AI_PHASE 2

MEASURE ENERGY CONSUMPTION

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TEAM ID	**PROJ_212174_TEAM_4**
PROJECT NAME	**MEASURE ENERGY CONSUMPTION**
MAXIMUM MARKS	

```
#Importing the packages needed for the above
given problem import numpy as np  import
pandas as pd


#importing the necessary packages and libraries for the above
given problems import numpy as np from numpy import
concatenate
import urllib.request as urllib
from sklearn.preprocessing import StandardScaler, MinMaxScaler,
LabelEncoder, OneHotEncoder
from sklearn.model_selection import
train_test_split from sklearn.metrics
import mean_squared_error   from
keras.models import Sequential from
keras.layers import Dense


#importing seaborn and
matplot libraries import
```

```
seaborn as sns import
matplotlib.pyplot as plt from
math import sqrt

#importing the required dataset libraries from
sklearn.metrics import
mean_squared_error,mean_absolute_error from
keras.models import Sequential
from keras.layers import
Dense,Dropout from
keras.layers import LSTM
color_pal =
sns.color_palette()

#importing the dataset “PJME_hourly.csv “ file to create a table for
the datetime of the dataset data =
pd.read_csv('PJME_hourly.csv',index_col=[0], parse_dates=[0])
data.head();
```

OUTPUT:

	PJME_MW
Datetime	
2002-12-31 01:00:00	26498.0
2002-12-31 02:00:00	25147.0
2002-12-31 03:00:00	24574.0
2002-12-31 04:00:00	24393.0
2002-12-31 05:00:00	24860.0

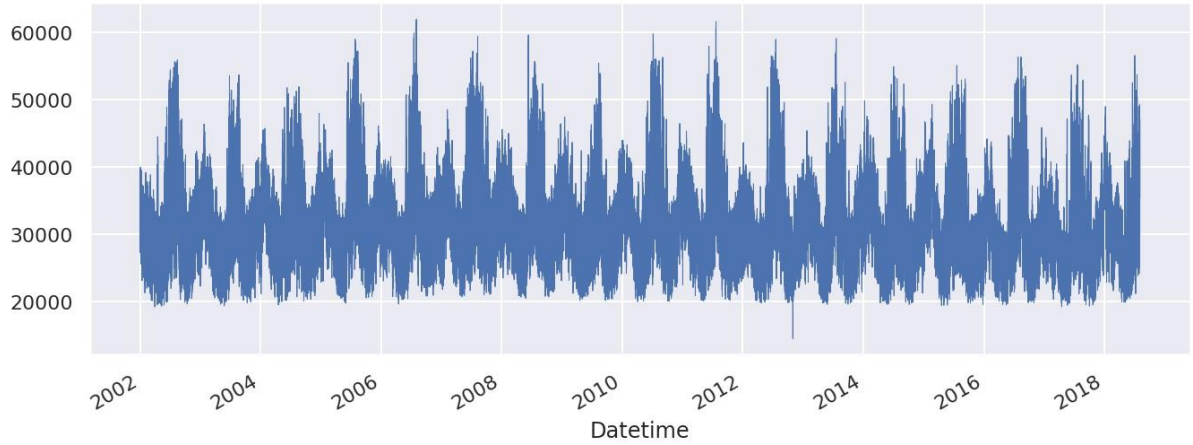
#Ploting a graph for the data set

file import seaborn as sns

sns.set(rc={'figure.figsize':(11, 4)})

data['PJME_MW'].plot(linewidth=0.

5); OUTPUT:



From the above graph we can analyse that datetime of the energy consumed from the years 2002 to 2018 from varies from each year throughout the energy consumed . We can also see that the between the years of 2006 and 2008 has the highest point of energy consumed.

#Finding if the dataset has any

null values data.isnull().sum()

OUTPUT:

