

# # EDA And Baseline on Motor Temperature Estimation

In [4]:

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

Requirement already satisfied: seaborn in c:\users\pedro\anaconda3\lib\site-packages (0.11.0)  
Requirement already satisfied: matplotlib>=2.2 in c:\users\pedro\anaconda3\lib\site-packages (from seaborn) (3.3.2)  
Requirement already satisfied: scipy>=1.0 in c:\users\pedro\anaconda3\lib\site-packages (from seaborn) (1.5.2)  
Requirement already satisfied: numpy>=1.15 in c:\users\pedro\anaconda3\lib\site-packages (from seaborn) (1.19.2)  
Requirement already satisfied: pandas>=0.23 in c:\users\pedro\anaconda3\lib\site-packages (from seaborn) (1.1.3)  
Requirement already satisfied: pillow>=6.2.0 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (8.0.1)  
Requirement already satisfied: python-dateutil>=2.1 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (2.8.1)  
Requirement already satisfied: cycler>=0.10 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (0.10.0)  
Requirement already satisfied: certifi>=2020.06.20 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (2020.6.20)  
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (1.3.0)  
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.3 in c:\users\pedro\anaconda3\lib\site-packages (from matplotlib>=2.2->seaborn) (2.4.7)  
Requirement already satisfied: pytz>=2017.2 in c:\users\pedro\anaconda3\lib\site-packages (from pandas>=0.23->seaborn) (2020.1)  
Requirement already satisfied: six>=1.5 in c:\users\pedro\anaconda3\lib\site-packages (from python-dateutil>=2.1->matplotlib>=2.2->seaborn) (1.15.0)  
Requirement already satisfied: scikit-learn==0.23.2 in c:\users\pedro\anaconda3\lib\site-packages (0.23.2)  
Requirement already satisfied: joblib>=0.11 in c:\users\pedro\anaconda3\lib\site-packages (from scikit-learn==0.23.2) (0.17.0)  
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\pedro\anaconda3\lib\site-packages (from scikit-learn==0.23.2) (2.1.0)  
Requirement already satisfied: numpy>=1.13.3 in c:\users\pedro\anaconda3\lib\site-packages (from scikit-learn==0.23.2) (1.19.2)  
Requirement already satisfied: scipy>=0.19.1 in c:\users\pedro\anaconda3\lib\site-packages (from scikit-learn==0.23.2) (1.5.2)

Importando Bibliotecas

In [5]:

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

```
['.ipynb_checkpoints', 'activate.csh', 'activate.fish', 'activate.nu', 'activate.ps1', 'activate.txt', 'activate_this.py', 'alembic.txt', 'archive.zip', 'automl_inicio.ipynb', 'AutoSklearn - Eletric Motor.ipynb', 'Book - Hands-on automated machine learning.ipynb', 'Curso Data science.ipynb', 'cygdb.txt', 'cython.txt', 'cythonize.txt', 'dask-scheduler.txt', 'dask-ssh.txt', 'dask-worker.txt', 'databricks.txt', 'datahr.csv', 'dbfs.txt', 'deactivate.nu', 'distro.txt', 'Eletric Motor_Autosklearn-Copy1.ipynb', 'Eletric Motor_Autosklearn.ipynb', 'Eletric Motor_Autosklearn_H2O.ipynb', 'Eletric Motor_pycaret.ipynb', 'f2py.txt', 'f2py3.8', 'f2py3.txt', 'find_similar_images.py', 'flask.txt', 'fonttools.txt', 'futurize.txt', 'gunicorn.txt', 'htmlmin.txt', 'ipython.txt', 'ipython3.txt', 'jsonschema.txt', 'jupyter-bundlerextension.txt', 'jupyter-console.txt', 'jupyter-dejavu.txt', 'jupyter-execute.txt', 'jupyter-kernel.txt', 'jupyter-kernelspec.txt', 'jupyter-migrate.txt', 'jupyter-nbconvert.txt', 'jupyter-nbextension.txt', 'jupyter-notebook.txt', 'jupyter-qtconsole.txt', 'jupyter-run.txt', 'jupyter-serverextension.txt', 'jupyter-troubleshoot.txt', 'jupyter-trust.txt', 'jupyter.txt', 'logs.log', 'mako-render.txt', 'measures_v2.csv', 'melb_data.csv', 'mlflow.txt', 'mlruns', 'nltk.txt', 'normalizer.txt', 'numba.txt', 'pandas_profiling.txt', 'pasteurize.txt', 'phik_trial.txt', 'pip-3.8', 'pip.txt', 'pip3.8', 'pip3.txt', 'plac_runner.py', 'pycc.txt', 'pyftmerge.txt', 'pyftsubset.txt', 'pygmentize.txt', 'python', 'python3', 'python3.8', 'send2trash.txt', 'smac.txt', 'spacy', 'sqlformat.txt', 'tabulate.txt', 'tqdm.txt', 'ttx.txt', 'wheel-3.8', 'wheel.txt', 'wheel3.8', 'wheel3.txt', 'wordcloud_cli.txt', 'wsdump.txt', '__pycache__']
```

Lendo o arquivo

In [6]:

```
df=pd.read_csv('measures_v2.csv', usecols=[0,1,2,3,4,5,6,7,8,9,10,11])
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 prevenir o
df.reset_index(drop=True, inplace=True) #Faz com que o Index volte a ser o que era antes
```

In [7]:

```
df.head()
```

Out[7]:

	u_q	coolant	stator_winding	u_d	stator_tooth	motor_speed	i_d	
0	41.938923	18.744030	66.684830	-123.478027	46.080647	4749.964355	-187.964111	7
1	-0.431508	59.902590	85.079312	-0.878644	76.299257	0.057160	-2.000745	
2	-1.541598	33.149664	48.669293	-0.333442	45.330586	0.001482	-2.000673	
3	42.387482	44.949261	104.791174	-123.337533	90.274398	5112.368164	-181.587703	6
4	15.335679	18.755226	113.366333	-130.067474	84.144737	3999.963135	-205.157623	9

In [8]:

```
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
```

Retira a última coluna que é no target do modelo de treinamento e modelos de teste

In [9]:

```
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]
```

In [13]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn import neighbors
from sklearn.neighbors import KNeighborsRegressor
from sklearn.metrics import mean_squared_error
from sklearn.metrics import r2_score
from sklearn.model_selection import train_test_split
%matplotlib inline
```

In [40]:

```
knn_model= neighbors.KNeighborsRegressor()
knn_treino=knn_model.fit(X_train,y_train)
knn_teste=knn_model.fit(X_train,y_train)
```

In [41]:

```
Pred_train_y =knn_model.predict(X_train)
```

In [42]:

```
Pred_test_y =knn_model.predict(X_test)
```

In [43]:

```
import sklearn.metrics
print("Scores R2 de treino", sklearn.metrics.r2_score(y_train,Pred_train_y))
print("Scores R2 de teste", sklearn.metrics.r2_score(y_test,Pred_test_y))
```

```
Scores R2 de treino 0.975183329761486
Scores R2 de teste 0.9608577627930146
```

In [44]:

```
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)
```

Erro quadrático Médio Treino 8.96069404148651

Erro quadrático Médio Teste 14.130213469806101

In [45]:

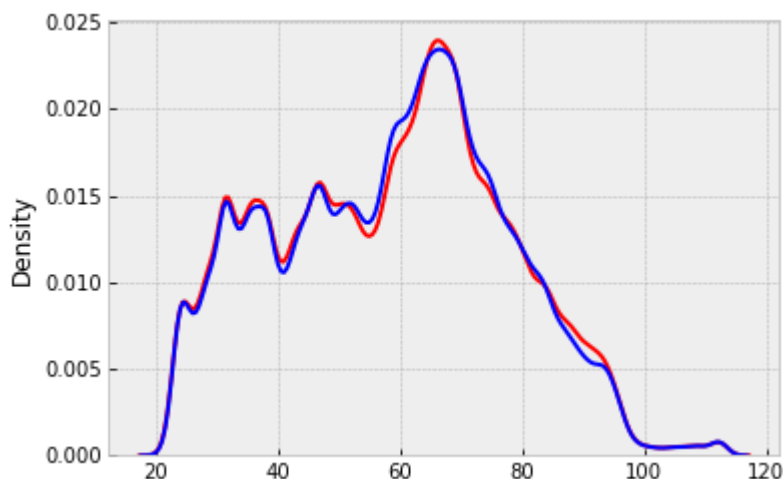
```
#Dados de treino
ax1 = sns.distplot(y_train, hist=False, color="r", label="Valor real")
sns.distplot(Pred_train_y, hist=False, color="b", label="Valor do treino" , ax=ax1);
```

C:\Users\pedro\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

warnings.warn(msg, FutureWarning)

C:\Users\pedro\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

warnings.warn(msg, FutureWarning)



Dados de Teste

In [46]:

