

# Report



ROBERT v 0.0.1 2023/05/02 20:47:18

Citation: ROBERT v 0.0.1, Dalmau, D.; Alegre-Requena, J. V., 2023. <https://github.com/jval egre/robert>

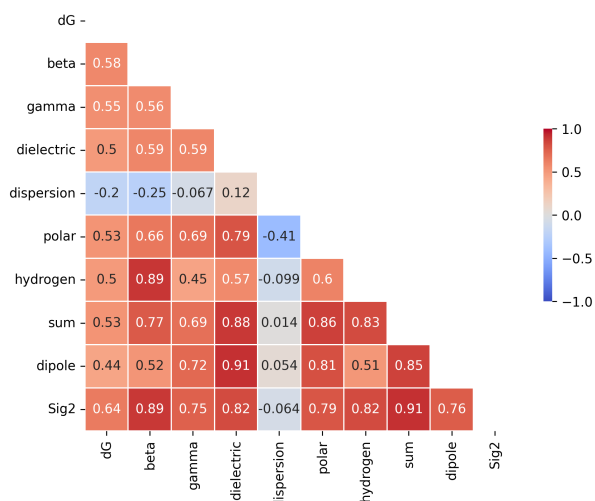
Command line used in ROBERT: `robert --ignore ['solvent','sample'] --y dG --csv_name Bandar_db.csv --epoch 10 --pf i_max 2 --train [60,70,80]`



## CURATE

- o Starting data curation with the CURATE module
- o Database Bandar\_db.csv loaded successfully, including:
  - 20 datapoints
  - 18 accepted descriptors
  - 2 ignored descriptors
  - 0 discarded descriptors
- o Analyzing categorical variables
  - No categorical variables were found.
- o Duplication filters activated  
Excluded datapoints:
- o Correlation filter activated with these thresholds:  $\text{thres}_x = 0.85$ ,  $\text{thres}_y = 0.02$   
Excluded descriptors:
  - n:  $R^{**2} = 0.02$  with the dG values
  - Sig3:  $R^{**2} = 0.89$  with beta
  - Hbond\_acc:  $R^{**2} = 0.91$  with beta
  - B:  $R^{**2} = 0.99$  with beta
  - MV\_boltz:  $R^{**2} = 0.0$  with the dG values
  - area:  $R^{**2} = 0.02$  with the dG values
  - volume:  $R^{**2} = 0.01$  with the dG values
  - V:  $R^{**2} = 0.01$  with the dG values
- o 12 columns remaining after applying correlation filters:
  - solvent
  - dG
  - beta
  - gamma
  - dielectric
  - dispersion
  - polar
  - hydrogen
  - sum
  - dipole
  - Sig2
  - sample
- o The Pearson heatmap was stored in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\CURATE\Pearson\_heatmap.png.
- o The curated database was stored in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\CURATE\Bandar\_db\_CURATE.csv.

