IMPORT LIBRIARIES

Load carbon emission data

```
from keras.callbacks import ModelCheckpoint
from keras.models import Sequential
from keras.layers import Dense, Activation, Flatten
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_absolute_error
from matplotlib import pyplot as plt
import seaborn as sb
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import warnings
warnings.filterwarnings('ignore')
warnings.filterwarnings('ignore', category=DeprecationWarning)
from xgboost import XGBRegressor
```

```
carb=pd.read_csv("/content/carbon.csv")
carbon_data=carb[["Year","total_population","Avg_Carbon_emmsion_per capita","avg_temp_change"
carbon_data["total_population"]=carbon_data["total_population"].apply(pd.np.log)
carbon_data.head()
```

	Year	total_population	Avg_Carbon_emmsion_per capita	avg_temp_change
0	1961	24.159987	3.326700	0.144488
1	1962	24.177561	3.498224	-0.028981
2	1963	24.199008	3.946614	-0.026252
3	1964	24.220168	4.046382	-0.122131
4	1965	24.241396	4.067733	-0.224178

Load weather Data

```
weather_data=pd.read_csv("/content/rainfall in india 1901-2015.csv")

## filter Year greater than 1960
```

```
weather_data=weather_data[weather_data["YEAR"]>1960]

## filter data based on Subdivision
weather_data=weather_data[weather_data["SUBDIVISION"]=='COASTAL KARNATAKA']

weather_data=weather_data.fillna(value=0)
weather_data.index=weather_data["YEAR"]
weather_data.head()
```

YEAR	SUBDIVISION	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1961	COASTAL KARNATAKA	1961	0.0	0.0	0.9	47.7	635.0	1013.0	1884.9	936.3	702.8	309.6	2
1962	COASTAL KARNATAKA	1962	0.2	3.4	0.1	31.6	359.4	405.4	1307.9	1080.9	413.5	313.4	1
1963	COASTAL KARNATAKA	1963	1.1	0.7	28.6	38.5	86.0	682.3	887.6	1013.8	181.0	233.7	
1964	COASTAL KARNATAKA	1964	0.0	0.0	2.6	5.8	23.4	631.7	864.0	978.1	363.9	200.2	5
1965	COASTAL KARNATAKA	1965	2.5	0.0	0.0	9.7	39.7	797.8	1002.5	577.2	196.8	25.1	2

unstack data columns "Months" into roles

```
_data=weather_data[
    ['JAN',
     'FEB',
     'MAR',
     'APR',
     'MAY',
     'JUN',
     'JUL',
     'AUG',
     'SEP',
     'OCT',
     'NOV',
     'DEC']]
_data.columns=['01-JAN',
 '02-FEB',
 '03-MAR',
 '04-APR',
 '05-MAY',
 '06-JUN',
 '07-JUL',
```

```
 '08-AUG',
 '09-SEP',
 '10-OCT',
 '11-NOV',
 "12-DEC"]
_data=_data.unstack().reset_index(name="value")
```

Merge the carbon and weather dataset

```
data=pd.merge(_data.sort_values(by=['YEAR','level_0']),carbon_data,left_on="YEAR",right_on="Y
 'Year',"value",
 'total_population',
 'Avg_Carbon_emmsion_per capita',
 'avg_temp_change']]
```

Data exploration

```
data.describe()
```

	Year	value	total_population	Avg_Carbon_emmsion_per capita	avg_temp_chan
count	660.000000	660.000000	660.000000	660.000000	660.0000
mean	1988.000000	292.753939	24.665035	4.807058	0.4045
std	15.886548	406.887090	0.272639	0.631570	0.4166
min	1961.000000	0.000000	24.159987	3.326700	-0.2241
25%	1974.000000	3.700000	24.432779	4.413151	0.0730
50%	1988.000000	69.800000	24.692304	4.738343	0.2815
75%	2002.000000	496.275000	24.910377	5.203349	0.8172

data split

```
test_data=data[501:]
train_data=data[:501]
```

```
header=list(train_data.columns)
target="value"
header.remove(target)
```

