```
!pip install seaborn
!pip install scikit-learn==0.23.2
!pip install auto-sklearn
```

```
Requirement already satisfied: tblib>=1.6.0 in /usr/local/lib/python3.7/dist-package
Requirement already satisfied: tornado>=5 in /usr/local/lib/python3.7/dist-packages (
Requirement already satisfied: sortedcontainers!=2.0.0,!=2.0.1 in /usr/local/lib/pyth
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-package
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dis
Collecting locket
  Downloading locket-1.0.0-py2.py3-none-any.whl (4.4 kB)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (fr
Collecting emcee>=3.0.0
  Downloading emcee-3.1.2-py2.py3-none-any.whl (46 kB)
     |████████████████████████████████| 46 kB 4.2 MB/s
Requirement already satisfied: heapdict in /usr/local/lib/python3.7/dist-packages (fr
Requirement already satisfied: MarkupSafe>=0.23 in /usr/local/lib/python3.7/dist-pack
Building wheels for collected packages: auto-sklearn, pynisher, smac, liac-arff
  Building wheel for auto-sklearn (setup.py) ... done
  Created wheel for auto-sklearn: filename=auto_sklearn-0.14.7-py3-none-any.whl size=
  Stored in directory: /root/.cache/pip/wheels/ba/43/5c/2fbe6fd19e3af314cbc4aa808378
  Building wheel for pynisher (setup.py) ... done
  Created wheel for pynisher: filename=pynisher-0.6.4-py3-none-any.whl size=7043 sha2
  Stored in directory: /root/.cache/pip/wheels/42/71/95/7555ec3253e1ba8add72ae5febf1b
  Building wheel for smac (setup.py) ... done
  Created wheel for smac: filename=smac-1.2-py3-none-any.whl size=215930 sha256=2814
  Stored in directory: /root/.cache/pip/wheels/ad/95/67/6afc6b04d3715070c853d0a9d7c7b
  Building wheel for liac-arff (setup.py) ... done
  Created wheel for liac-arff: filename=liac_arff-2.5.0-py3-none-any.whl size=11732 s
  Stored in directory: /root/.cache/pip/wheels/1f/0f/15/332ca86cbebf25ddf98518caaf887
Successfully built auto-sklearn pynisher smac liac-arff
Installing collected packages: locket, pyyaml, partd, fsspec, cloudpickle, scipy, das
  Attempting uninstall: pyyaml
    Found existing installation: PyYAML 3.13
    Uninstalling PyYAML-3.13:
      Successfully uninstalled PyYAML-3.13
  Attempting uninstall: cloudpickle
    Found existing installation: cloudpickle 1.3.0
    Uninstalling cloudpickle-1.3.0:
      Successfully uninstalled cloudpickle-1.3.0
  Attempting uninstall: scipy
    Found existing installation: scipy 1.4.1
    Uninstalling scipy-1.4.1:
      Successfully uninstalled scipy-1.4.1
  Attempting uninstall: dask
    Found existing installation: dask 2.12.0
    Uninstalling dask-2.12.0:
      Successfully uninstalled dask-2.12.0
  Attempting uninstall: scikit-learn
    Found existing installation: scikit-learn 0.23.2
    Uninstalling scikit-learn-0.23.2:
      Successfully uninstalled scikit-learn-0.23.2
  Attempting uninstall: distributed
    Found existing installation: distributed 1.25.3
    Uninstalling distributed-1.25.3:
      Successfully uninstalled distributed-1.25.3
ERROR: pip's dependency resolver does not currently take into account all the package
yellowbrick 1.4 requires scikit-learn>=1.0.0, but you have scikit-learn 0.24.2 which
gym 0.17.3 requires cloudpickle<1.7.0,>=1.2.0, but you have cloudpickle 2.1.0 which i
albumentations 0.1.12 requires imgaug<0.2.7,>=0.2.5, but you have imgaug 0.2.9 which
Successfully installed ConfigSpace-0.4.21 auto-sklearn-0.14.7 cloudpickle-2.1.0 dask-
WARNING: The following packages were previously imported in this runtime:
  [cloudpickle,scipy]
You must restart the runtime in order to use newly installed versions.
```