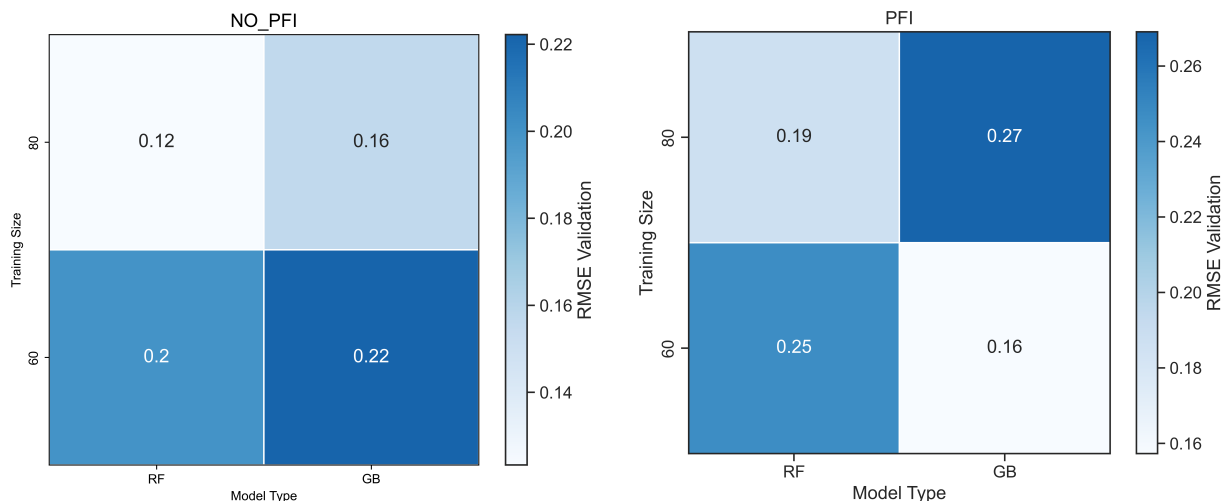
Time CURATE: 0.78 seconds



## GENERATE

- o Starting generation of ML models with the GENERATE module
- o Database C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\CURATE\Bandar\_db\_CURATE.csv loaded successfully, including:
  - 20 datapoints
  - 10 accepted descriptors
  - 2 ignored descriptors
  - 0 discarded descriptors
- o Starting heatmap scan with 4 ML models ['RF', 'GB', 'NN', 'VR'] and 3 training sizes [60, 70, 80]

Heatmap generation:



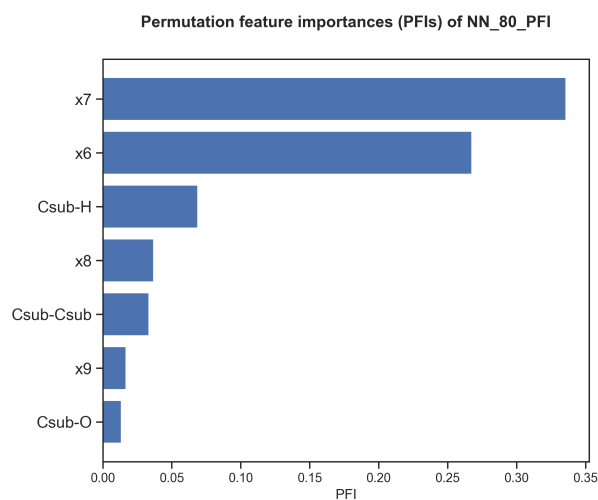
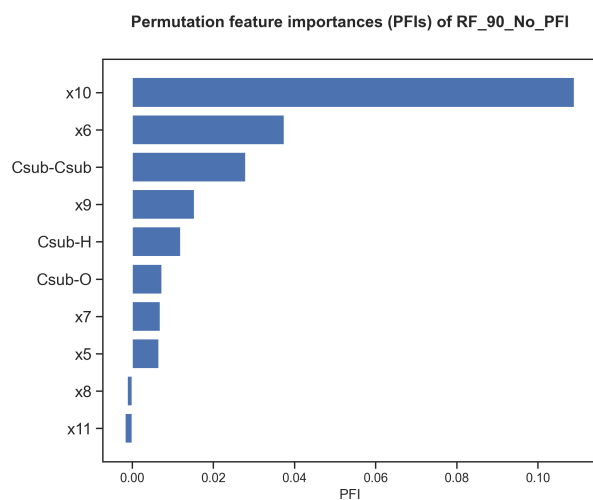
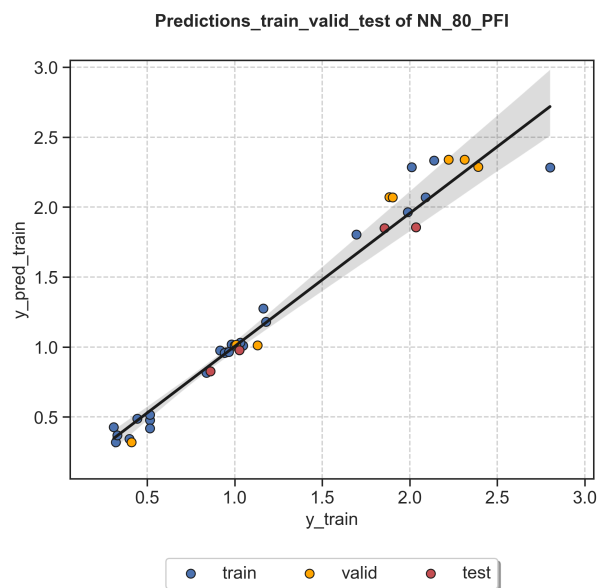
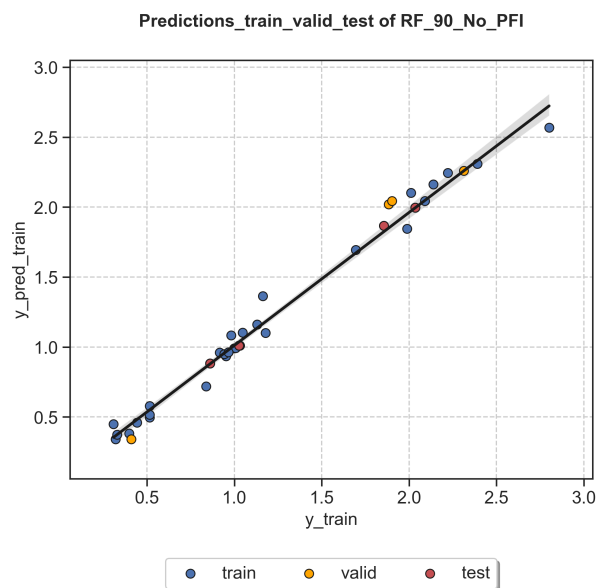
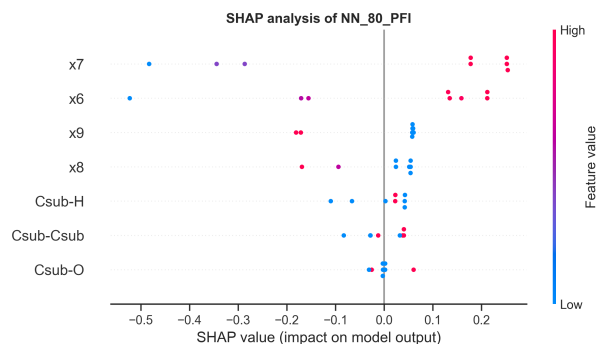
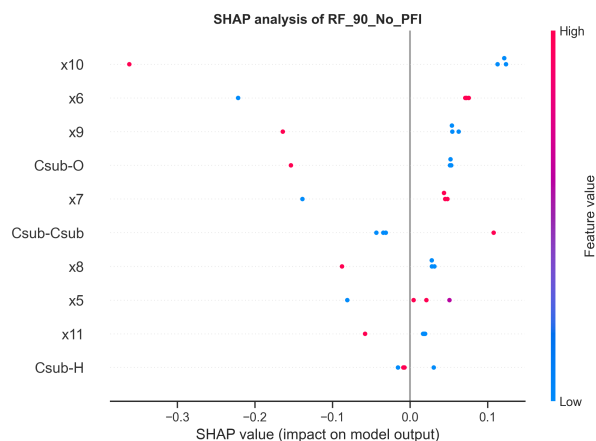
## PREDICT

- o Representation of predictions and analysis of ML models with the PREDICT module
- o ML model NN\_60.csv (with no PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma', 'dielectric', 'dispersion', 'polar', 'hydrogen', 'sum', 'dipole', 'Sig2']
  - Training points: 12
  - Validation points: 8
  - Train set with predicted results: NN\_60\_train\_No\_PFI.csv

- Validation set with predicted results: NN\_60\_valid\_No\_PFI.csv
- o Saving graphs and CSV databases in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT:
  - Graph in: C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT/Results\_NN\_60\_No\_PFI.png
  - o Results saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT/Results\_NN\_60\_No\_PFI.dat:
    - Points Train:Validation = 12:8
    - Proportion Train:Validation = 60:40
    - Train : R2 = 0.51, MAE = 0.32, RMSE = 0.4
    - Validation : R2 = 0.51, MAE = 0.18, RMSE = 0.23
  - o SHAP plot saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\SHAP\_NN\_60\_No\_PFI.png
  - o SHAP values saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\SHAP\_NN\_60\_No\_PFI.dat:
    - gamma = min: -0.24, max: 0.21
    - beta = min: -0.12, max: 0.19
    - Sig2 = min: -0.043, max: 0.13
    - dispersion = min: -0.052, max: 0.13
    - polar = min: -0.088, max: 0.081
    - dipole = min: -0.029, max: 0.063
    - dielectric = min: -0.071, max: 0.059
    - sum = min: -0.045, max: 0.042
    - hydrogen = min: -0.014, max: 0.0088
  - o PFI plot saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\PFI\_NN\_60\_No\_PFI.png
  - o PFI values saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\PFI\_NN\_60\_No\_PFI.dat:
    - Original score (from model.score, R2) = 0.5
    - gamma = 1.2 +/- 0.6
    - beta = 0.19 +/- 0.22
    - dielectric = 0.14 +/- 0.24
    - dipole = 0.13 +/- 0.13
    - Sig2 = 0.098 +/- 0.051
    - sum = 0.065 +/- 0.081
    - polar = 0.011 +/- 0.18
    - hydrogen = 0.0082 +/- 0.022
    - dispersion = -0.11 +/- 0.09
  - o Outliers plot saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\Outliers\_NN\_60\_No\_PFI.png
  - o Outlier values saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\Outliers\_NN\_60\_No\_PFI.dat:
    - x No variable names found or names option not specified! Outliers will be printed with no names
    - Train: 1 outliers out of 12 datapoints (8.3%)
    - Validation: 0 outliers out of 8 datapoints (0.0%)
- o ML model NN\_60\_PFI.csv (with PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma']
  - Training points: 12
  - Validation points: 8
    - Train set with predicted results: NN\_60\_train\_PFI.csv
    - Validation set with predicted results: NN\_60\_valid\_PFI.csv
- o Saving graphs and CSV databases in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT:
  - Graph in: C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT/Results\_NN\_60\_PFI.png
  - o Results saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT/Results\_NN\_60\_PFI.dat:
    - Points Train:Validation = 12:8
    - Proportion Train:Validation = 60:40

- Train :  $R^2 = 0.47$ , MAE = 0.28, RMSE = 0.39
- Validation :  $R^2 = 0.6$ , MAE = 0.18, RMSE = 0.21
- o SHAP plot saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\SHAP\_NN\_60\_PFI.png
- o SHAP values saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\SHAP\_NN\_60\_PFI.dat:
  - beta = min: -0.21, max: 0.4
  - gamma = min: -0.22, max: 0.24
- o PFI plot saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\PFI\_NN\_60\_PFI.png
- o PFI values saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\PFI\_NN\_60\_PFI.dat:
  - Original score (from model.score,  $R^2$ ) = 0.58
  - beta = 0.55 +/- 0.25
  - gamma = 0.51 +/- 0.3
- o Outliers plot saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\Outliers\_NN\_60\_PFI.png
- o Outlier values saved in C:\Users\David\Desktop\Articulo ROBERT\Pruebas\_ROBERT\Regression\Bandar\PREDICT\Outliers\_NN\_60\_PFI.dat:
  - x No variable names found or names option not specified! Outliers will be printed with no names

Time PREDICT: 8.72 seconds



## VERIFY

- o Starting tests to verify the prediction ability of the ML models with the VERIFY module
- o ML model NN\_60.csv (with no PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma', 'dielectric', 'dispersion', 'polar', 'hydrogen', 'sum', 'dipole']