PJME_MW 0

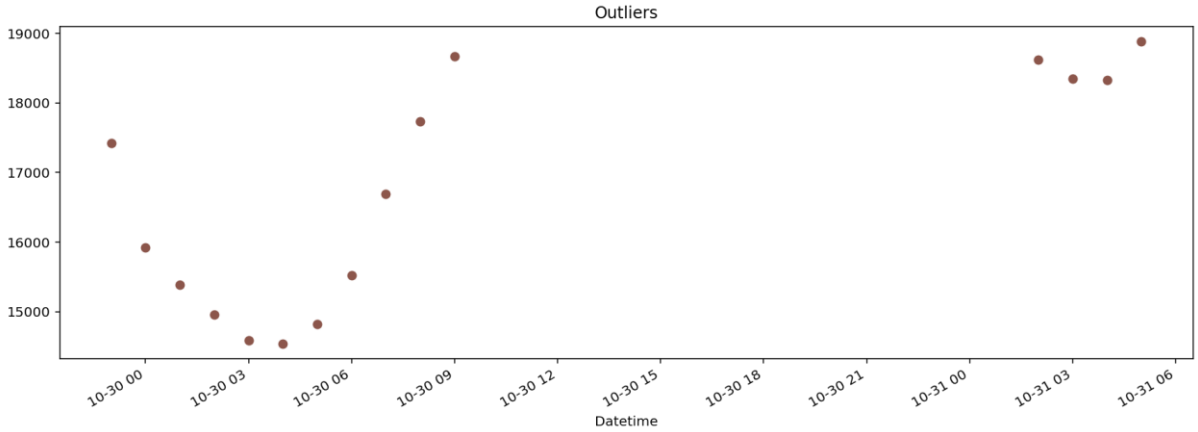
dtype: int64

#Ploting a graph to outline the outliers in the given dataset

```
data.query('PJME_MW < 19_000')['PJME_MW'] \
    .plot(style='o',
figsize=(15, 5),
color=color_pal[5],
title='Outliers')
```

OUTPUT:

<Axes: title={'center': 'Outliers'}, xlabel='Datetime'>



From the above graph we can see that there are outliers present in the dataset. There are four outliers present in the above graph.

#Datacleaning the dataset import pandas as pd data =

pd.read_csv('PJME_hourly.csv',index_col=[0],

parse_dates=[0]) data.head() print("\nDataset after

Data Cleaning:") print(data.head())

OUTPUT:

Dataset after Data Cleaning: PJME_MW Datetime 2002-12-31 01:00:00 26498.0 2002-12-31 02:00:00 25147.0 2002-12-31 03:00:00 24574.0 2002-12-31 04:00:00 24393.0 2002-12-31 05:00:00 24860.0

```
#Plotting a table to differentiate between the years of calculations made
from the dataset def create_features(df, label=None):
    """
    Creates time series features from datetime index.
    """
    df = df.copy()     df['date'] =
df.index     df['hour'] =
df['date'].dt.hour
df['dayofweek'] =
df['date'].dt.dayofweek
df['quarter'] = df['date'].dt.quarter
df['month'] = df['date'].dt.month
df['year'] = df['date'].dt.year
df['dayofyear'] =
df['date'].dt.dayofyear
df['dayofmonth'] =
df['date'].dt.day
df['weekofyear'] =
df['date'].dt.weekofyear
    X = df[['hour','dayofweek','quarter','month','year',
'dayofyear','dayofmonth','weekofyear']]
    if label:
        y =
df[label]
return X, y
return X
    X, y = create_features(data, label='PJME_MW')
```

df = pd.concat([X, y], axis=1) df.head()

OUTPUT:

	hour	dayofweek	quarter	month	year	dayofyear	dayofmonth	weekofyear	PJME_MW
Datetime									
2002-12-31 01:00:00	1	1	4	12	2002	365	31	1	26498.0
2002-12-31 02:00:00	2	1	4	12	2002	365	31	1	25147.0
2002-12-31 03:00:00	3	1	4	12	2002	365	31	1	24574.0
2002-12-31 04:00:00	4	1	4	12	2002	365	31	1	24393.0
2002-12-31 05:00:00	5	1	4	12	2002	365	31	1	24860.0

#Finding the mean for

the dataset mean =

data.mean()

print("Mean:")

print(mean)

OUTPUT:

Mean:

PJME_MW 32080.222831

dtype: float64

#Finding the median for

the dataset median =

data.median()

print("\nMedian:")

print(median) OUTPUT:

Median:

PJME_MW

31421.0

dtype: float64

#Finding the mode for

the dataset mode =

data.mode().iloc[0]

print("\nMode:")

print(mode)

OUTPUT:

Mode:

PJME_MW 30051.0

Name: 0, dtype: float64

The outliers and the null values in the dataset can be overcome by the mean, median, mode models which analyse the dataset for the null values and outliers present inside the data. These in terms help the dataset to remove unnecessary data values present in it . It may lead to removing of false values present in the dataset.

