or consider increasing regularisation._
↳Duality gap: 9.650e+14, tolerance: 2.710e+10
    coef_, l1_reg, l2_reg, X, y, max_iter, tol, rng, random, positive
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running LassoCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/

```

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```

↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
running LassoLars model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default_
↳of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), LassoLars())

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)

Set parameter alpha to: original_alpha * np.sqrt(n_samples).
FutureWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running LassoLarsCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default_
↳of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), LassoLarsCV())

```

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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)
```

Set parameter `alpha` to: `original_alpha * np.sqrt(n_samples)`.

```
FutureWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
running LassoLarsIC model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default
of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), LassoLarsIC())
```

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}
```

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```

model.fit(X, y, **kwargs)

Set parameter alpha to: original_alpha * np.sqrt(n_samples).
FutureWarning,
running LinearRegression model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
running LinearSVR model
running MLPRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/neural_network/_multilayer_perceptron.py:696:_
ConvergenceWarning: Stochastic Optimizer: Maximum iterations (200) reached and the_
optimization hasn't converged yet.
ConvergenceWarning,
running NuSVR model
running OneClassSVM model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
running OrthogonalMatchingPursuit model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default_
of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), OrthogonalMatchingPursuit())

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)

FutureWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/linear_model/_omp.py:766: RuntimeWarning: Orthogonal_
matching pursuit ended prematurely due to linear dependence in the dictionary. The_

```

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```

↳requested precision might not have been met.
    return_n_iter=True,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running OrthogonalMatchingPursuitCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_base.py:138: FutureWarning: The default_
↳of 'normalize' will be set to False in version 1.2 and deprecated in version 1.4.
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), OrthogonalMatchingPursuitCV())

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)

FutureWarning,
running PoissonRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_glm/glm.py:323: 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)
running RANSACRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running RadiusNeighborsRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more_
↳samples have no neighbors within specified radius; predicting NaN.
    warnings.warn(empty_warning_msg)

```

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```

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/experiments/_main.py:2230: UserWarning: model_
↳RadiusNeighborsRegressor predicted only nans
    warnings.warn(f"model {model.model_name} predicted only nans")
running RandomForestRegressor model
running Ridge model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running RidgeCV model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running SGDRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running SVR model
running TheilsenRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_theil_sen.py:131: ConvergenceWarning:
↳Maximum number of iterations 50 reached in spatial median for TheilSen regressor.
    ConvergenceWarning,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↳encountered in log
    log_a = np.log(a)
running TweedieRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/linear_model/_glm/glm.py:323: ConvergenceWarning:
↳lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

```

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Increase the number of iterations (max_iter) or scale the data as shown in:

```

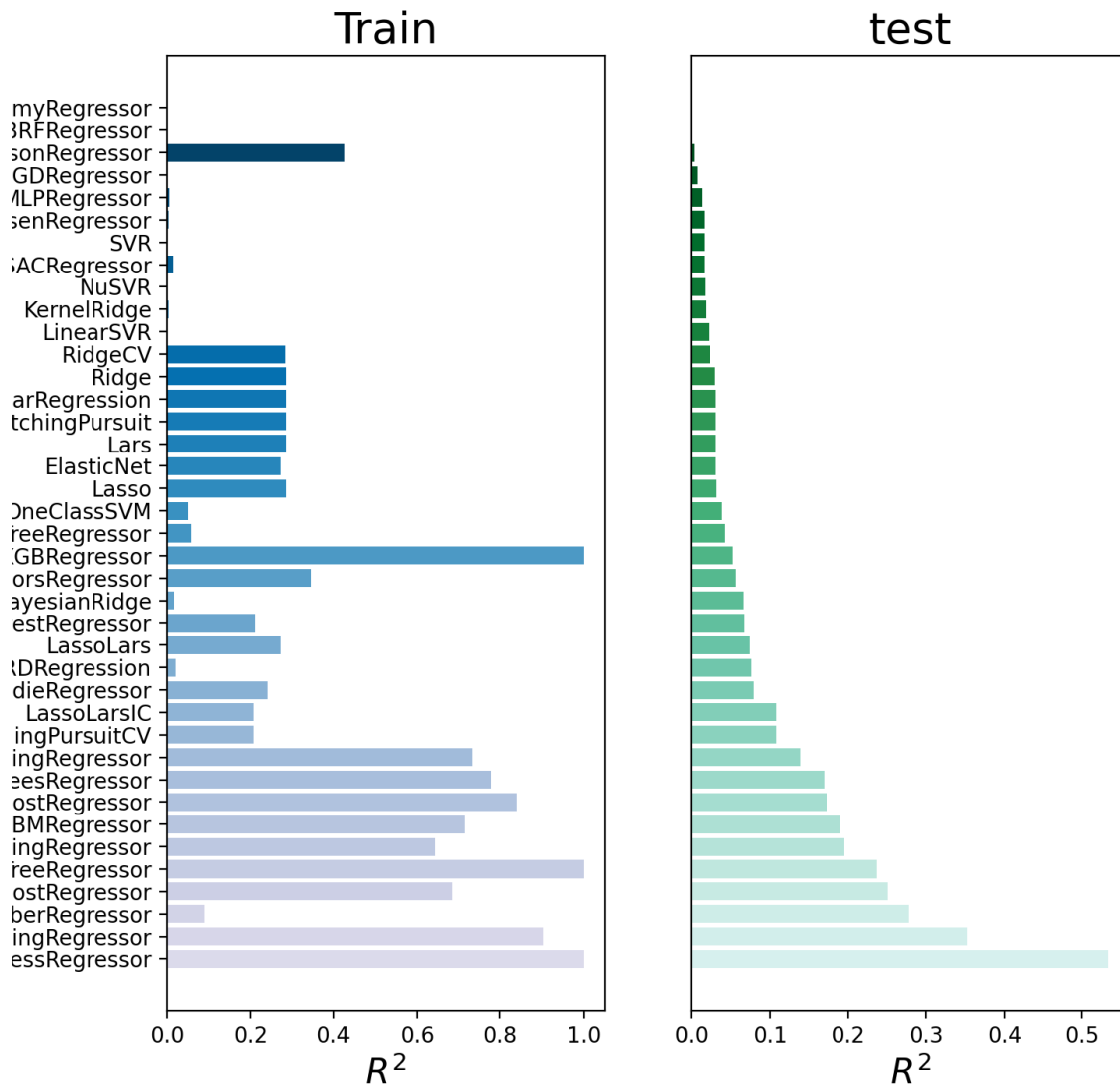
https://scikit-learn.org/stable/modules/preprocessing.html
self.n_iter_ = _check_optimize_result("lbfgs", opt_res)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)
running XGBRFRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
c /= stddev[None, :]
running XGBRegressor model
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
encountered in log
log_a = np.log(a)

```

```

comparisons.compare_errors('r2', data=data)

```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_

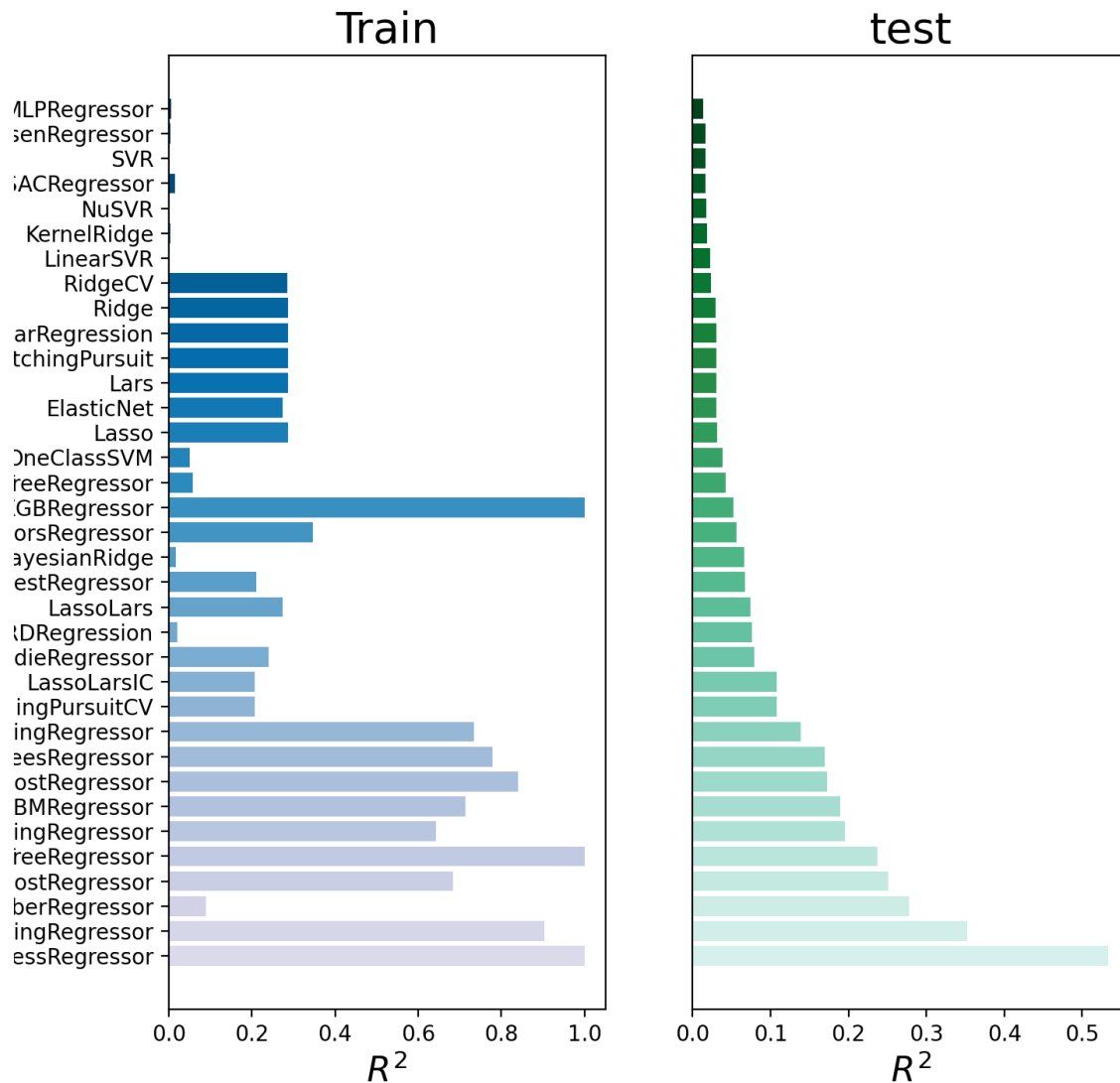
```

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```
↳ encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
↳ samples have no neighbors within specified radius; predicting NaN.
  warnings.warn(empty_warning_msg)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[None, :]
```

```
best_models = comparisons.compare_errors(
    'r2',
    data=data,
    cutoff_type='greater',
    cutoff_val=0.01)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_

```

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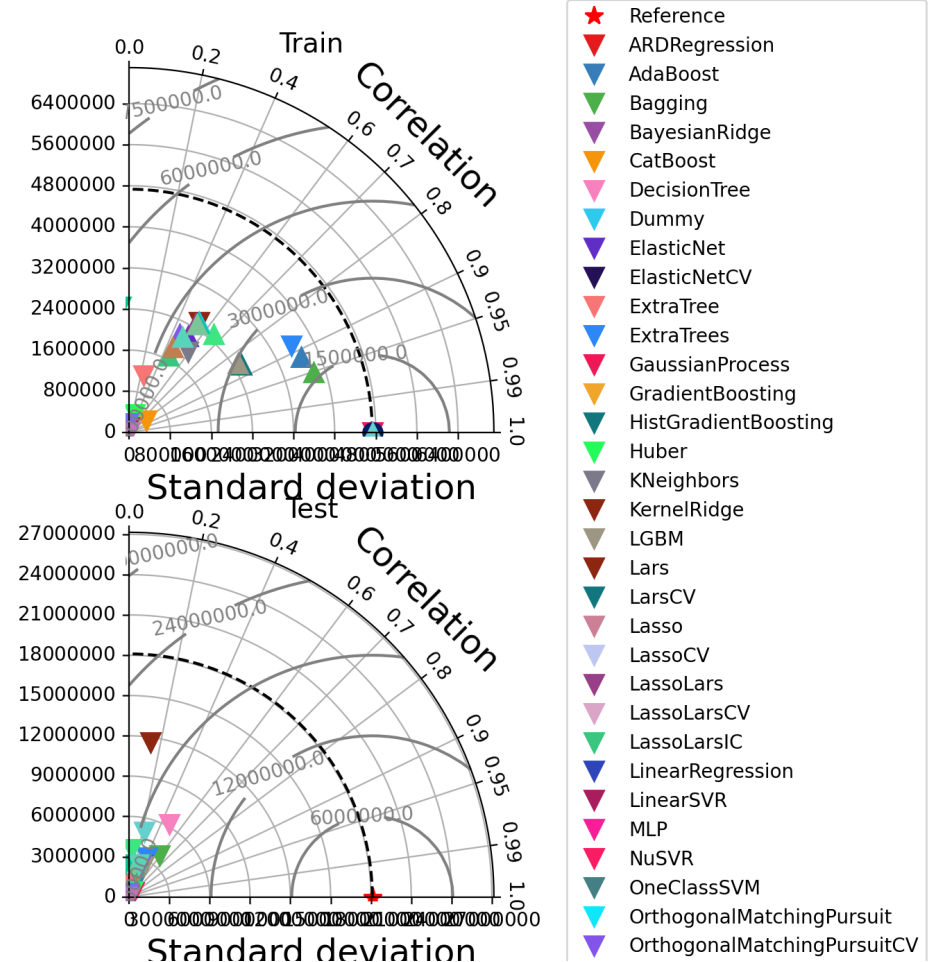
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```

→encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
→samples have no neighbors within specified radius; predicting NaN.
  warnings.warn(empty_warning_msg)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
→encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
→encountered in true_divide
  c /= stddev[None, :]

```

```
comparisons.taylor_plot(data=data)
```



```
***** Removing Examples with nan in labels *****
```

```
***** Training *****
```

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```

input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]

```

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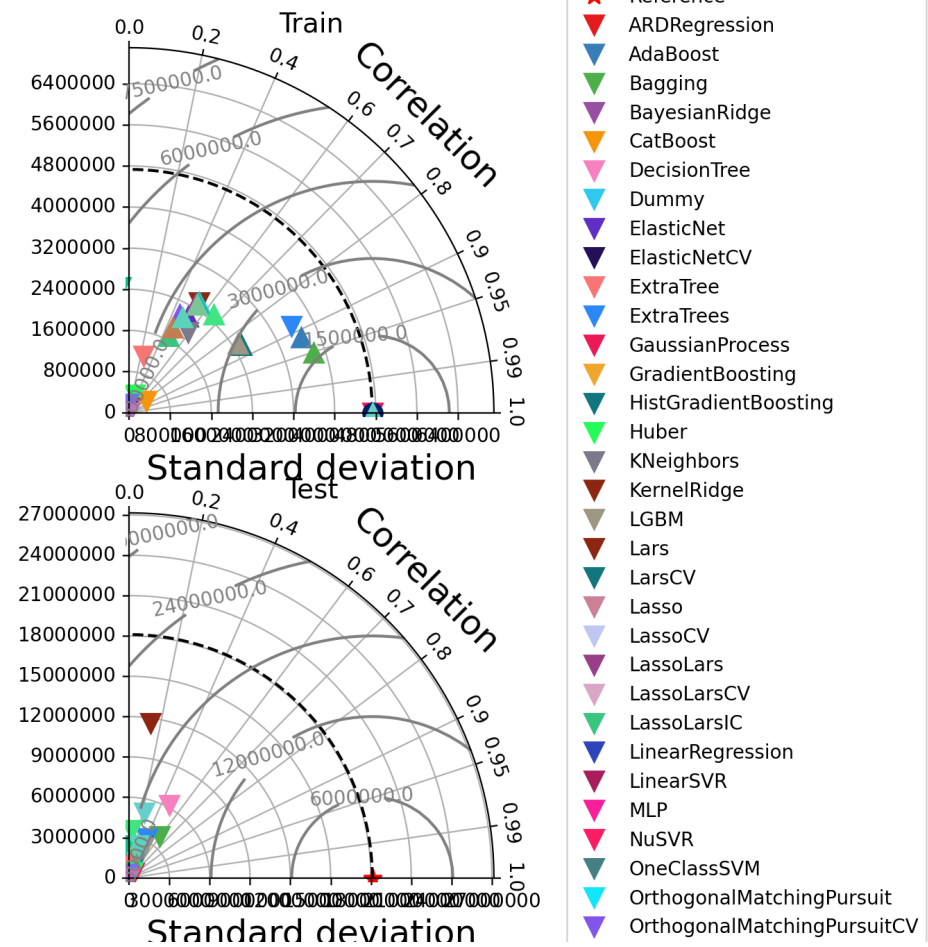
```