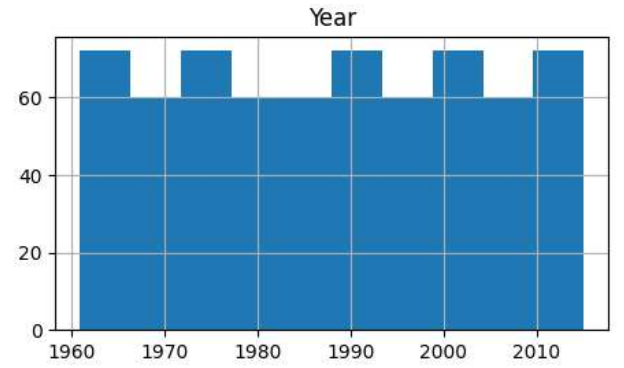
Hot Encode data

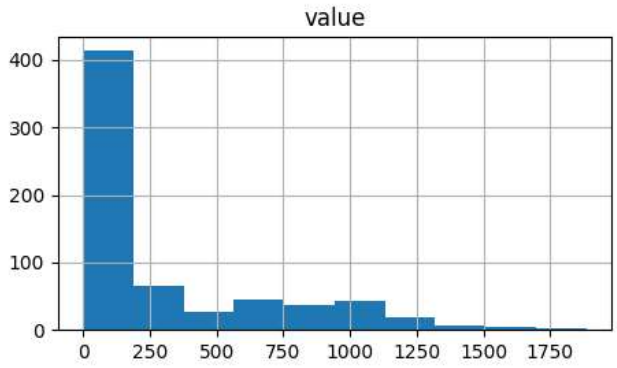
```
!pip install category_encoders
```

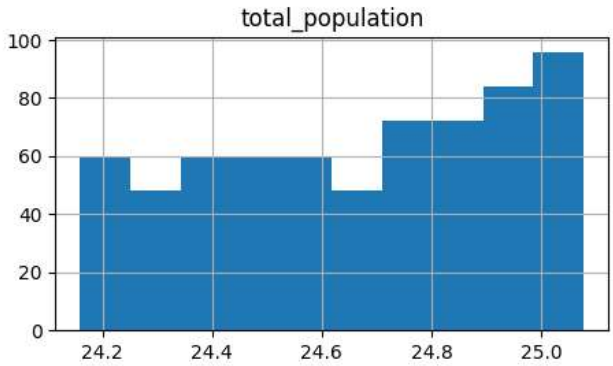
```
Collecting category_encoders
  Downloading category_encoders-2.6.3-py2.py3-none-any.whl (81 kB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 81.9/81.9 kB 2.0 MB/s eta 0:00:00
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: scikit-learn>=0.20.0 in /usr/local/lib/python3.10/dist-pa
Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.10/dist-packages (
Requirement already satisfied: statsmodels>=0.9.0 in /usr/local/lib/python3.10/dist-pack
Requirement already satisfied: pandas>=1.0.5 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: patsy>=0.5.1 in /usr/local/lib/python3.10/dist-packages (
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from pats
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-pa
Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.10/dist-package
Installing collected packages: category_encoders
Successfully installed category_encoders-2.6.3
```

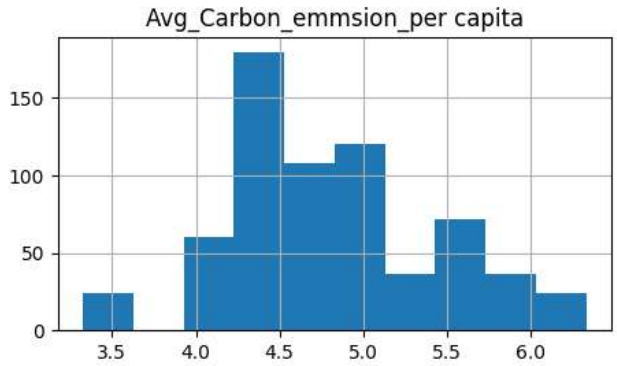
```
import category_encoders as ce
encoder=ce.OneHotEncoder()
encoder.fit(train_data[header],train_data[target])
transformed_train=encoder.transform(train_data[header])
```

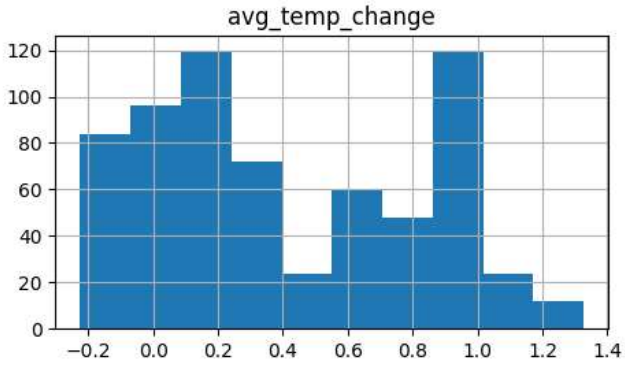
```
data.hist(figsize = (12,10))
plt.show()
```