- , 'Sig2']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60.csv (with no PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma', 'dielectric', 'dispersion', 'polar', 'hydrogen', 'sum', 'dipole']
- , 'Sig2']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60.csv (with no PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma', 'dielectric', 'dispersion', 'polar', 'hydrogen', 'sum', 'dipole']
- , 'Sig2']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60.csv (with no PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma', 'dielectric', 'dispersion', 'polar', 'hydrogen', 'sum', 'dipole']
- , 'Sig2']
  - Training points: 12
  - Validation points: 8
- o VERIFY donut plots saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\B andar\VERIFY\VERIFY\_tests\_NN\_60\_No\_PFI.png
  - o VERIFY test values saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\B andar\VERIFY\VERIFY\_tests\_NN\_60\_No\_PFI.dat:
- Results of the VERIFY tests:
  - Original score (train set for CV): RMSE = 0.4, with a +- threshold (thres\_test option) of 20.0%
  - o 5-fold CV: NOT DETERMINED, data splitting was done with KN. CV result: RMSE = 0.61
  - Original score (validation set): RMSE = 0.23, with a +- threshold (thres\_test option) of 20.0%
- :
  - o X\_shuffle: PASSED, RMSE = 0.51 is higher than the threshold (0.27)
  - o y\_shuffle: PASSED, RMSE = 0.43 is higher than the threshold (0.27)
  - o onehot: PASSED, RMSE = 0.46 is higher than the threshold (0.27)
- o ML model NN\_60\_PFI.csv (with PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60\_PFI.csv (with PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60\_PFI.csv (with PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG
  - Model: NN
  - Descriptors: ['beta', 'gamma']
  - Training points: 12
  - Validation points: 8
- o ML model NN\_60\_PFI.csv (with PFI filter) and its corresponding Xy database were loaded successfully, including:
  - Target value: dG

- Model: NN
- Descriptors: ['beta', 'gamma']
- Training points: 12
- Validation points: 8

o VERIFY donut plots saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\B andar\VERIFY\VERIFY\_tests\_NN\_60\_PFI.png

o VERIFY test values saved in C:\Users\David\Desktop\Artículo ROBERT\Pruebas\_ROBERT\Regression\B andar\VERIFY\VERIFY\_tests\_NN\_60\_PFI.dat:

Results of the VERIFY tests:

Original score (train set for CV): RMSE = 0.39, with a +- threshold (thres\_test option) of 20.

0%:

- 5-fold CV: NOT DETERMINED, data splitting was done with KN. CV result: RMSE = 0.5

Original score (validation set): RMSE = 0.21, with a +- threshold (thres\_test option) of 20.0%

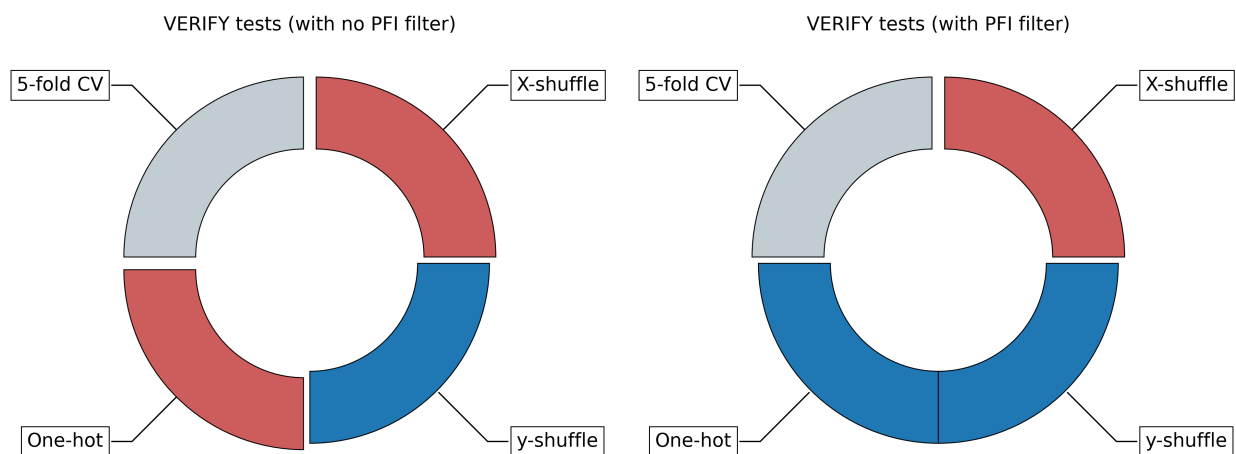
:

o X\_shuffle: PASSED, RMSE = 0.39 is higher than the threshold (0.25)

o y\_shuffle: PASSED, RMSE = 0.31 is higher than the threshold (0.25)

o onehot: PASSED, RMSE = 0.36 is higher than the threshold (0.25)

Time VERIFY: 1.56 seconds



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**AQME-ROBERT**