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more_
↳samples have no neighbors within specified radius; predicting NaN.
    warnings.warn(empty_warning_msg)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳encountered in true_divide
    c /= stddev[None, :]

```

<Figure size 900x700 with 2 Axes>

```
comparisons.taylor_plot(data=data)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)

```

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```

target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
  c /= stddev[None, :]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more_
samples have no neighbors within specified radius; predicting NaN.
  warnings.warn(empty_warning_msg)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
encountered in true_divide

```

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```

c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
encountered in true_divide
c /= stddev[None, :]

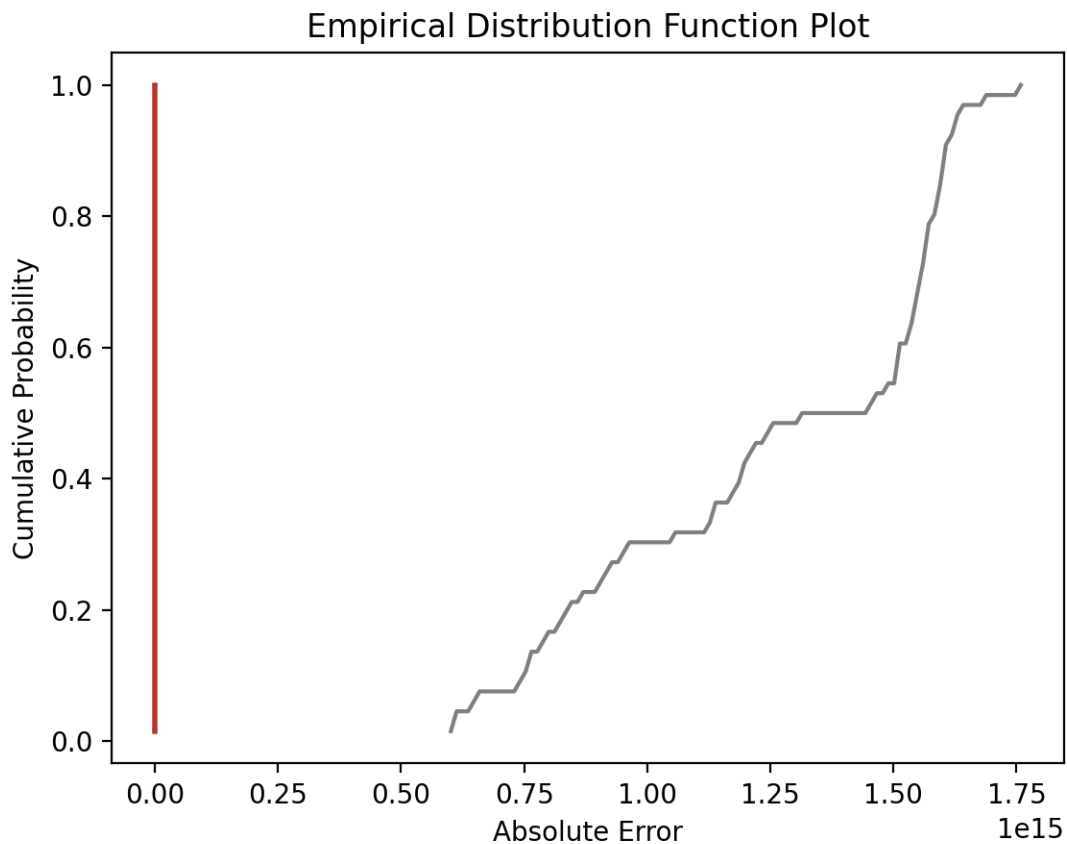
<Figure size 900x700 with 2 Axes>

```

```

comparisons.compare_edf_plots(data=data)

```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

```

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```

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

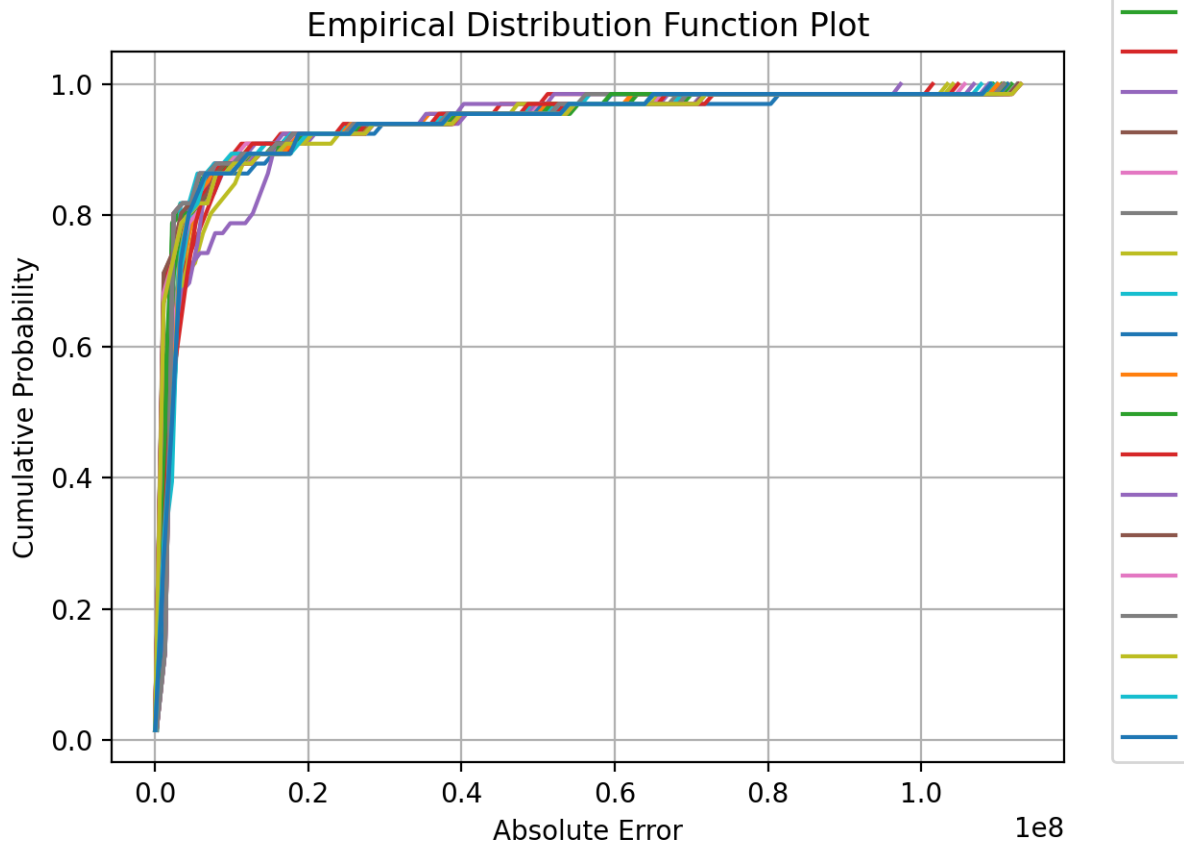
***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
↳samples have no neighbors within specified radius; predicting NaN.
    warnings.warn(empty_warning_msg)

comparisons.compare_edf_plots(data=data, exclude=["SGDRegressor", "KernelRidge",
↳"PoissonRegressor"])

```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

```

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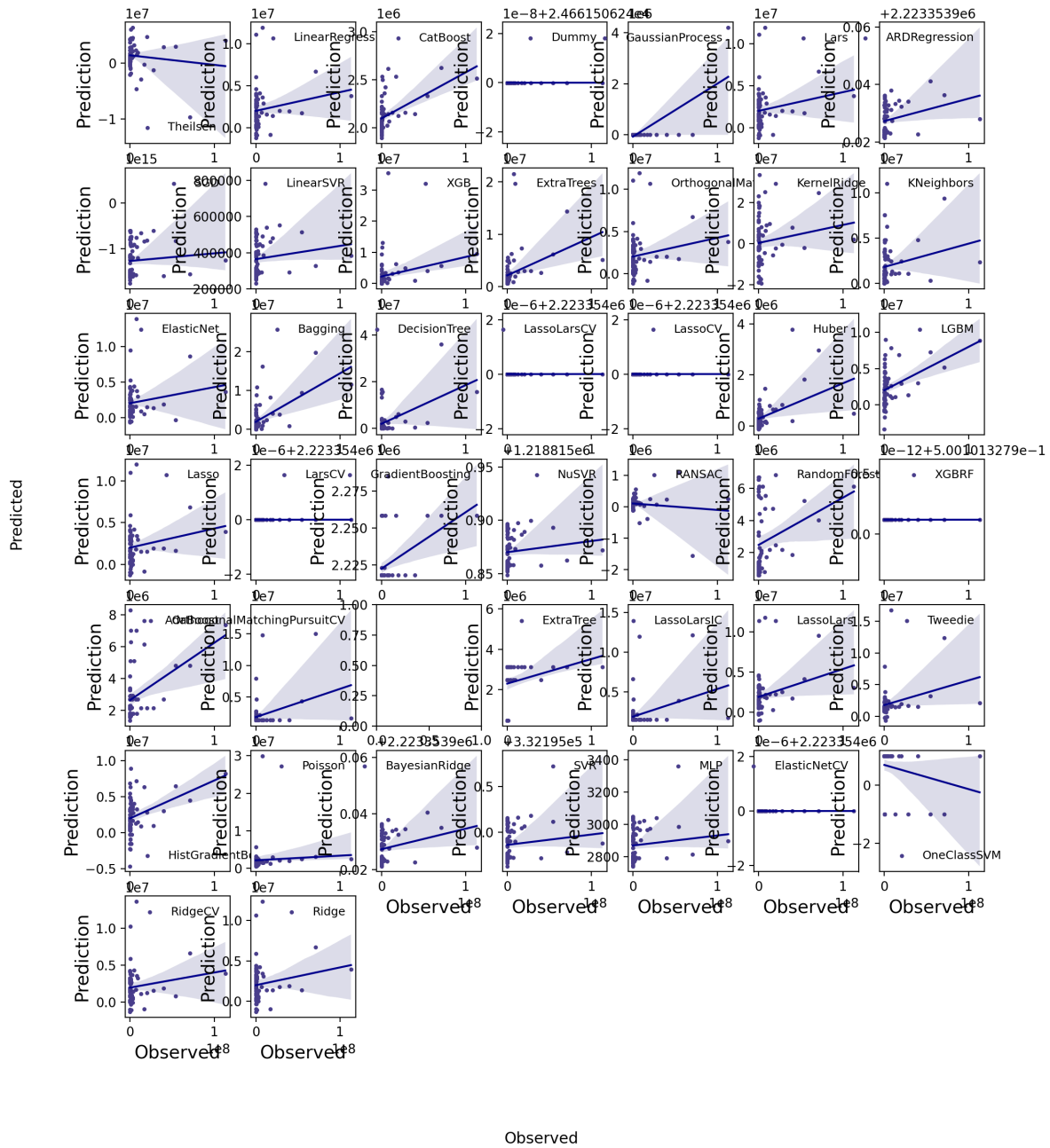
```
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
↳samples have no neighbors within specified radius; predicting NaN.
    warnings.warn(empty_warning_msg)

comparisons.compare_regression_plots(data=data, figsize=(12, 14))
```



***** Removing Examples with nan in labels *****

***** Training *****

input_x shape: (121, 13)

target shape: (121, 1)

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```

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

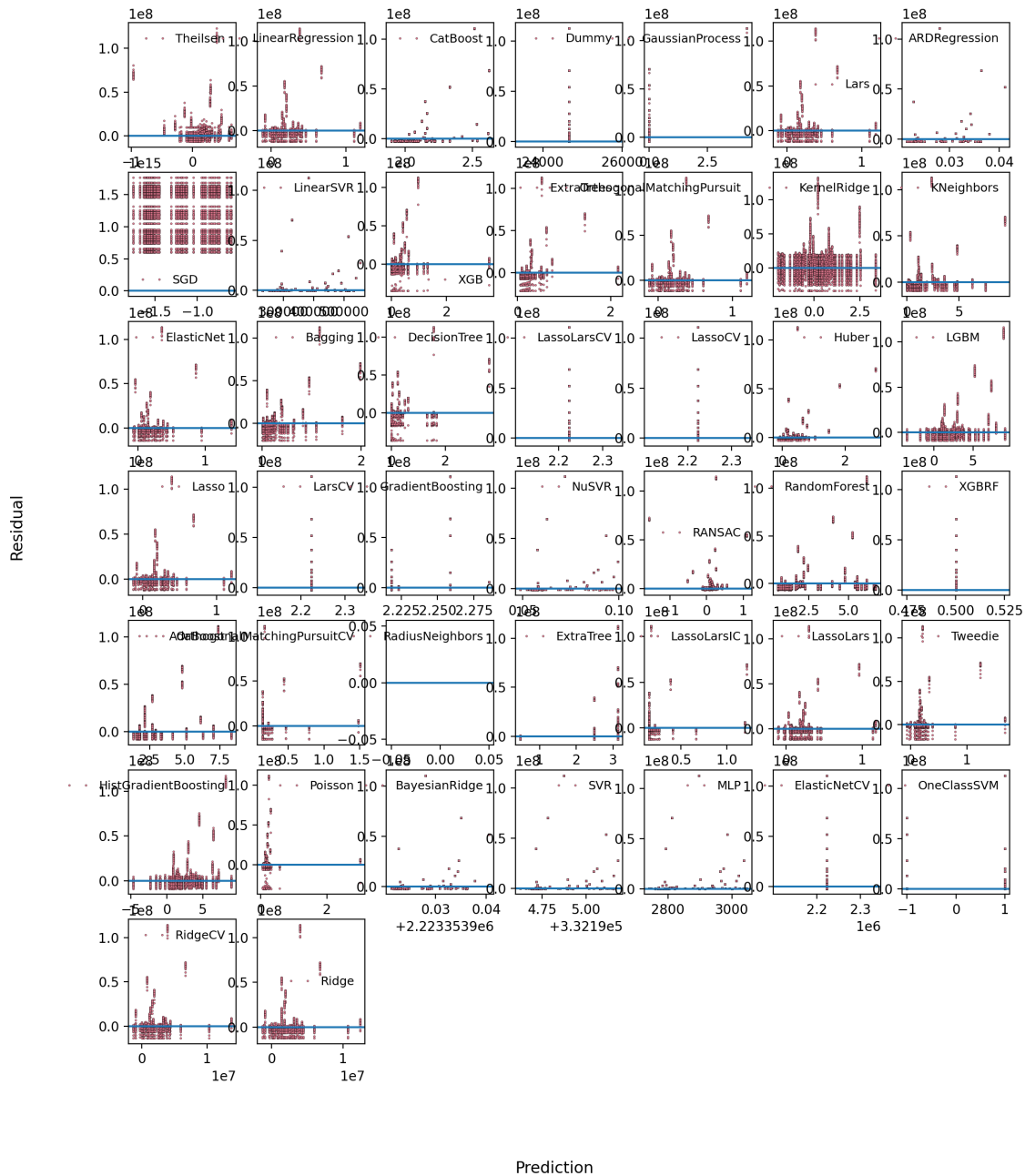
***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
samples have no neighbors within specified radius; predicting NaN.
warnings.warn(empty_warning_msg)
Model RadiusNeighborsRegressor only predicted nans

comparisons.compare_residual_plots(data=data, figsize=(12, 14))

```



***** Removing Examples with nan in labels *****

***** Training *****

input_x shape: (121, 13)

target shape: (121, 1)

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```

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/sklearn/neighbors/_regression.py:470: UserWarning: One or more
samples have no neighbors within specified radius; predicting NaN.
warnings.warn(empty_warning_msg)

<Figure size 1200x1400 with 49 Axes>

```

Total running time of the script: (2 minutes 13.912 seconds)

1.4 Comparison of deep learning architectures

```

from ai4water.datasets import busan_beach
from ai4water.utils.utils import get_version_info
from ai4water.experiments import DLRegressionExperiments

```

```

for k,v in get_version_info().items():
    print(f"{k} version: {v}")