Neutral Network Model

```
NN_model = Sequential()

# The Input Layer :
NN_model.add(Dense(32, kernel_initializer='normal',input_dim = transformed_train.shape[1], ac

# The Hidden Layers :
NN_model.add(Dense(16, kernel_initializer='normal',activation='relu'))
NN_model.add(Dense(8, kernel_initializer='normal',activation='relu'))
NN_model.add(Dense(4, kernel_initializer='normal',activation='relu'))

# The Output Layer :
NN_model.add(Dense(1, kernel_initializer='normal',activation='linear'))

# Compile the network :
```

```
NN_model.compile(loss='mean_absolute_error', optimizer='adam', metrics=['mean_absolute_error'
NN_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 32)                544

 dense_1 (Dense)             (None, 16)                528

 dense_2 (Dense)             (None, 8)                 136

 dense_3 (Dense)             (None, 4)                 36

 dense_4 (Dense)             (None, 1)                 5

=================================================================
Total params: 1249 (4.88 KB)
Trainable params: 1249 (4.88 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

Save models

```
checkpoint_name = 'Weights-{epoch:03d}--{val_loss:.5f}.hdf5'
checkpoint = ModelCheckpoint(checkpoint_name, monitor='val_loss', verbose = 1, save_best_only
callbacks_list = [checkpoint]
```

Train Model

```
NN_model.fit(transformed_train, train_data[target], epochs=800, batch_size=12, validation_spl
```

```
34/34 [==============================] - ETA: 0s - loss: 81.3306 - mean_absolute_erro
Epoch 791: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 5ms/step - loss: 81.3306 - mean_absolute_
Epoch 792/800
18/34 [==============>...............] - ETA: 0s - loss: 125.4399 - mean_absolute_er
Epoch 792: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 5ms/step - loss: 103.5617 - mean_absolute
Epoch 793/800
23/34 [===================>..........] - ETA: 0s - loss: 81.7766 - mean_absolute_erro
Epoch 793: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 4ms/step - loss: 82.4484 - mean_absolute_
Epoch 794/800
21/34 [=================>............] - ETA: 0s - loss: 85.9998 - mean_absolute_erro
Epoch 794: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 4ms/step - loss: 89.0592 - mean_absolute_
Epoch 795/800
16/34 [=============>................] - ETA: 0s - loss: 81.0849 - mean_absolute_erro
Epoch 795: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 5ms/step - loss: 82.3663 - mean_absolute_
Epoch 796/800
20/34 [================>.............] - ETA: 0s - loss: 91.7290 - mean_absolute_erro
Epoch 796: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 4ms/step - loss: 86.2677 - mean_absolute_
Epoch 797/800
20/34 [================>.............] - ETA: 0s - loss: 83.8479 - mean_absolute_erro
Epoch 797: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 4ms/step - loss: 81.6876 - mean_absolute_
Epoch 798/800
20/34 [================>.............] - ETA: 0s - loss: 88.9530 - mean_absolute_erro
Epoch 798: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 4ms/step - loss: 93.3828 - mean_absolute_
Epoch 799/800
19/34 [===============>..............] - ETA: 0s - loss: 93.4762 - mean_absolute_erro
Epoch 799: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 6ms/step - loss: 87.8402 - mean_absolute_
Epoch 800/800
17/34 [==============>...............] - ETA: 0s - loss: 78.9171 - mean_absolute_erro
Epoch 800: val_loss did not improve from 82.66892
34/34 [==============================] - 0s 6ms/step - loss: 80.8614 - mean_absolute_
<keras.src.callbacks.History at 0x7fcb0c26a350>
```

Download weights