```
ax1 = sns.distplot(y_test, hist=False, color="r", label="Actual Value")
sns.distplot(Pred_test_y, hist=False, color="b", label="Fitted Values" , ax=ax1)
```

C:\Users\pedro\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

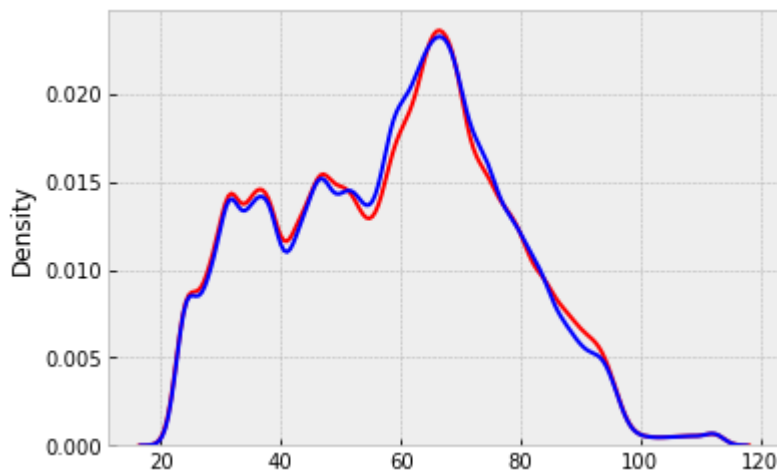
warnings.warn(msg, FutureWarning)

C:\Users\pedro\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

warnings.warn(msg, FutureWarning)

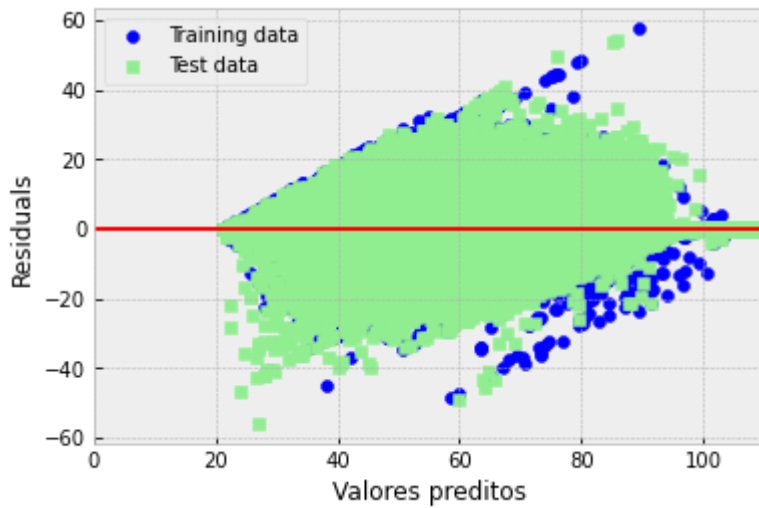
Out[46]:

<AxesSubplot:ylabel='Density'>



In [47]:

```
plt.scatter(Pred_train_y, Pred_train_y - y_train, c='blue', marker='o', label='Training data')
plt.scatter(Pred_test_y, Pred_test_y - y_test, c='lightgreen', marker='s', label='Test data')
plt.xlabel('Valores preditos')
plt.ylabel('Residuals')
plt.legend(loc='upper left')
plt.hlines(y=0, xmin=0, xmax=110, lw=2, color='red')
plt.xlim([0, 110])
plt.show()
```





In [48]:

```
plt.scatter(Pred_train_y, y_train, label="Train samples", c='#d95f02')
plt.scatter(Pred_test_y, y_test, label="Test samples", c='#7570b3')
plt.xlabel("Valores preditos")
plt.ylabel("Valores reais")
plt.legend()
plt.plot([30, 150], [30, 150], c='k', zorder=0)
plt.xlim([30, 150])
plt.ylim([30, 150])
plt.tight_layout()
plt.show()
```