```

```

python version: 3.7.9 (default, Oct 19 2020, 15:13:17)
[GCC 7.5.0]

```

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```

os version: posix
ai4water version: 1.06
lightgbm version: 3.3.5
tcn version: 3.5.0
catboost version: 1.1.1
xgboost version: 1.6.2
easy_mpl version: 0.21.2
SeqMetrics version: 1.3.4
tensorflow version: 2.7.0
keras.api._v2.keras version: 2.7.0
numpy version: 1.21.1
pandas version: 1.3.4
matplotlib version: 3.5.3
h5py version: 3.8.0
joblib version: 1.2.0

```

```

data = busan_beach()
print(data)

```

	tide_cm	wat_temp_c	...	rel_hum	tetx_coppml
index			...		
2018-06-19 00:00:00	36.407149	19.321232	...	95.000000	NaN
2018-06-19 00:30:00	35.562515	19.320124	...	95.000000	NaN
2018-06-19 01:00:00	34.808016	19.319666	...	95.000000	NaN
2018-06-19 01:30:00	30.645216	19.320406	...	95.006667	NaN
2018-06-19 02:00:00	26.608980	19.326729	...	95.006667	NaN
...
2019-09-07 22:00:00	-3.989912	20.990612	...	88.170000	NaN
2019-09-07 22:30:00	-2.807042	21.012014	...	88.256667	NaN
2019-09-07 23:00:00	-3.471326	20.831739	...	87.833333	NaN
2019-09-07 23:30:00	0.707771	21.006086	...	88.370000	NaN
2019-09-08 00:00:00	1.011731	20.896149	...	87.700000	NaN

[1446 rows x 14 columns]

```

comparisons = DLRegressionExperiments(
    input_features=data.columns.tolist()[0:-1],
    output_features=data.columns.tolist()[-1:],
    split_random=True,
    val_fraction=0.0,
    epochs=200,
    ts_args={"lookback": 12},
    verbosity=0,
    save=False,
)

```

```

comparisons.fit(data=data,
                include=['MLP',
                        'LSTM',
                        'CNLSTM',
                        'TCN',

```

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```

        "TFT",
        "LSTMAutoEncoder",
    ])

```

```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)
running MLP model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead."")
running LSTM model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')

```

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```

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
running CNNLSTM model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳encountered in true_divide
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[None, :]
running TCN model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
running TFT model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
running LSTMAutoEncoder model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')

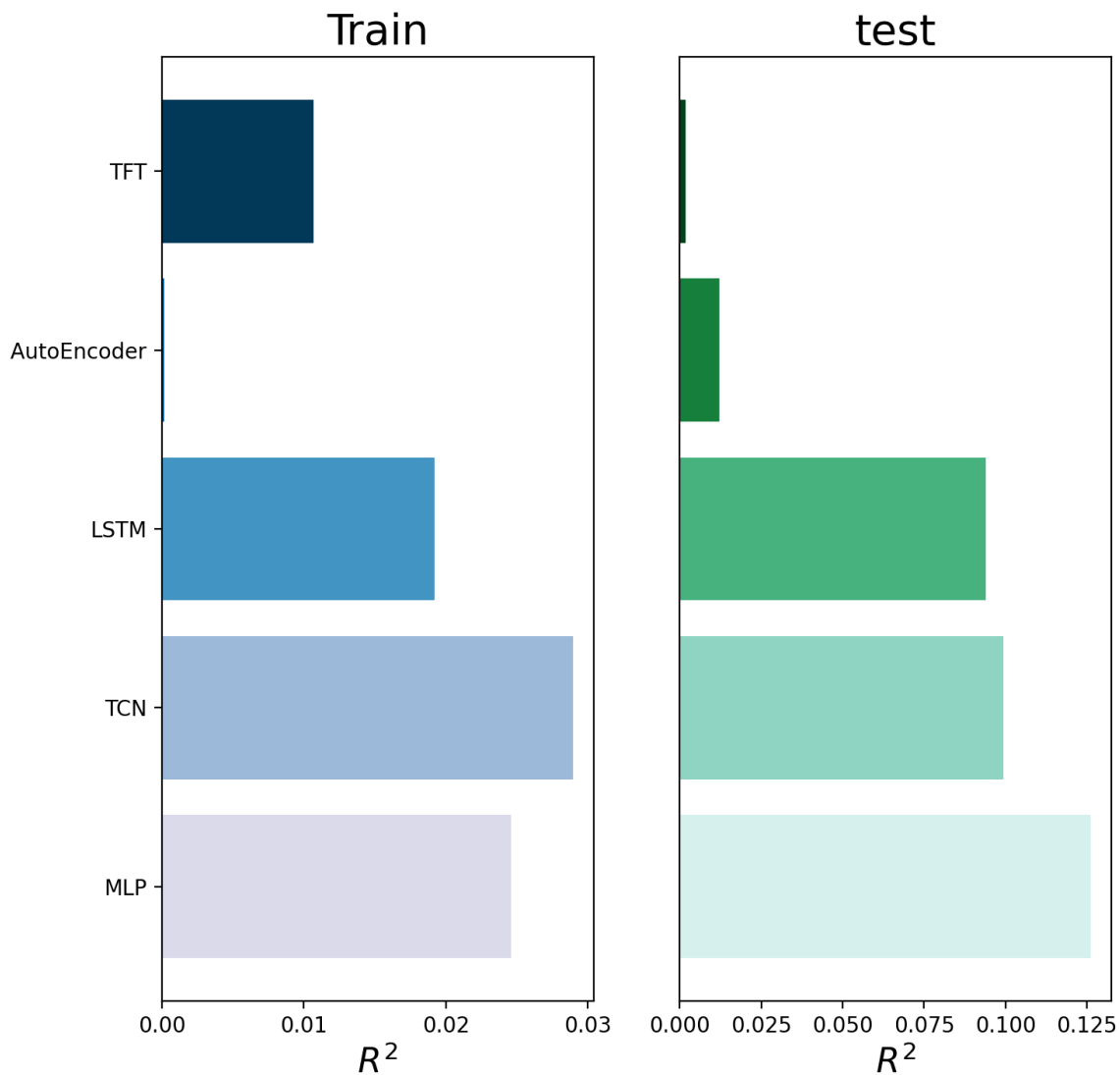
```

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```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.'''')
```

```
comparisons.compare_errors('r2', data=data)
```



```
***** Removing Examples with nan in labels *****
```

```
***** Training *****
input_x shape: (152, 12, 13)
```

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```

target shape: (152, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/

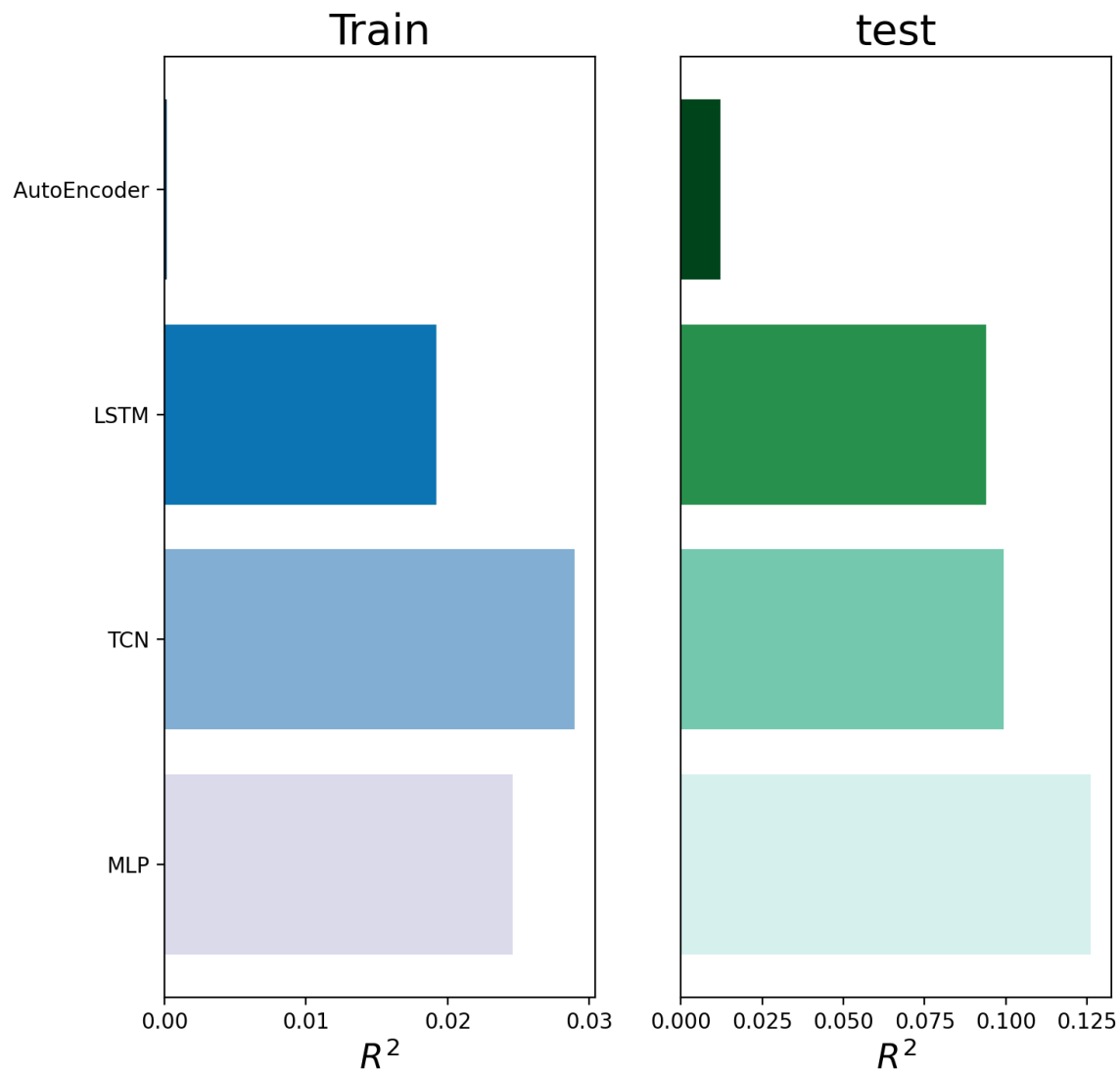
```

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```
↪) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↪pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↪) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↪pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↪) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↪pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↪) ', 'for plot_model/model_to_dot to work.')
```

```
best_models = comparisons.compare_errors(
    'r2',
    data=data,
    cutoff_type='greater',
    cutoff_val=0.01)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

```

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```

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead."")
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')

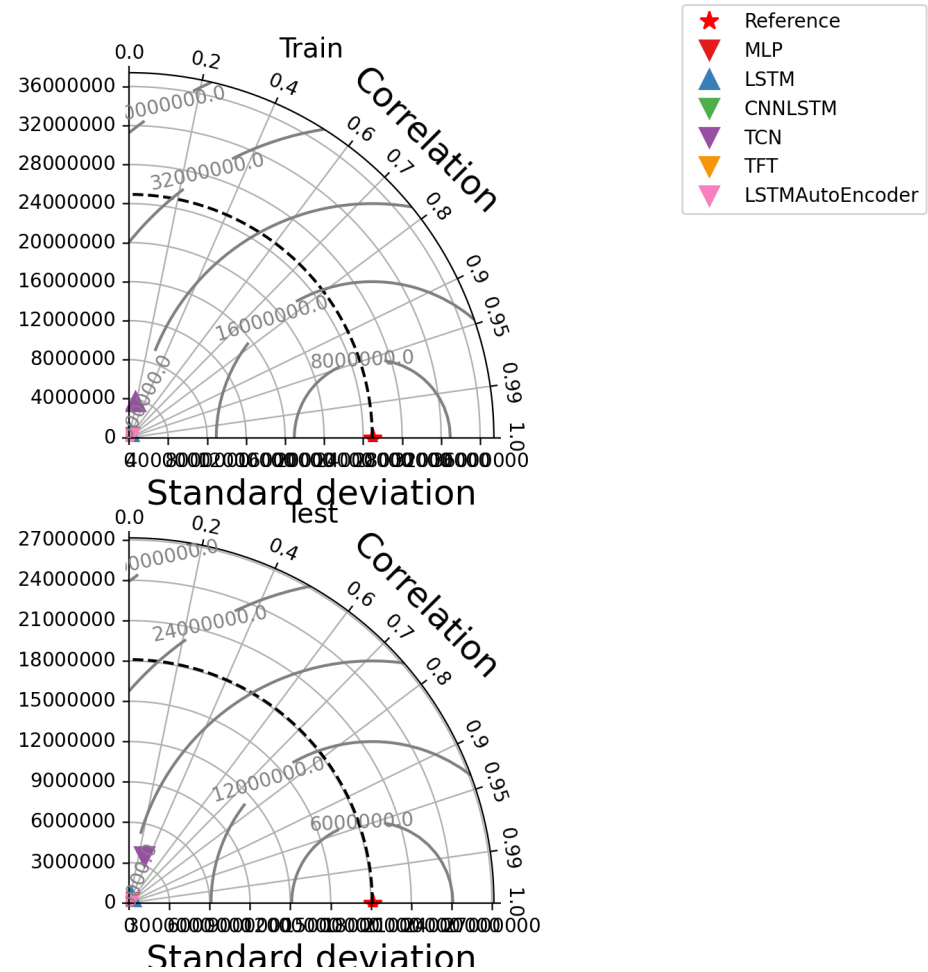
```

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```
→) ', 'for plot_model/model_to_dot to work.')
```

```
comparisons.taylor_plot(data=data)
```



```
***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
```

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```

target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

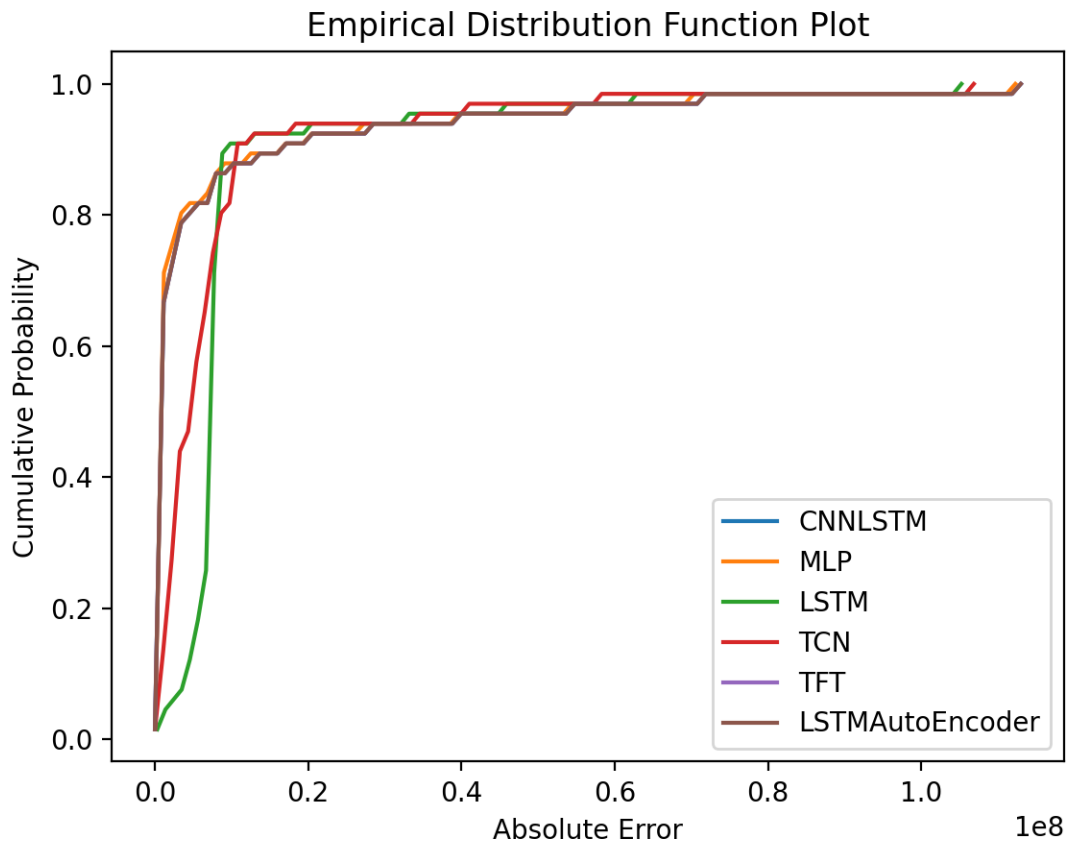
***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.'')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
    c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
<Figure size 900x700 with 2 Axes>

```

```
comparisons.compare_edf_plots(data=data)
```



```
***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
```

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```

input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

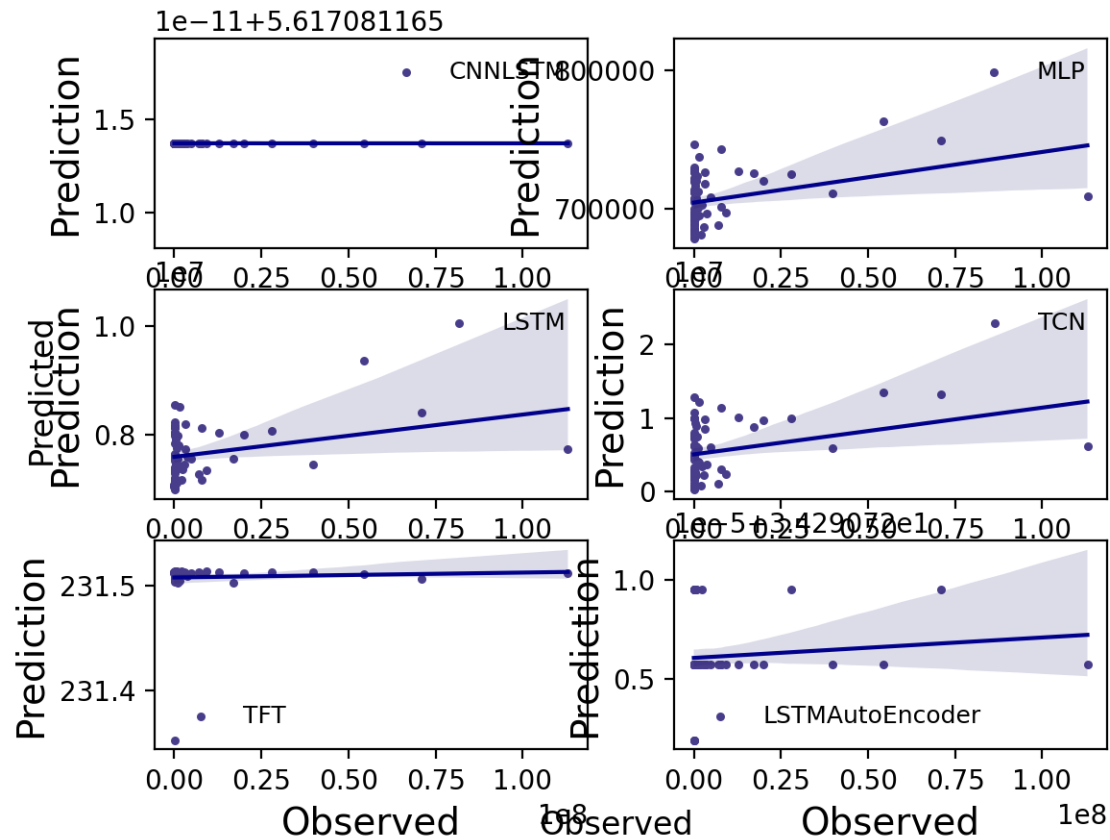
***** Test *****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.""")
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')

```

```

comparisons.compare_regression_plots(data=data)

```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (152, 12, 13)
target shape: (152, 1)

```

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```

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

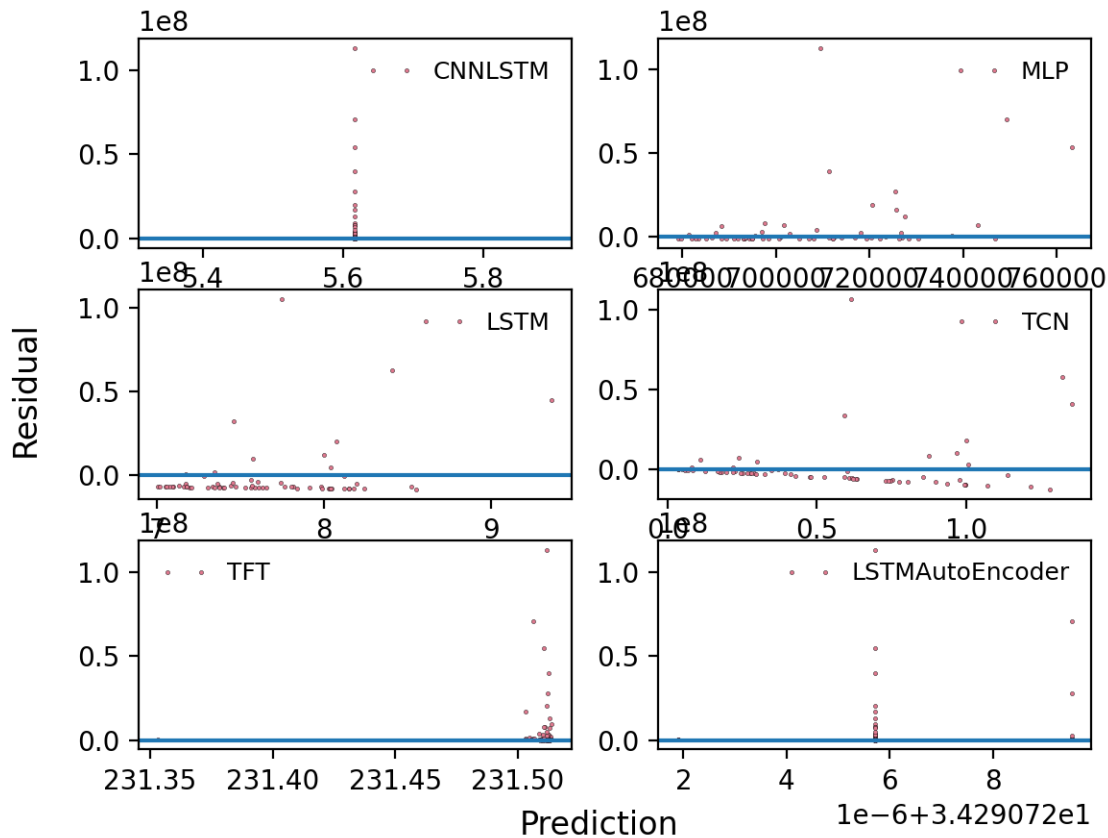
**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead.'')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')

```

```

comparisons.compare_residual_plots(data=data)

```



```
***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (152, 12, 13)
target shape: (152, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (152, 12, 13)
target shape: (152, 1)
```

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```

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (0,)
target shape: (0,)

***** Removing Examples with nan in labels *****

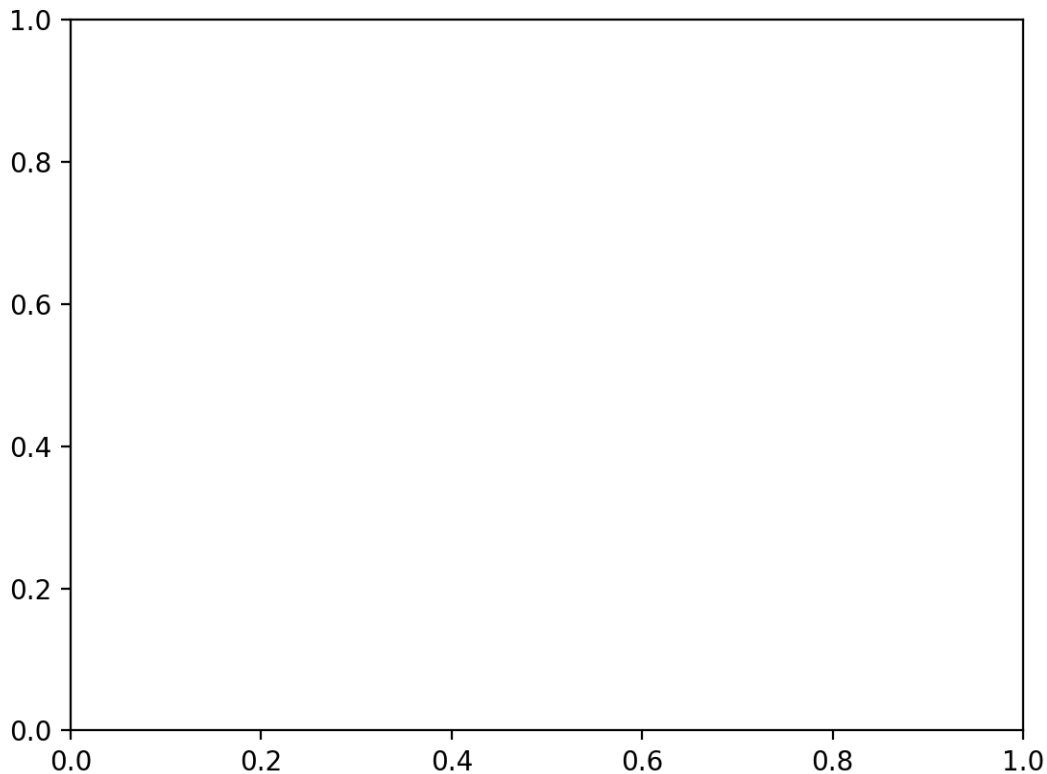
**** Test ****
input_x shape: (66, 12, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/_main.py:1982: UserWarning:
    argument test is deprecated and will be removed in future. Please
    use 'predict_on_test_data' method instead.
    use 'predict_on_{data}_data' method instead."")
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
<Figure size 640x480 with 6 Axes>

```

```

comparisons.loss_comparison()

```



<AxesSubplot:>

Total running time of the script: (4 minutes 31.377 seconds)

1.5 Comparison of LSTM with different transformations

```
from ai4water.models import LSTM
from ai4water.utils.utils import get_version_info
from ai4water.experiments import TransformationExperiments
from ai4water.hyperopt import Categorical, Integer
from ai4water.utils.utils import dateandtime_now

from ai4water.datasets import busan_beach

for k,v in get_version_info().items():
    print(f"{k} version: {v}")
```

```
python version: 3.7.9 (default, Oct 19 2020, 15:13:17)
[GCC 7.5.0]
os version: posix
ai4water version: 1.06
```

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```

lightgbm version: 3.3.5
tcn version: 3.5.0
catboost version: 1.1.1
xgboost version: 1.6.2
easy_mpl version: 0.21.2
SeqMetrics version: 1.3.4
tensorflow version: 2.7.0
keras.api._v2.keras version: 2.7.0
numpy version: 1.21.1
pandas version: 1.3.4
matplotlib version: 3.5.3
h5py version: 3.8.0
joblib version: 1.2.0

```

```

lookback = 14

data = busan_beach()
input_features = data.columns.tolist()[0:-1]
output_features = data.columns.tolist()[-1:]

```

```

class MyTransformationExperiments(TransformationExperiments):

    def update_paras(self, **kwargs):
        _layers = LSTM(units=kwargs['units'],
                        input_shape=(lookback, len(input_features)),
                        activation=kwargs['activation'])

        y_transformation = kwargs['y_transformation']
        if y_transformation == "none":
            y_transformation = None

        return {
            'model': _layers,
            'batch_size': int(kwargs['batch_size']),
            'lr': float(kwargs['lr']),
            'y_transformation': y_transformation
        }

```

```

cases = {
    'model_none': {'y_transformation': 'none'},
    'model_minmax': {'y_transformation': 'minmax'},
    'model_zscore': {'y_transformation': 'zscore'},
    'model_robust': {'y_transformation': 'robust'},
    'model_quantile': {'y_transformation': 'quantile'},
    'model_log': {'y_transformation': {'method': 'log', 'treat_negatives': True, 'replace_
↪zeros': True}},
    'model_pareto': {"y_transformation": "pareto"},
    'model_vast': {"y_transformation": "vast"},
    'model_mmad': {"y_transformation": "mmad"}
}

```

```
search_space = [
    Integer(low=10, high=30, name='units', num_samples=10),
    Categorical(categories=['relu', 'elu', 'tanh', "linear"], name='activation'),
    Categorical(categories=[4, 8, 12, 16, 24, 32], name='batch_size'),
    Categorical(categories=[0.05, 0.02, 0.009, 0.007, 0.005,
                           0.003, 0.001, 0.0009, 0.0007, 0.0005, 0.0003,
                           0.0001, 0.00009, 0.00007, 0.00005], name='lr'),
]
```

```
x0 = [16, "relu", 32, 0.0001]

experiment = MyTransformationExperiments(
    cases=cases,
    input_features=input_features,
    output_features = output_features,
    param_space=search_space,
    x0=x0,
    verbosity=0,
    epochs=100,
    exp_name = f"ecoli_lstm_y_exp_{datetime.now()}",
    ts_args={"lookback": lookback},
    save=False
)
```

```
experiment.fit(data = data, run_type='dry_run')
```

```
***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****
```

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```

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
running None model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
running minmax model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:959: RuntimeWarning: overflow encountered
↳ in square
    s = s**2
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳ encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:959: RuntimeWarning: overflow encountered
↳ in square
    s = s**2
running zscore model
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:959: RuntimeWarning: overflow encountered
↳ in square
    s = s**2
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳ encountered in log
    log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/scipy/stats/stats.py:959: RuntimeWarning: overflow encountered

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↳ in square
  s = s**2
running robust model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
running quantile model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
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assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳ encountered in true_divide
  zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
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  zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value_
↳ encountered in true_divide
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value_
↳ encountered in true_divide
  c /= stddev[None, :]
running log model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')

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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value_
↳encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/nanfunctions.py:1396: RuntimeWarning: All-NaN slice_
↳encountered
    overwrite_input, interpolation)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
↳encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
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↳encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1135: RuntimeWarning: overflow encountered_
↳in square
    return sqrt(np.average((self.true - self.predicted) ** 2, axis=0, weights=weights))
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value_
↳encountered in subtract
    X -= avg[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_main.py:486: RuntimeWarning: overflow encountered_
↳in square
    return float(np.average((self.true - self.predicted) ** 2, axis=0, weights=weights))
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:1171: RuntimeWarning: overflow encountered_
↳in square
    numerator = (weight * (self.true - self.predicted) ** 2).sum(axis=0,
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:951: RuntimeWarning: invalid value_
↳encountered in subtract
    a_zero_mean = a - mean
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/nanfunctions.py:1545: RuntimeWarning: invalid value_
↳encountered in subtract
    np.subtract(arr, avg, out=arr, casting='unsafe')
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/