RESTART RUNTIME

```python
import numpy as np #Biblioteca "matemática"
import pandas as pd #Biblioteca para manipulação e análise de dados
import matplotlib.pyplot as plt #Extenção da biblioteca que faz a pltagem de gráficos
from matplotlib.colors import rgb2hex
import seaborn as sns
import os #Funcionalidade simplificadas de sistema operacionais
print(os.listdir())
plt.style.use('bmh')
```

```
['.config', 'drive', 'sample_data']
```

```python
from google.colab import drive
```

```
drive.mount("/content/drive")

```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.r
```

```
import io
df=pd.read_csv('/content/drive/MyDrive/meu_projeto/meu_projeto_env/bin/measures_v2.csv

```

```
df.shape
df.head()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-1-efd2fb27aa9c> in <module>()
----> 1 df.shape
      2 df.head()

NameError: name 'df' is not defined
```

SEARCH STACK OVERFLOW

```
target = df.pop('pm') #Temperatura do rotor
df = pd.concat([df, target], axis=1)

```

```
df = df.sample(frac=1,random_state=0) #embaralha os dados do dataframe #Ajuda a previr
df.reset_index(drop=True, inplace=True) #Faz com que o Index volte a ser o que era ant
df
```

| | u_q | coolant | stator_winding | u_d | stator_tooth | motor_speed |
|---|---|---|---|---|---|---|
| **0** | 41.938923 | 18.744030 | 66.684830 | -123.478027 | 46.080647 | 4749.964355 |
| **1** | -0.431508 | 59.902590 | 85.079312 | -0.878644 | 76.299257 | 0.057160 |
| **2** | -1.541598 | 33.149664 | 48.669293 | -0.333442 | 45.330586 | 0.001482 |
| **3** | 42.387482 | 44.949261 | 104.791174 | -123.337533 | 90.274398 | 5112.368164 |
| **4** | 15.335679 | 18.755226 | 113.366333 | -130.067474 | 84.144737 | 3999.963135 |
| **...** | ... | ... | ... | ... | ... | ... |
| **1330811** | 12.093378 | 18.362038 | 19.795088 | 0.766441 | 19.273512 | 249.997833 |
| **1330812** | 23.644573 | 18.671892 | 39.454746 | -22.069843 | 32.786079 | 499.995819 |
| **1330813** | 31.839993 | 54.416758 | 102.315358 | 56.278286 | 88.524355 | 1096.309584 |
| **1330814** | 94.615028 | 18.818180 | 36.839790 | -1.240177 | 36.204067 | 1999.979004 |
| **1330815** | -1.087644 | 18.247478 | 20.067276 | 1.469395 | 19.850620 | -0.004758 |

1330816 rows × 12 columns

```
split_index=int(len(df) * 0.75)

train_df = df[:split_index] #Primeiros 75%
test_df = df[split_index:] #outros 25% restantes

train_df.info()
test_df.info()

```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 998112 entries, 0 to 998111
Data columns (total 12 columns):
 #   Column          Non-Null Count   Dtype  
---  ------          --------------   -----  
 0   u_q             998112 non-null  float64
 1   coolant         998112 non-null  float64
 2   stator_winding  998112 non-null  float64
 3   u_d             998112 non-null  float64
 4   stator_tooth    998112 non-null  float64
 5   motor_speed     998112 non-null  float64
 6   i_d             998112 non-null  float64
 7   i_q             998112 non-null  float64
 8   stator_yoke     998112 non-null  float64
 9   ambient         998112 non-null  float64
 10  torque          998112 non-null  float64
 11  pm              998112 non-null  float64
dtypes: float64(12)
memory usage: 91.4 MB
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 332704 entries, 998112 to 1330815
Data columns (total 12 columns):
 #   Column          Non-Null Count   Dtype  
---  ------          --------------   -----  
 0   u_q             332704 non-null  float64
 1   coolant         332704 non-null  float64
 2   stator_winding  332704 non-null  float64
 3   u_d             332704 non-null  float64
 4   stator_tooth    332704 non-null  float64
 5   motor_speed     332704 non-null  float64
 6   i_d             332704 non-null  float64
 7   i_q             332704 non-null  float64
 8   stator_yoke     332704 non-null  float64
 9   ambient         332704 non-null  float64
 10  torque          332704 non-null  float64
 11  pm              332704 non-null  float64
dtypes: float64(12)
memory usage: 30.5 MB
```

```
X_train = train_df.to_numpy()[:, :-1]
y_train = train_df.to_numpy()[:, -1]

X_test = test_df.to_numpy()[:, :-1]
y_test = test_df.to_numpy()[:, -1]

```

```
feature_type = ['numerical']*11
```

```
!pip install scipy==1.7.0
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/p
Collecting scipy==1.7.0
  Downloading scipy-1.7.0-cp37-cp37m-manylinux_2_5_x86_64.manylinux1_x86_64.whl (28.5
     |████████████████████████████████| 28.5 MB 1.6 MB/s
Requirement already satisfied: numpy<1.23.0,>=1.16.5 in /usr/local/lib/python3.7/dist
Installing collected packages: scipy
  Attempting uninstall: scipy
    Found existing installation: scipy 1.7.3
    Uninstalling scipy-1.7.3:
      Successfully uninstalled scipy-1.7.3
ERROR: pip's dependency resolver does not currently take into account all the package
yellowbrick 1.4 requires scikit-learn>=1.0.0, but you have scikit-learn 0.24.2 which
gym 0.17.3 requires cloudpickle<1.7.0,>=1.2.0, but you have cloudpickle 2.1.0 which i
albumentations 0.1.12 requires imgaug<0.2.7,>=0.2.5, but you have imgaug 0.2.9 which
Successfully installed scipy-1.7.0
WARNING: The following packages were previously imported in this runtime:
  [scipy]
You must restart the runtime in order to use newly installed versions.
```

RESTART RUNTIME

```
from pandas.core import algorithms
import autosklearn.regression
import sklearn.metrics
from pprint import pprint

autosklearn_regressor = autosklearn.regression.AutoSklearnRegressor(
    per_run_time_limit=200,

)
```

```
autosklearn_regressor.fit(X_train,y_train)
```

```
AutoSklearnRegressor(per_run_time_limit=200)
```

```
Pred_train_y=autosklearn_regressor.predict(X_train)
Pred_test_y=autosklearn_regressor.predict(X_test)

```

```
print(autosklearn_regressor.leaderboard())
```

```
          rank  ensemble_weight                 type      cost    duration
model_id
43           1             0.40  k_nearest_neighbors  0.002416   37.370763
47           2             0.38  k_nearest_neighbors  0.002638   60.228681
28           3             0.18  k_nearest_neighbors  0.002641   65.127751
10           4             0.04    gradient_boosting  0.017248  109.899132
```

```
print(autosklearn_regressor.show_models())
```

```
{43: {'model_id': 43, 'rank': 1, 'cost': 0.002415576892158544, 'ensemble_weight': 0.4
                                    learning_rate=0.036087332404571744, max_iter=512,
                                    max_leaf_nodes=64, min_samples_leaf=3,
                                    n_iter_no_change=18, random_state=1,
                                    validation_fraction=None, warm_start=True)}}
```

## Acurácia dos modelos

```
print("Train R2 score:", sklearn.metrics.r2_score(y_train, Pred_train_y))

print("Test R2 score:", sklearn.metrics.r2_score(y_test, Pred_test_y))
```

```
Train R2 score: 0.9993409819610849
Test R2 score: 0.9980519065396045
```

```
MSE_treino=sklearn.metrics.mean_squared_error(y_train, Pred_train_y)

MSE_teste=sklearn.metrics.mean_squared_error(y_test, Pred_test_y)

Print("Erro quadrático Médio Treino", MSE_treino)

Print("Erro quadrático Médio Teste", MSE_teste)

```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-1-1906ba2df9b2> in <module>()
----> 1 MSE_treino=sklearn.metrics.mean_squared_error(y_train, Pred_train_y)
      2 
      3 MSE_teste=sklearn.metrics.mean_squared_error(y_test, Pred_test_y)
      4 
      5 Print("Erro quadrático Médio Treino", MSE_treino)

NameError: name 'sklearn' is not defined
```

SEARCH STACK OVERFLOW

## Gráficos dos dados - Treino

```
#Dados de treino
ax1 = sns.distplot(y_train, hist=False, color="r", label="Valor real")
sns.distplot(Pred_train_y, hist=False, color="b", label="Valor do treino" , ax=ax1);
```