```
from IPython.display import FileLinks
FileLinks(".")
```

```
./
  Weights-180--294.58475.hdf5
  Weights-200--291.00107.hdf5
  Weights-552--84.77763.hdf5
  Weights-202--290.49716.hdf5
  Weights-267--99.15730.hdf5
  carbon.csv
  Weights-229--142.87506.hdf5
  Weights-249--115.55874.hdf5
  Weights-382--89.30989.hdf5
  Weights-213--267.69687.hdf5
  Weights-205--289.27173.hdf5
  Weights-214--256.88132.hdf5
  Weights-183--294.25638.hdf5
  Weights-244--119.43921.hdf5
  Weights-222--174.60799.hdf5
  Weights-152--295.33643.hdf5
  Weights-476--87.80801.hdf5
  Weights-235--130.45287.hdf5
  Weights-315--91.58018.hdf5
  Weights-286--94.68541.hdf5
  Weights-346--89.47212.hdf5
  Weights-209--283.11398.hdf5
  rainfall in india 1901-2015.csv
  Weights-212--273.21863.hdf5
  Weights-178--294.74295.hdf5
  Weights-206--287.17606.hdf5
  Weights-181--294.58109.hdf5
  Weights-117--295.86172.hdf5
  Weights-223--164.22314.hdf5
  Weights-219--184.52104.hdf5
  Weights-220--178.81392.hdf5
  Weights-247--116.40198.hdf5
  Weights-221--174.84880.hdf5
  Weights-471--88.52103.hdf5
  Weights-196--292.68600.hdf5
  Weights-633--82.95525.hdf5
  Weights-553--84.71387.hdf5
  Weights-599--83.61707.hdf5
  Weights-198--291.74765.hdf5
  Weights-271--96.01743.hdf5
  Weights-124--295.84711.hdf5
  Weights-268--97.02303.hdf5
  Weights-430--89.25896.hdf5
  Weights-058--295.88062.hdf5
  Weights-227--148.77081.hdf5
  Weights-225--158.40407.hdf5
  Weights-593--83.93576.hdf5
  Weights-327--90.03574.hdf5
  Weights-506--85.02807.hdf5
  Weights-203--289.40750.hdf5
  Weights-258--100.25188.hdf5
  Weights-185--293.82654.hdf5
  Weights-477--86.10834.hdf5
  Weights-151--295.56998.hdf5
  Weights-194--292.73715.hdf5
```

Weights-003--301.33160.hdf5
Weights-191--293.16592.hdf5
Weights-250--111.13242.hdf5
Weights-004--296.07050.hdf5
Weights-144--295.58835.hdf5
Weights-216--216.42584.hdf5
Weights-210--281.24860.hdf5
Weights-458--88.89967.hdf5
Weights-193--292.90463.hdf5
Weights-513--84.92876.hdf5
Weights-208--284.96103.hdf5
Weights-318--90.53912.hdf5
Weights-517--84.79759.hdf5
Weights-207--286.27066.hdf5
Weights-130--295.64667.hdf5
Weights-189--293.77029.hdf5
Weights-234--131.03850.hdf5
Weights-739--82.66892.hdf5
Weights-240--122.34835.hdf5
Weights-252--107.75970.hdf5
Weights-201--290.49924.hdf5
Weights-184--294.19699.hdf5
Weights-197--292.10092.hdf5
Weights-158--295.09833.hdf5
Weights-002--309.83258.hdf5
Weights-280--95.89721.hdf5
Weights-215--233.72586.hdf5
Weights-001--311.00473.hdf5
Weights-170--294.77328.hdf5
Weights-285--94.97563.hdf5
Weights-455--89.07556.hdf5
Weights-199--291.12234.hdf5
Weights-237--126.16482.hdf5
Weights-211--278.34723.hdf5
Weights-126--295.77954.hdf5
Weights-190--293.72400.hdf5
Weights-293--93.60370.hdf5

./.config/

.last_survey_prompt.yaml
active_config
default_configs.db
gce
.last_opt_in_prompt.yaml
.last_update_check.json
config_sentinel

./.config/configurations/

config_default

./.config/logs/2023.11.03/

18.00.39.484927.log
18.00.06.856125.log
18.00.18.330056.log
18.00.27.780630.log
17.59.39.197392.log
18.00.40.388891.log

./sample_data/

anscombe.json

Predict this month's rainfall

```
NN_model.predict(np.array([[0,0 ,0, 0,  0,  0,  1,  0,  0,  0,  0,  0,  2021,   24.910377,  4
```

```
1/1 [==============================] - 0s 66ms/step
1128.2424
```

Predict Next month's rainfall

```
NN_model.predict(np.array([[0,0 ,0, 0,  0,  0,  0,  1,  0,  0,  0,  0,  2021,   24.910377,  4
```

```
1/1 [==============================] - 0s 19ms/step
805.1434
```