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→python3.7/site-packages/numpy/lib/function_base.py:4009: RuntimeWarning: invalid value_
→encountered in subtract
    diff_b_a = subtract(b, a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/SeqMetrics/_rgr.py:980: RuntimeWarning: overflow encountered_
→in square
    _nse = 1 - sum((self.predicted - self.true) ** 2) / sum((self.true - np.mean(self.
→true)) ** 2)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
→py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/numpy/lib/nanfunctions.py:1396: RuntimeWarning: All-NaN slice_
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    overwrite_input, interpolation)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value_
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value_
→encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value_
→encountered in subtract
    X -= avg[:, None]
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→python3.7/site-packages/numpy/lib/function_base.py:4009: RuntimeWarning: invalid value_
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    return float(np.average((self.true - self.predicted) ** 2, axis=0, weights=weights))
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/SeqMetrics/_rgr.py:1135: RuntimeWarning: overflow encountered_
→in square
    return sqrt(np.average((self.true - self.predicted) ** 2, axis=0, weights=weights))
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
→python3.7/site-packages/SeqMetrics/_rgr.py:1171: RuntimeWarning: overflow encountered_
→in square
    numerator = (weight * (self.true - self.predicted) ** 2).sum(axis=0,

```

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```

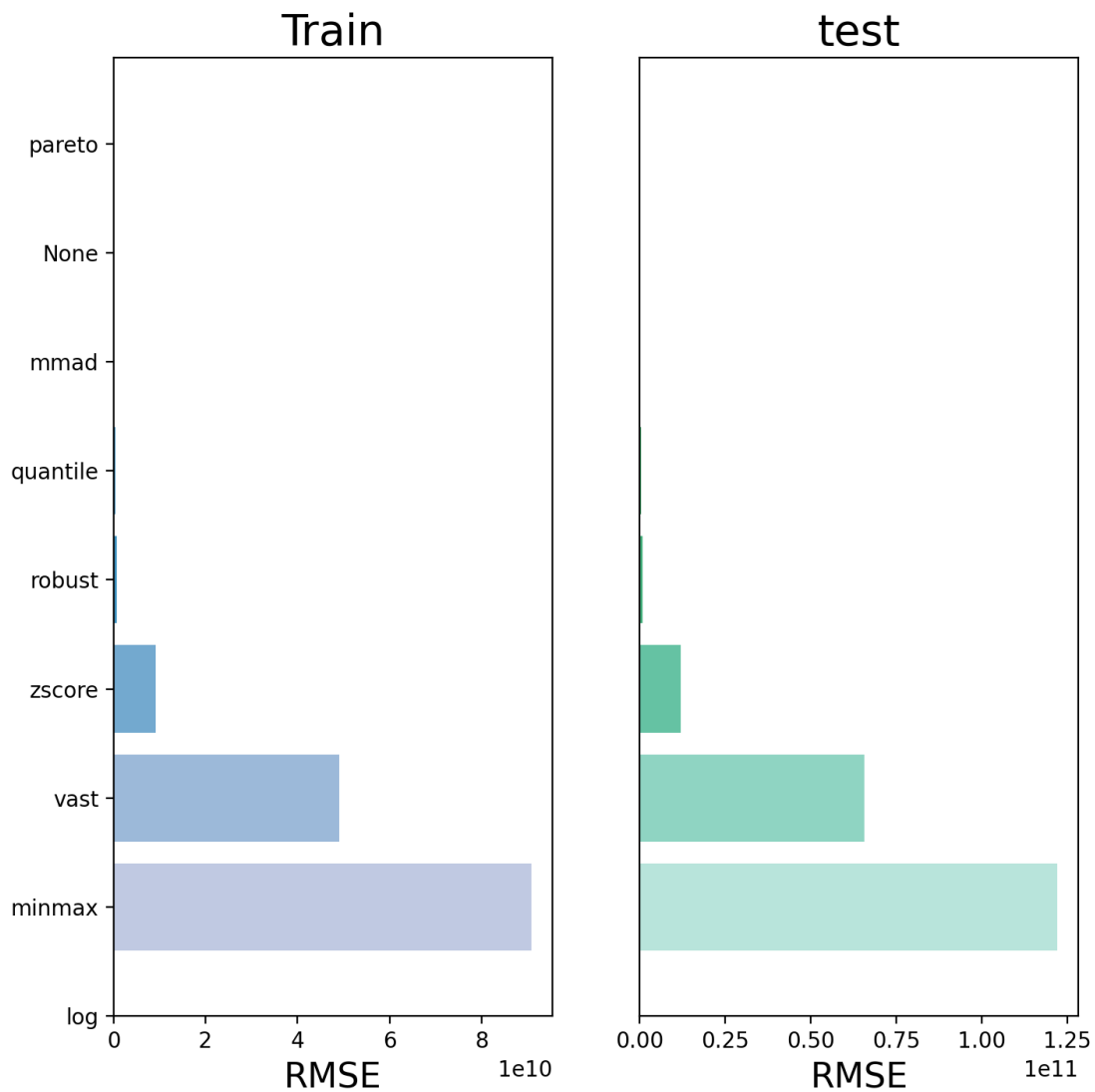
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/SeqMetrics/_rgr.py:980: RuntimeWarning: overflow encountered_
↳in square
    _nse = 1 - sum((self.predicted - self.true) ** 2) / sum((self.true - np.mean(self.
↳true)) ** 2)
running pareto model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
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running vast model
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
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assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

```

experiment.compare_errors('rmse', data=data)

```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

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```

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
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assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳ py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value
↳ encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value

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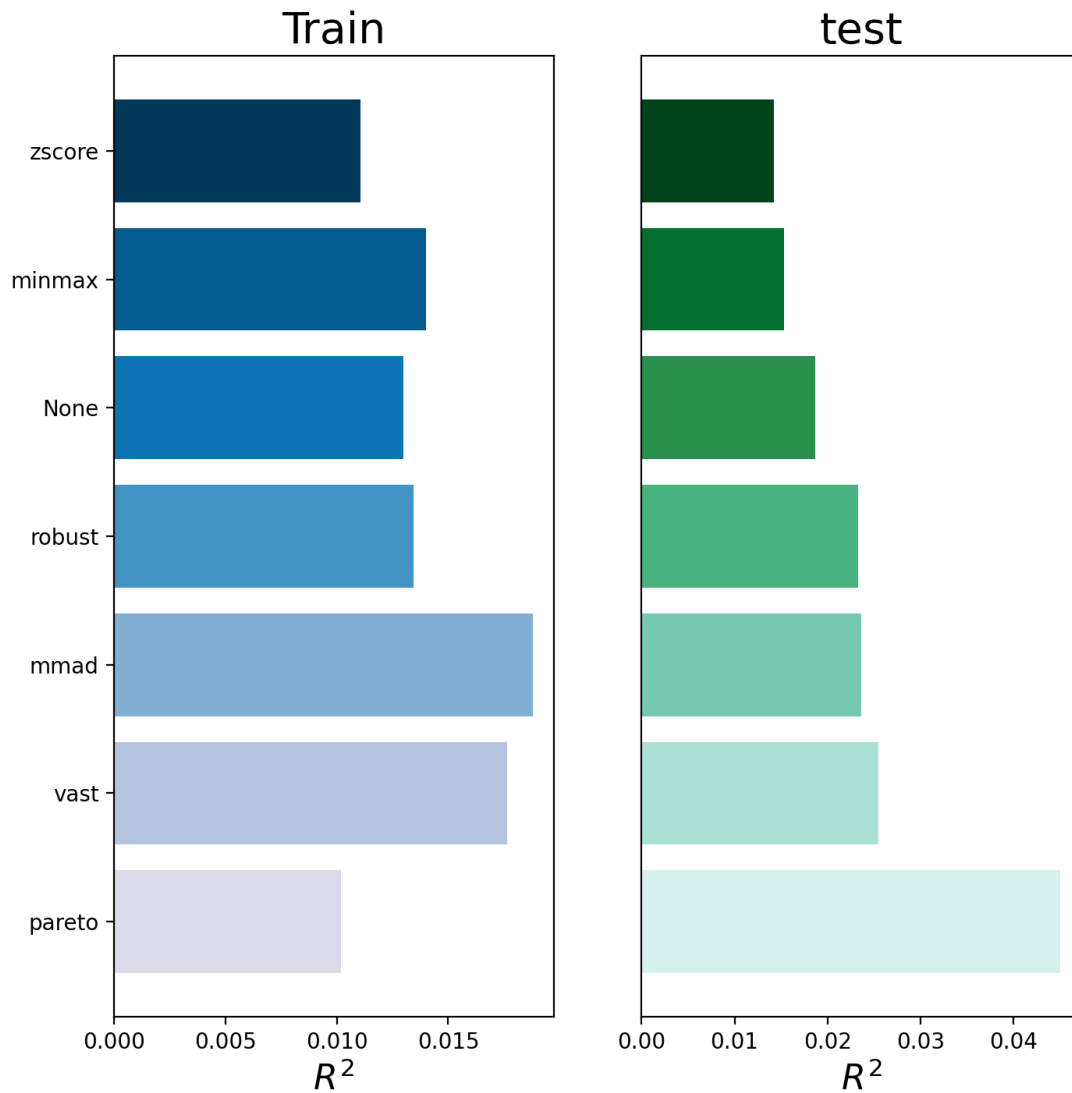
↳ encountered in subtract
  X -= avg[:, None]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
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assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

```

experiment.compare_errors('r2', data=data)

```

```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

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```

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
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/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳ py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value
↳ encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value

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```

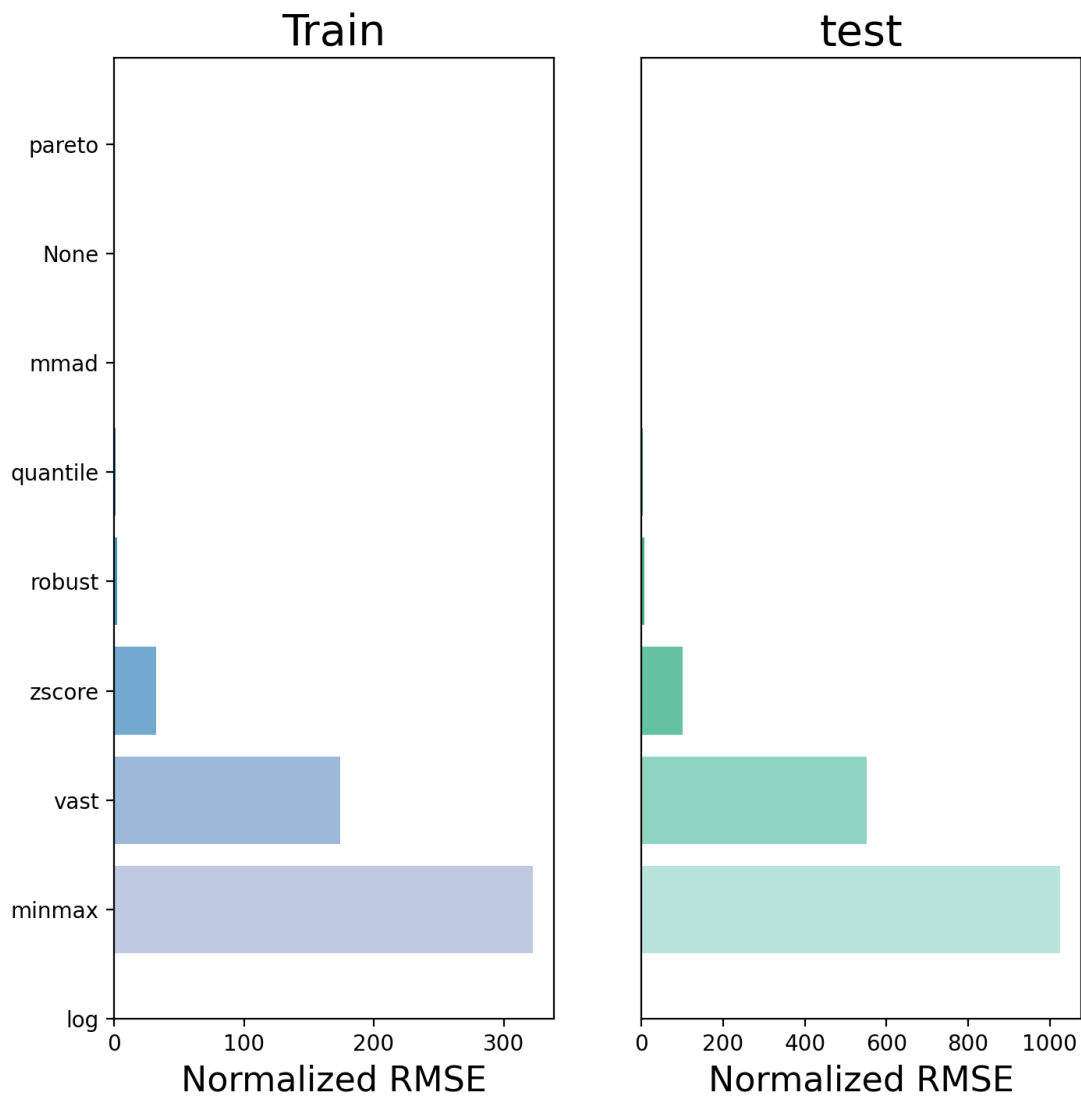
↳ encountered in subtract
  X -= avg[:, None]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
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assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

```

experiment.compare_errors('nrmse', data=data)

```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳ py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value
↳ encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value

```

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```

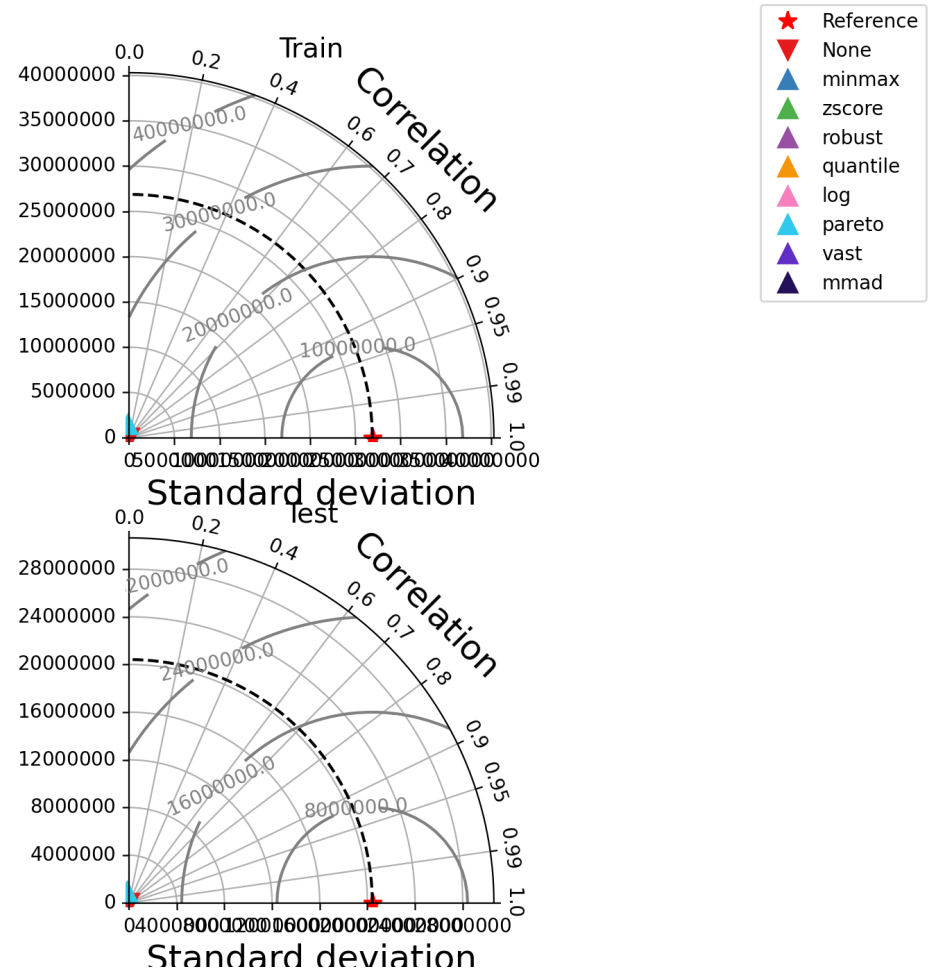
↳ encountered in subtract
  X -= avg[:, None]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳ encountered in true_divide
  c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

```

experiment.taylor_plot(data=data)

```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)

```

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```

target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳ py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/SeqMetrics/_rgr.py:1148: RuntimeWarning: invalid value
↳ encountered in subtract
    zy = (self.predicted - np.mean(self.predicted)) / np.std(self.predicted, ddof=1)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/core/_methods.py:230: RuntimeWarning: invalid value
↳ encountered in subtract
    x = asanyarray(arr - arrmean)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳ python3.7/site-packages/numpy/lib/function_base.py:2536: RuntimeWarning: invalid value
↳ encountered in subtract
    X -= avg[:, None]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳ pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳ ), 'for plot_model/model_to_dot to work.')

```

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```

assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2691: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[:, None]
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/function_base.py:2692: RuntimeWarning: invalid value
↳encountered in true_divide
    c /= stddev[None, :]
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

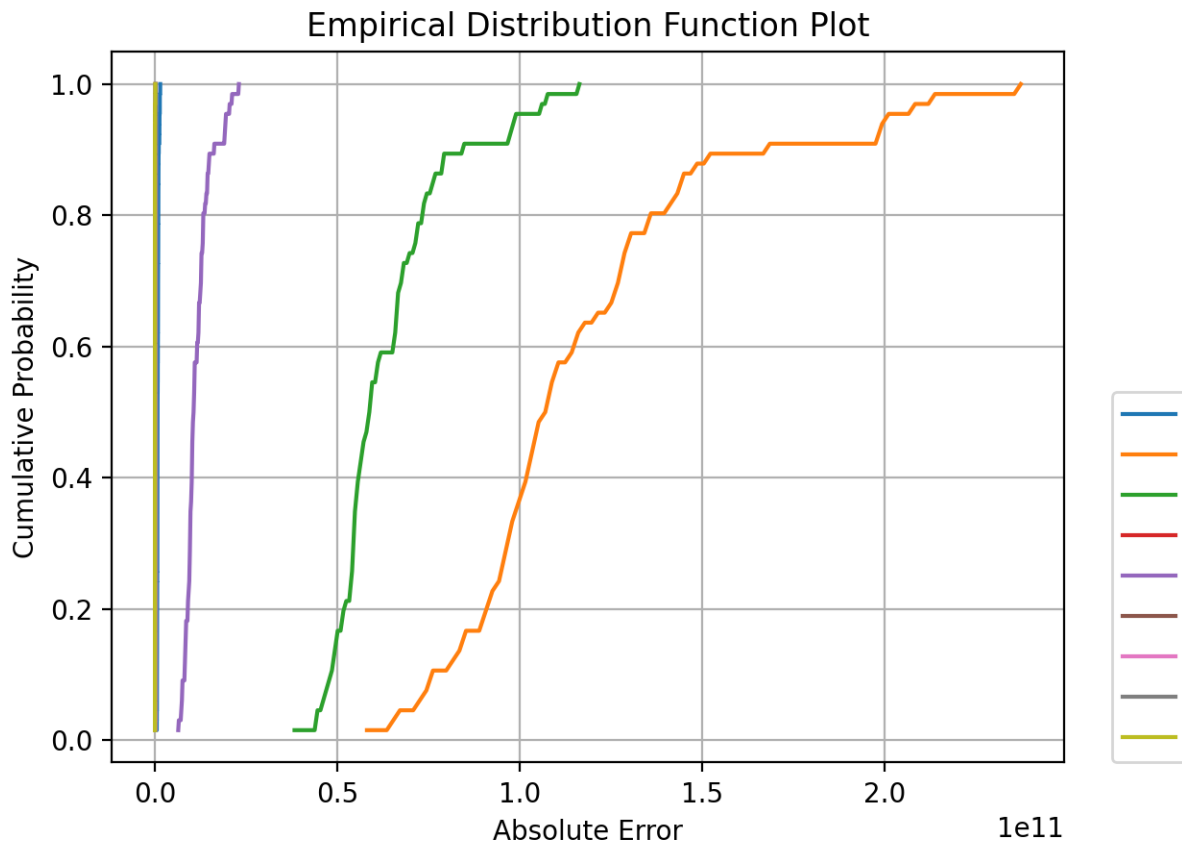
<Figure size 900x700 with 2 Axes>

```

```

experiment.compare_edf_plots(data=data)

```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 14, 13)
target shape: (121, 1)

```

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```

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/core/function_base.py:134: RuntimeWarning: invalid value
↳encountered in double_scalars
    delta = stop - start
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

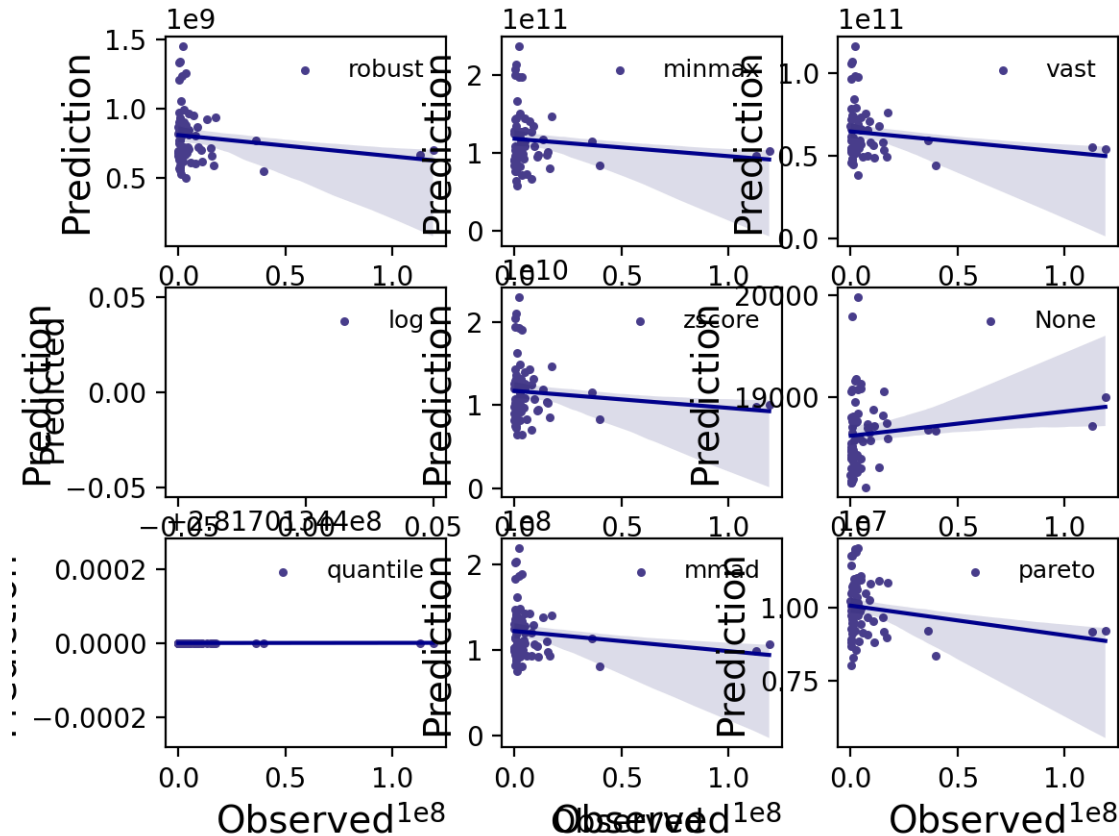
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```
dot plot of model could not be plotted due to ('You must install pydot (`pip install pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/`', 'for plot_model/model_to_dot to work.')
```

```
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
```

```
experiment.compare_regression_plots(data=data)
```



```
***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
```

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```

input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/numpy/lib/nanfunctions.py:1396: RuntimeWarning: All-NaN slice
↳encountered
    overwrite_input, interpolation)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

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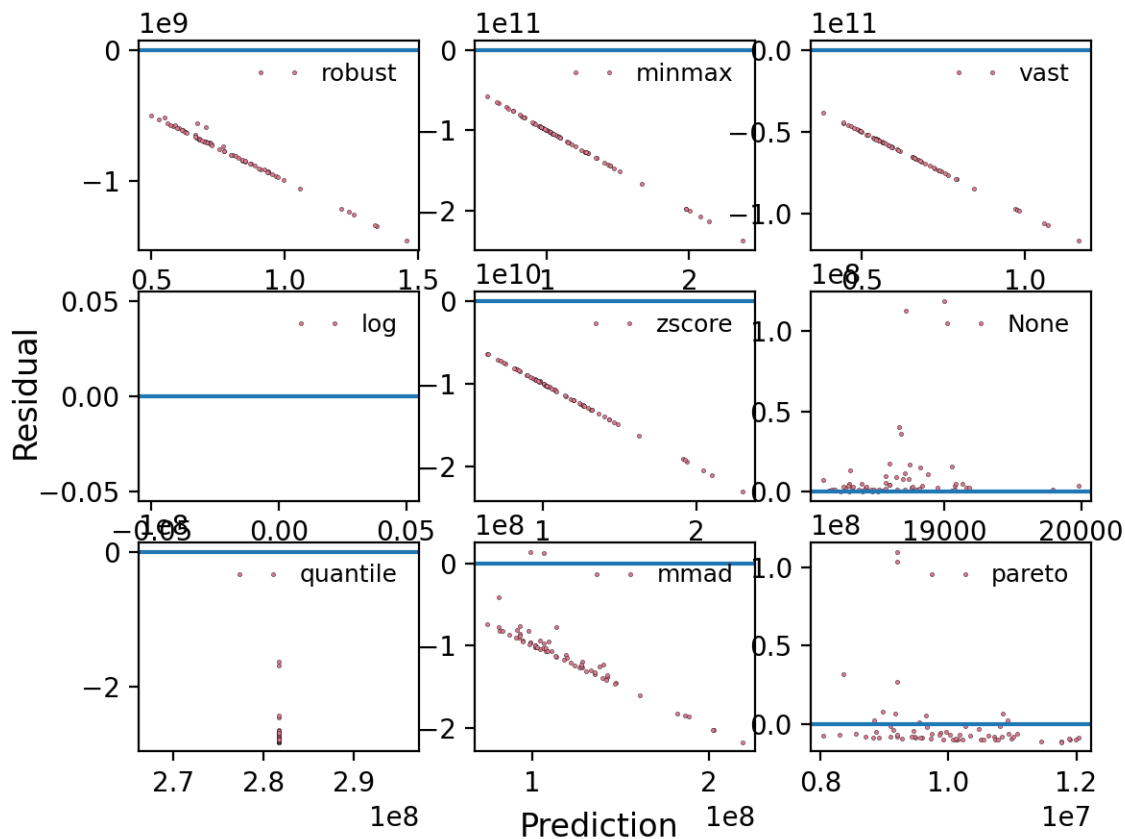
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```

dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
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↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

```
experiment.compare_residual_plots(data=data)
```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

```

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```

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 14, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 14, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 14, 13)
target shape: (66, 1)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/ai4water/preprocessing/transformations/_transformations.
↳py:570: RuntimeWarning: overflow encountered in exp
    return self.inv_func(x)
dot plot of model could not be plotted due to ('You must install pydot (`pip install
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

```

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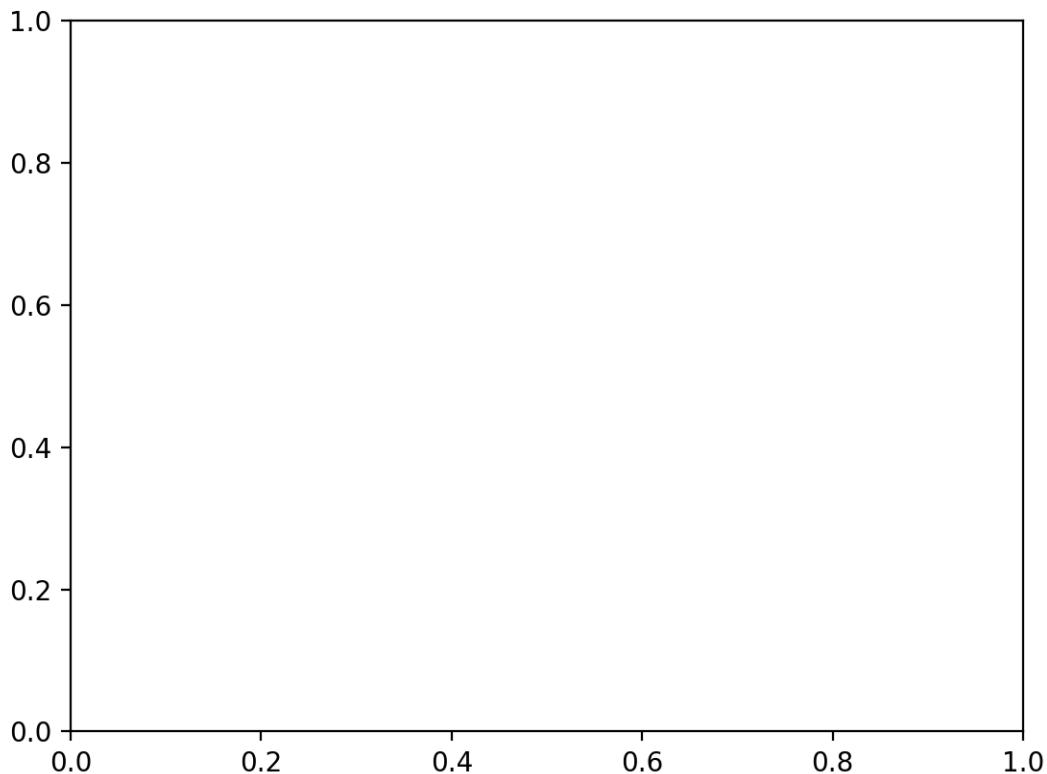
```

dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)
dot plot of model could not be plotted due to ('You must install pydot (`pip install_
↳pydot`) and install graphviz (see instructions at https://graphviz.gitlab.io/download/
↳) ', 'for plot_model/model_to_dot to work.')
assigning name Input to IteratorGetNext:0 with shape (None, 14, 13)

<Figure size 640x480 with 9 Axes>

```

```
experiment.loss_comparison()
```



```
<AxesSubplot:>
```


Total running time of the script: (1 minutes 23.557 seconds)

1.6 Comparison of XGBRegressor with different transformations

```
from ai4water.datasets import busan_beach
from ai4water.utils.utils import get_version_info
from ai4water.experiments import TransformationExperiments
from ai4water.hyperopt import Categorical, Integer, Real
from ai4water.utils.utils import dateandtime_now

for k,v in get_version_info().items():
    print(f"{k} version: {v}")
```

```
python version: 3.7.9 (default, Oct 19 2020, 15:13:17)
[GCC 7.5.0]
os version: posix
ai4water version: 1.06
lightgbm version: 3.3.5
tcn version: 3.5.0
catboost version: 1.1.1
xgboost version: 1.6.2
easy_mpl version: 0.21.2
SeqMetrics version: 1.3.4
tensorflow version: 2.7.0
keras.api._v2.keras version: 2.7.0
numpy version: 1.21.1
pandas version: 1.3.4
matplotlib version: 3.5.3
h5py version: 3.8.0
joblib version: 1.2.0
```

```
data = busan_beach()
input_features = data.columns.tolist()[0:-1]
output_features = data.columns.tolist()[-1:]
```

```
class MyTransformationExperiments(TransformationExperiments):

    def update_paras(self, **kwargs):

        y_transformation = kwargs.pop('y_transformation')
        if y_transformation == "none":
            y_transformation = None

        return {
            'model': {"XGBRegressor": kwargs},
            'y_transformation': y_transformation
        }
```

```

cases = {
    'model_None': {'y_transformation': 'none'},
    'model_minmax': {'y_transformation': 'minmax'},
    'model_zscore': {'y_transformation': 'zscore'},
    'model_center': {'y_transformation': 'center'},
    'model_scale': {'y_transformation': 'scale'},
    'model_robust': {'y_transformation': 'robust'},
    'model_quantile': {'y_transformation': 'quantile'},
    'model_box_cox': {'y_transformation': {'method': 'box-cox', 'treat_negatives': True,
↪ 'replace_zeros': True}},
    'model_yeo-johnson': {'y_transformation': 'yeo-johnson'},
    'model_sqrt': {'y_transformation': 'sqrt'},
    'model_log': {'y_transformation': {'method': 'log', 'treat_negatives': True, 'replace_
↪ zeros': True}},
    'model_log10': {'y_transformation': {'method': 'log10', 'treat_negatives': True,
↪ 'replace_zeros': True}},
    'model_pareto': {'y_transformation': "pareto"},
    'model_vast': {'y_transformation': "vast"},
    'model_mmad': {'y_transformation': "mmad"}
}

```

```

num_samples=10
search_space = [
    # maximum number of trees that can be built
    Integer(low=10, high=30, name='iterations', num_samples=num_samples),
    # Used for reducing the gradient step.
    Real(low=0.09, high=0.3, prior='log-uniform', name='learning_rate', num_samples=num_
↪ samples),
    # Coefficient at the L2 regularization term of the cost function.
    Real(low=0.5, high=5.0, name='l2_leaf_reg', num_samples=num_samples),
    # arger the value, the smaller the model size.
    Real(low=0.1, high=10, name='model_size_reg', num_samples=num_samples),
    # percentage of features to use at each split selection, when features are selected over_
↪ again at random.
    Real(low=0.1, high=0.5, name='rsm', num_samples=num_samples),
    # number of splits for numerical features
    Integer(low=32, high=50, name='border_count', num_samples=num_samples),
    # The quantization mode for numerical features. The quantization mode for numerical_
↪ features.
    Categorical(categories=['Median', 'Uniform', 'UniformAndQuantiles',
↪ 'MaxLogSum', 'MinEntropy', 'GreedyLogSum'], name='feature_border_
↪ type')
]

```

```
x0 = [10, 0.11, 1.0, 1.0, 0.2, 45, "Uniform"]
```

```

experiment = MyTransformationExperiments(
    cases=cases,
    input_features=input_features,
    output_features = output_features,
    param_space=search_space,
    x0=x0,

```

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```

    verbosity=0,
    split_random=True,
    exp_name = f"xgb_y_exp_{datetime.now()}",
    save=False
)

```

```

experiment.fit(data = data, run_type='dry_run')

```

```

***** Removing Examples with nan in labels *****

```

```

***** Training *****

```

```

input_x shape: (121, 13)
target shape: (121, 1)

```

```

***** Removing Examples with nan in labels *****

```

```

***** Validation *****

```

```

input_x shape: (31, 13)
target shape: (31, 1)

```

```

***** Removing Examples with nan in labels *****

```

```

***** Test *****

```

```

input_x shape: (66, 13)
target shape: (66, 1)

```

```

***** Removing Examples with nan in labels *****

```

```

***** Training *****

```

```

input_x shape: (121, 13)
target shape: (121, 1)

```

```

***** Removing Examples with nan in labels *****

```

```

***** Validation *****

```

```

input_x shape: (31, 13)
target shape: (31, 1)

```

```

***** Removing Examples with nan in labels *****

```

```

***** Test *****

```

```

input_x shape: (66, 13)
target shape: (66, 1)

```

```

running None model

```

```

[02:19:51] WARNING: ../src/learner.cc:627:

```

```

Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.

```

```

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being_
↳used

```

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but getting flagged wrongly here. Please open an issue if you find any such cases.

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
running minmax model
```

```
[02:19:54] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being_

```
↳used
```

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
running zscore model
```

```
[02:19:56] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being_

```
↳used
```

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
running center model
```

```
[02:19:59] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being_

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```

↪used
  but getting flagged wrongly here. Please open an issue if you find any such cases.

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
running  scale model
[02:20:01] WARNING: ../src/learner.cc:627:
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↪size_reg", "rsm" } might not be used.

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being_
↪used
  but getting flagged wrongly here. Please open an issue if you find any such cases.

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
running  robust model
[02:20:04] WARNING: ../src/learner.cc:627:
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↪size_reg", "rsm" } might not be used.

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being_
↪used
  but getting flagged wrongly here. Please open an issue if you find any such cases.

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↪python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value_
↪encountered in log
  log_a = np.log(a)
running  quantile model
[02:20:06] WARNING: ../src/learner.cc:627:

```

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```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
running box_cox model
```

```
[02:20:09] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
running yeo-johnson model
```

```
[02:20:12] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
running sqrt model
```

```
[02:20:14] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
running log model
```

```
[02:20:17] WARNING: ../src/learner.cc:627:
```

```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

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```

running log10 model
[02:20:19] WARNING: ../src/learner.cc:627:
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being
↳used
but getting flagged wrongly here. Please open an issue if you find any such cases.

running pareto model
[02:20:22] WARNING: ../src/learner.cc:627:
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being
↳used
but getting flagged wrongly here. Please open an issue if you find any such cases.

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳encountered in log
log_a = np.log(a)
running vast model
[02:20:25] WARNING: ../src/learner.cc:627:
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.

This could be a false alarm, with some parameters getting used by language bindings but
then being mistakenly passed down to XGBoost core, or some parameter actually being
↳used
but getting flagged wrongly here. Please open an issue if you find any such cases.

/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳encountered in log
log_a = np.log(a)
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
↳encountered in log
log_a = np.log(a)
running mmad model
[02:20:27] WARNING: ../src/learner.cc:627:

```

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```
Parameters: { "border_count", "feature_border_type", "iterations", "l2_leaf_reg", "model_
↳size_reg", "rsm" } might not be used.
```

This could be a false alarm, with some parameters getting used by language bindings but then being mistakenly passed down to XGBoost core, or some parameter actually being

↳used

but getting flagged wrongly here. Please open an issue if you find any such cases.

```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

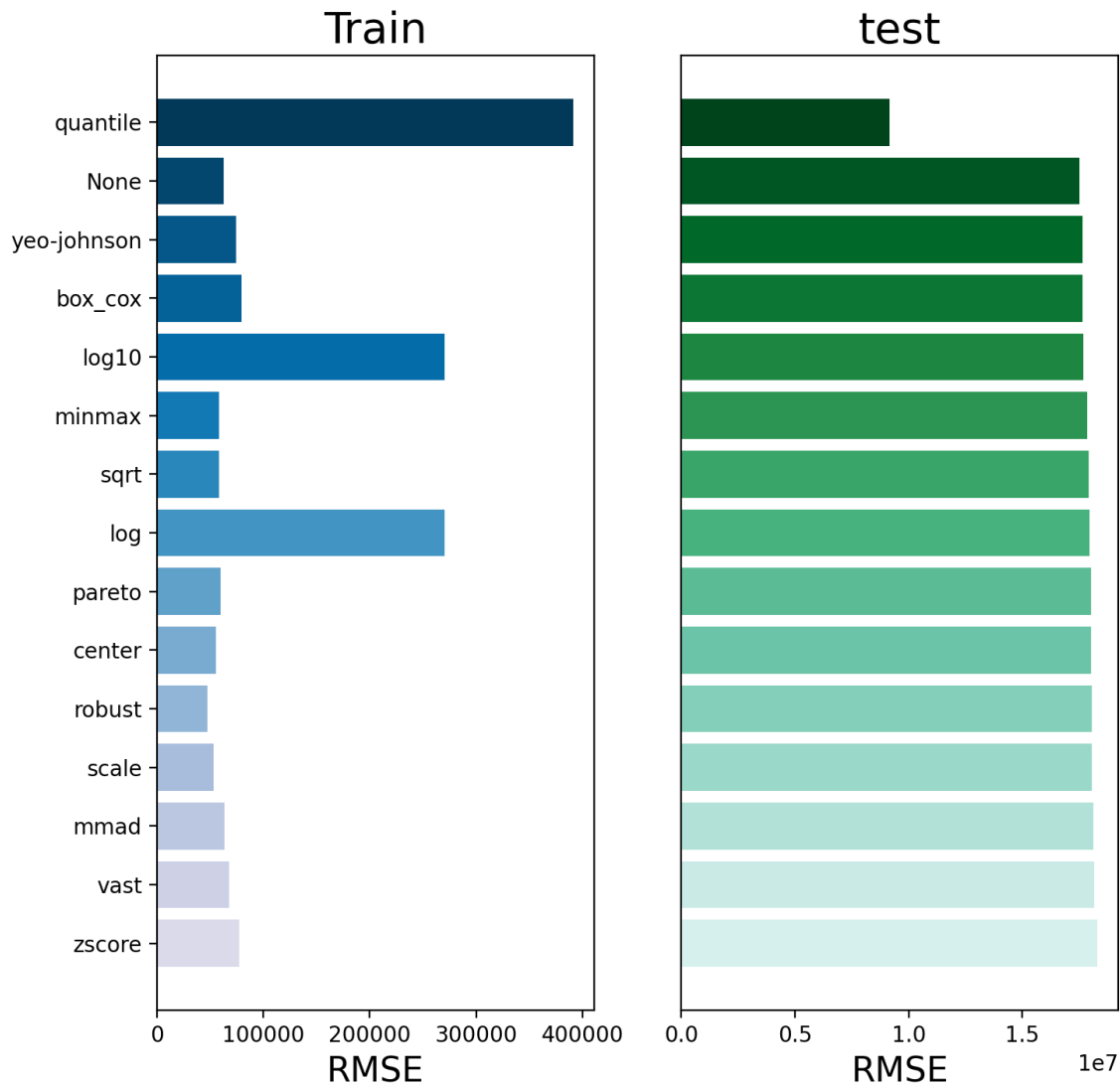
```
/home/docs/checkouts/readthedocs.org/user_builds/ai4water-experiments/envs/latest/lib/
```

```
↳python3.7/site-packages/scipy/stats/stats.py:283: RuntimeWarning: invalid value
```

```
↳encountered in log
```

```
log_a = np.log(a)
```

```
experiment.compare_errors('rmse', data=data)
```

```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```
***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

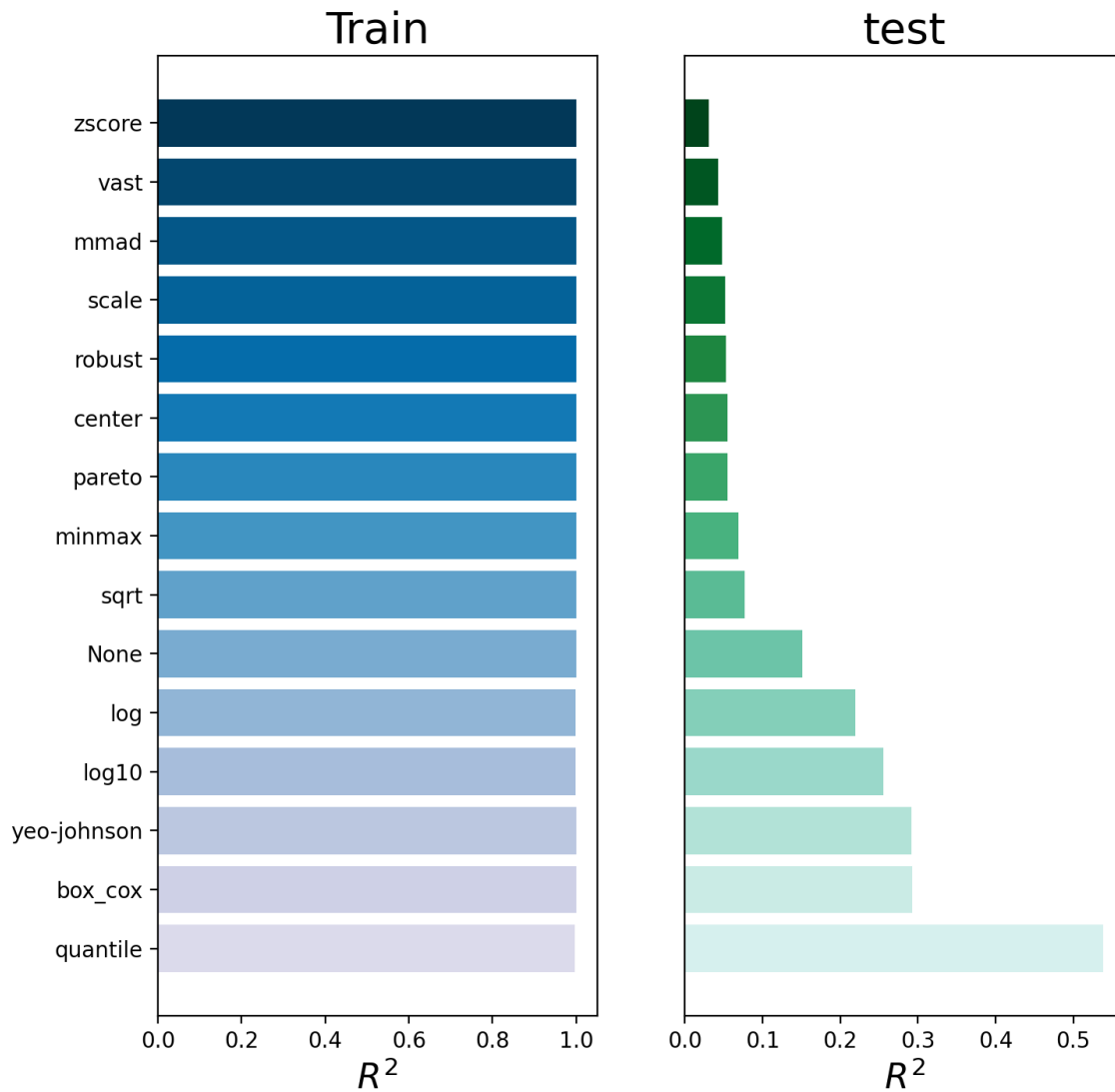
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
```

```
experiment.compare_errors('r2', data=data)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```
***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

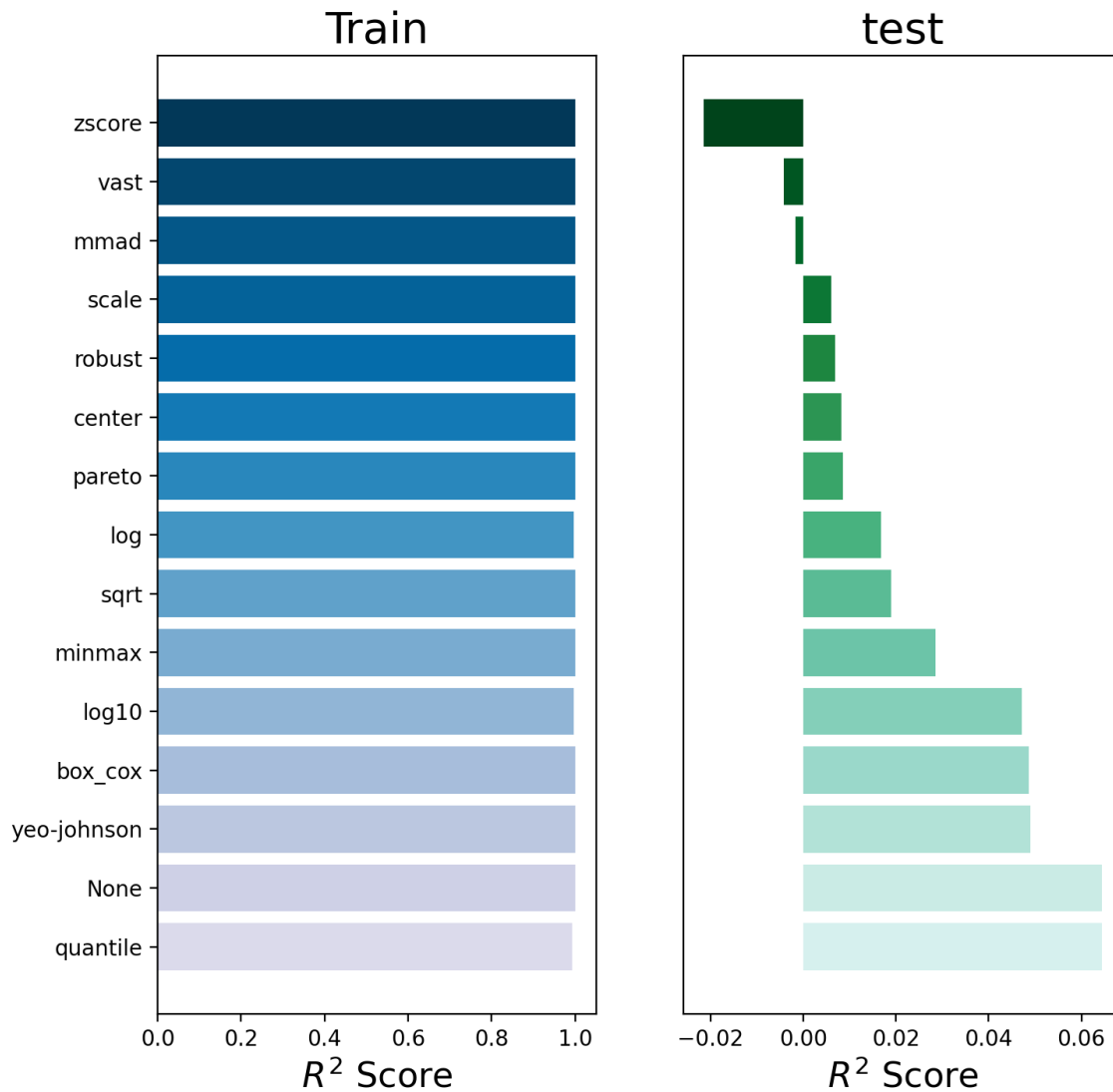
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
```

```
experiment.compare_errors('r2_score', data=data)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```
***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

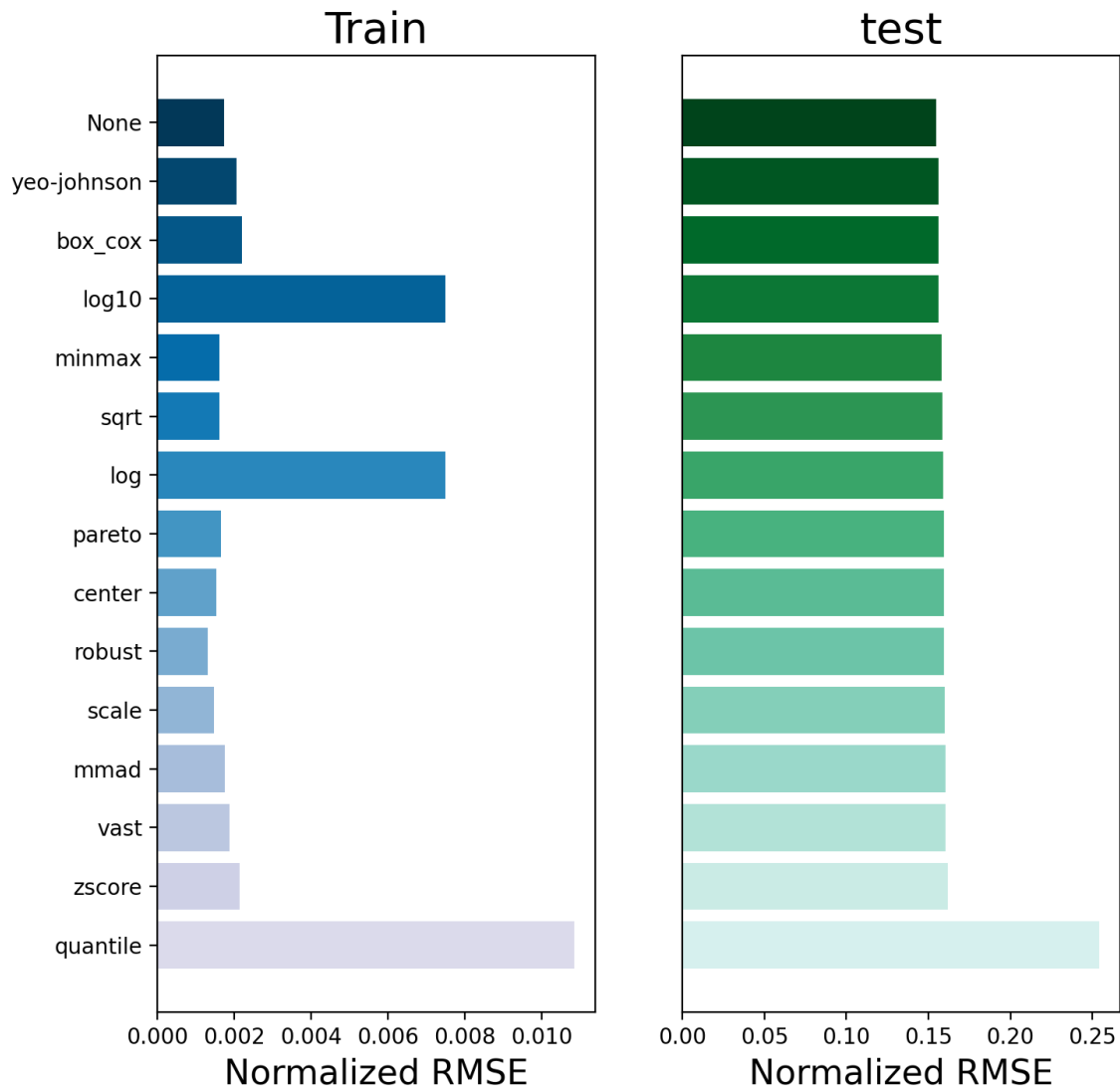
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
```

```
experiment.compare_errors('nrmse', data=data)
```



```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

```

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```
***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

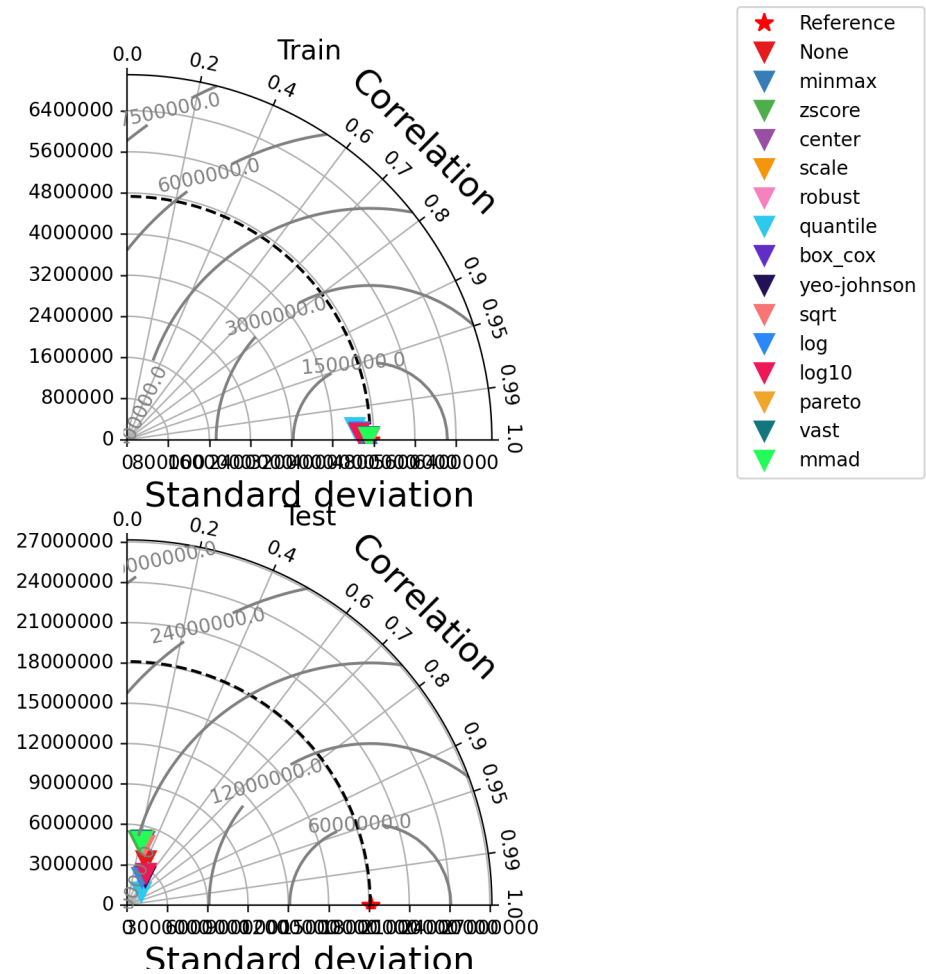
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
```

```
experiment.taylor_plot(data=data)
```

```

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)

```

(continues on next page)

(continued from previous page)

```
target shape: (121, 1)
```

```
***** Removing Examples with nan in labels *****
```

```
***** Validation *****
```

```
input_x shape: (31, 13)
```

```
target shape: (31, 1)
```

```
***** Removing Examples with nan in labels *****
```

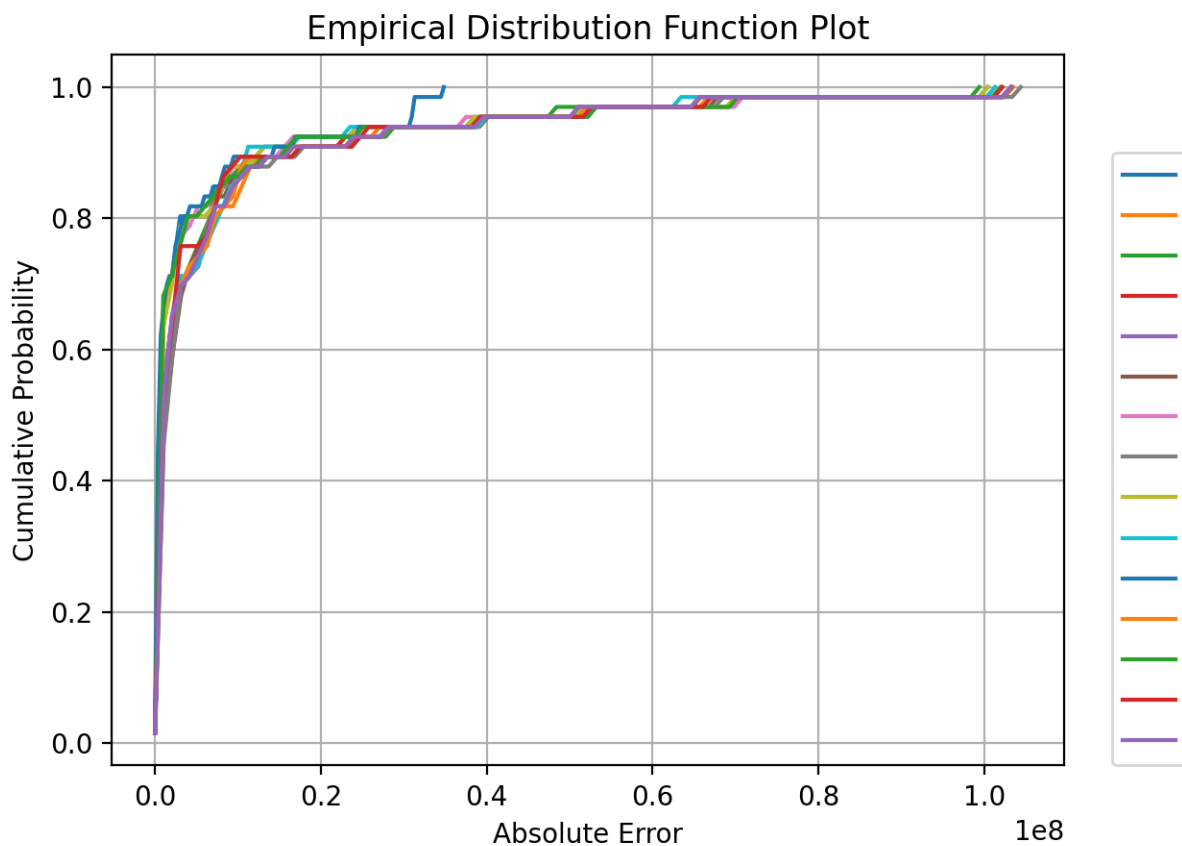
```
***** Test *****
```

```
input_x shape: (66, 13)
```

```
target shape: (66, 1)
```

```
<Figure size 900x700 with 2 Axes>
```

```
experiment.compare_edf_plots(data=data)
```



```
***** Removing Examples with nan in labels *****
```

```
***** Training *****
```

```
input_x shape: (121, 13)
```

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(continued from previous page)

```
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

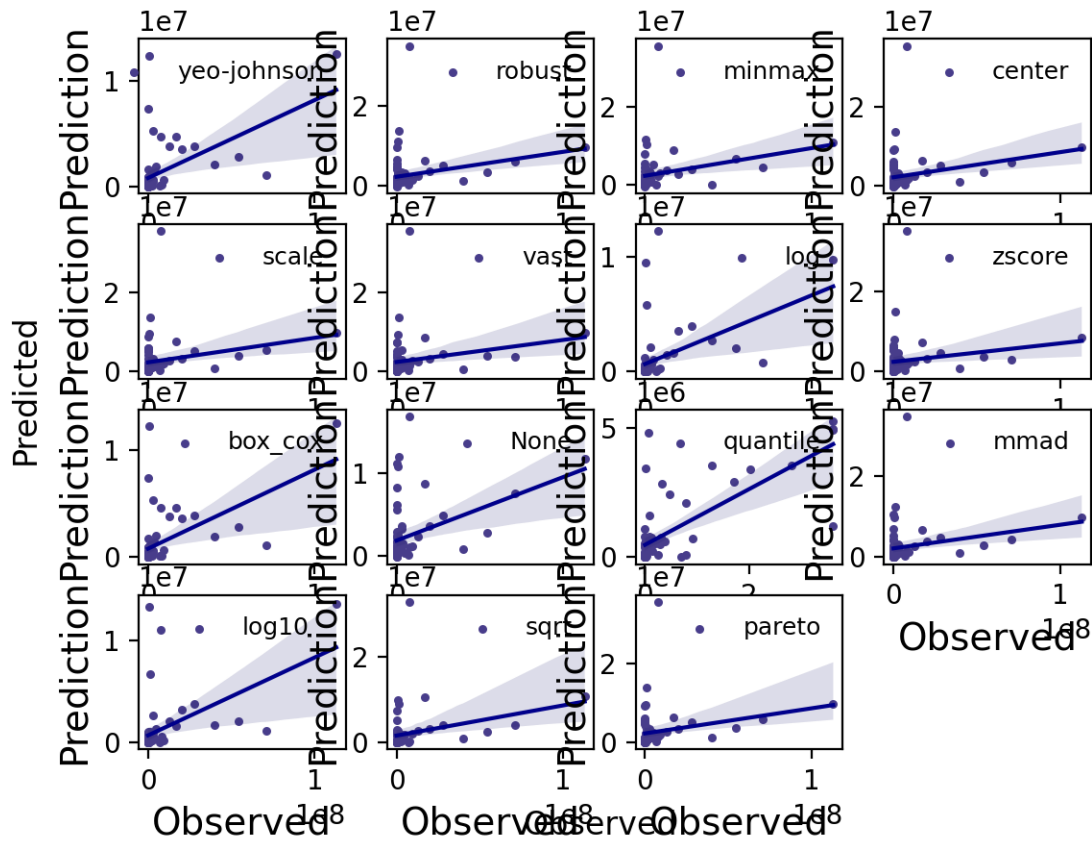
***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)
```

```
experiment.compare_regression_plots(data=data)
```



```

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

**** Validation ****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

**** Test ****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

**** Training ****
input_x shape: (121, 13)
target shape: (121, 1)

```

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```
***** Removing Examples with nan in labels *****
```

```
***** Validation *****
```

```
input_x shape: (31, 13)
```

```
target shape: (31, 1)
```

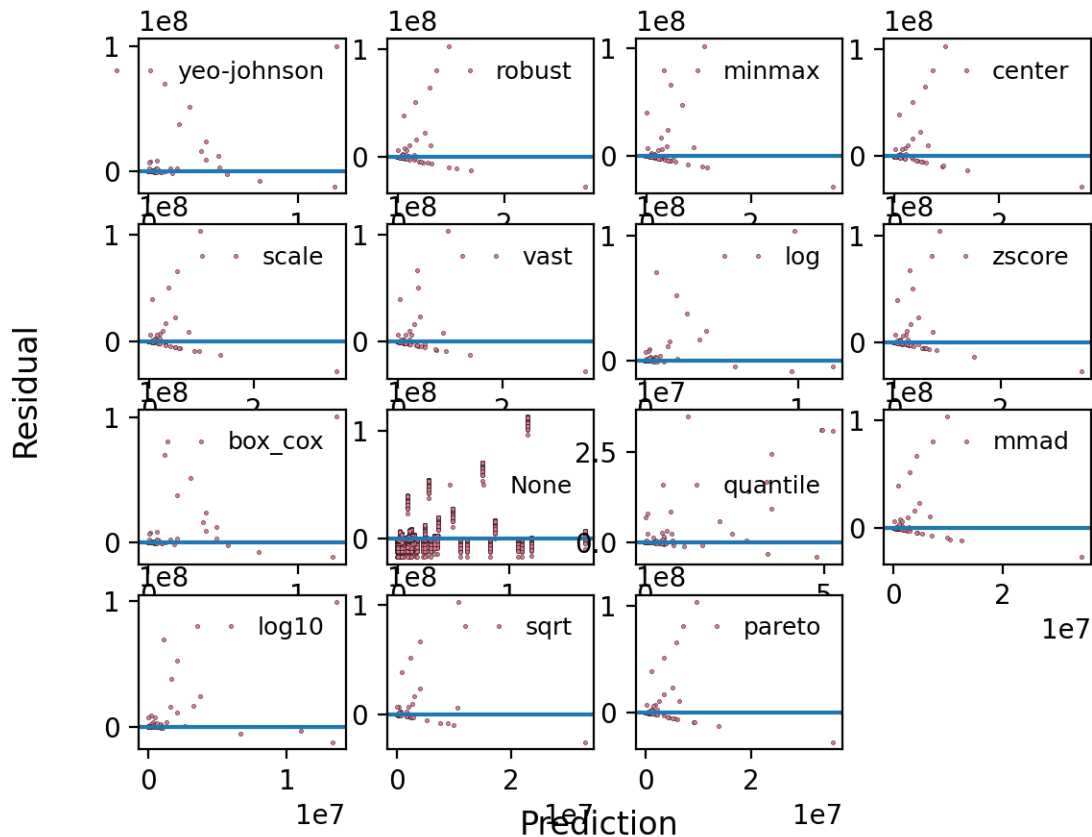
```
***** Removing Examples with nan in labels *****
```

```
***** Test *****
```

```
input_x shape: (66, 13)
```

```
target shape: (66, 1)
```

```
experiment.compare_residual_plots(data=data)
```



```
***** Removing Examples with nan in labels *****
```

```
***** Training *****
```

```
input_x shape: (121, 13)
```

```
target shape: (121, 1)
```

```
***** Removing Examples with nan in labels *****
```

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```
***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

***** Removing Examples with nan in labels *****

***** Training *****
input_x shape: (121, 13)
target shape: (121, 1)

***** Removing Examples with nan in labels *****

***** Validation *****
input_x shape: (31, 13)
target shape: (31, 1)

***** Removing Examples with nan in labels *****

***** Test *****
input_x shape: (66, 13)
target shape: (66, 1)

<Figure size 640x480 with 16 Axes>
```

Total running time of the script: (0 minutes 52.032 seconds)

INDICES AND TABLES

- `genindex`
- `modindex`
- `search`