Load the dataset dataset_path =

"path/to/hourly_energy_consumption.csv"

data = pd.read_csv(dataset_path)

```
# Explore the first few rows of
the dataset print("Initial
Dataset:") print(data.head())

# Data Cleaning: Handling missing
values (if any) data = data.dropna()

# Data Cleaning: Handling duplicate
entries (if any) data =
data.drop_duplicates()

# Data Cleaning: Handling other errors (specific to your dataset)
055555555555555553
-+88888888+8/2# After cleaning
print("\nDataset 9aft.0-9er Data
Cleaning:") print(data.head())

# Further data preprocessing steps can be added based on project
requirements
```

In the above code, replace "path/to/hourly_energy_consumption.csv" with the actual path where you have saved the downloaded dataset. This code snippet loads the dataset, removes any rows with missing values, and drops duplicate entries. You can add more specific cleaning operations based on the characteristics of your dataset, such as handling outliers, correcting inconsistent values, or dealing with formatting errors.

```
# Preprocess data
labelEncoder =
LabelEncoder()
```

```
oneHotEncoder =
OneHotEncoder(categorical_features=[0]) ss =
StandardScaler() values = df.values

# integer encode direction

#encoder = LabelEncoder()

#values[:,8] = encoder.fit_transform(values[:,8])

# ensure all data is float
values = values.astype('float32')

# normalize features scaler =
MinMaxScaler(feature_range=(0,
1)) scaled =
scaler.fit_transform(values)

# frame as supervised learning
reframed = series_to_supervised(scaled, 1, 1)

# drop columns we don't want to predict
reframed.drop(reframed.columns[[9,10,11,12,13,14,15,16]], axis=1,
inplace=True) print(reframed.shape)
print(reframed.head())
```

OUTPUT:

```
(145366, 10)
   var1(t-1)  var2(t-1)  var3(t-1)  var4(t-1)  var5(t-1)  var6(t-1)  \
0        NaN        NaN        NaN        NaN        NaN        NaN
1   0.043478   0.166667        1.0        1.0        0.0    0.99726
2   0.086957   0.166667        1.0        1.0        0.0    0.99726
3   0.130435   0.166667        1.0        1.0        0.0    0.99726
4   0.173913   0.166667        1.0        1.0        0.0
0.99726
   var7(t-1)  var8(t-1)  var9(t-1)   var9(t)   0        NaN        NaN        NaN
0.251849
1         1.0        0.0   0.251849  0.223386
2         1.0        0.0   0.223386  0.211314
3         1.0        0.0   0.211314  0.207500
4         1.0        0.0   0.207500  0.217339
```

```
# make a prediction
yhat =
model.predict(X_te
st)
X_test = X_test.reshape((X_test.shape[0], X_test.shape[2]))

# invert scaling for forecast inv_yhat =
concatenate((X_test[:,:-1],yhat),
axis=1) inv_yhat =
scaler.inverse_transform(inv_yhat)
inv_yhat = inv_yhat[:,-1] # invert
scaling for actual
y_test = y_test.reshape((len(y_test),
1)) inv_y = concatenate((X_test[:,:-
1],y_test), axis=1) inv_y =
scaler.inverse_transform(inv_y)
inv_y = inv_y[:,-1]
# calculate RMSE
MSE=mean_squared_error(inv_y,inv_yhat)
MAE=mean_absolute_error(inv_y,inv_yhat)
RMSE = sqrt(mean_squared_error(inv_y, inv_yhat))
print('MSE: %.3f' % MSE + '   MAE: %.3f' % MAE + '
RMSE: %.3f' % RMSE) OUTPUT:
```

MSE: 1522100.750   MAE: 933.959   RMSE: 1233.734

```
#Calculates the MAPE for the dataset def
mean_absolute_percentage_error(y_true,
y_pred):      """Calculates MAPE given y_true
and y_pred"""     y_true, y_pred =
np.array(y_true), np.array(y_pred)     return
np.mean(np.abs((y_true - y_pred) / y_true)) *
100

print(mean_absolute_percentage_error(inv_y,inv_yh
at)) OUTPUT:
```

3.113434463739395

#Plotting a graph to differentiate the actual value and the predicted value from the datasets file and plots the difference

```
aa=[x for x in range(500)]
plt.figure(figsize=(8,4)) plt.plot(aa,
inv_y[:500], marker='.',
label="actual") plt.plot(aa,
inv_yhat[:500], 'r', label="prediction")

plt.tight_layout()
sns.despine(top=True)
plt.subplots_adjust(left=
0.07)
plt.ylabel('PJME_MW',
size=15) plt.xlabel('Time
step', size=15)
plt.legend(fontsize=15)
plt.show();
```

OUTPUT: