In [310]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

%matplotlib notebook

import seaborn as sns
```

In [311]:
```
plt.style.use("seaborn-colorblind")
```

In [312]:
```
data = pd.read_csv("C:/Users/VARUN/Desktop/AirPollution/Dataset/cpcb_dly_aq_tamil_nadu-2010.csv")
```

In [313]:
```
data.head()
```

Out[313]:

	Stn Code	Sampling Date	State	City/Town/Village/Area	Location of Monitoring Station	Agency	Type of Location	SO2	NO2	RSPM/PM10	SPM
0	38	1/5/2010	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	9.60	17.166667	73.333333	149.666667
1	38	1/7/2010	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	11.15	20.283333	61.333333	150.333333
2	38	1/12/2010	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12.45	20.516667	75.000000	114.666667
3	38	19-01-10	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	10.75	18.183333	120.000000	197.666667
4	38	21-01-10	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	9.78	17.320000	96.500000	216.000000

In [314]:
```
dates = ['-'.join(i.split('-')[1:]) for i in data['Sampling Date']]
```

In [315]:
```
data['Sampling Date'] = dates
```

In [316]:
```
for i in range(len(data['City/Town/Village/Area'])):
    if data['City/Town/Village/Area'][i] != 'Chennai':
        data.drop(i, inplace = True)
```

In [317]:
```
data.head()
```

Out[317]:

	Stn Code	Sampling Date	State	City/Town/Village/Area	Location of Monitoring Station	Agency	Type of Location	SO2	NO2	RSPM/PM10	SPM
0	38		Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	9.60	17.166667	73.333333	149.666667
1	38		Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	11.15	20.283333	61.333333	150.333333
2	38		Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12.45	20.516667	75.000000	114.666667
3	38	01-10	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	10.75	18.183333	120.000000	197.666667
4	38	01-10	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	9.78	17.320000	96.500000	216.000000

In [318]:
```
data = data.groupby("Sampling Date").mean().drop("SPM", axis=1)
data
```

Out[318]:

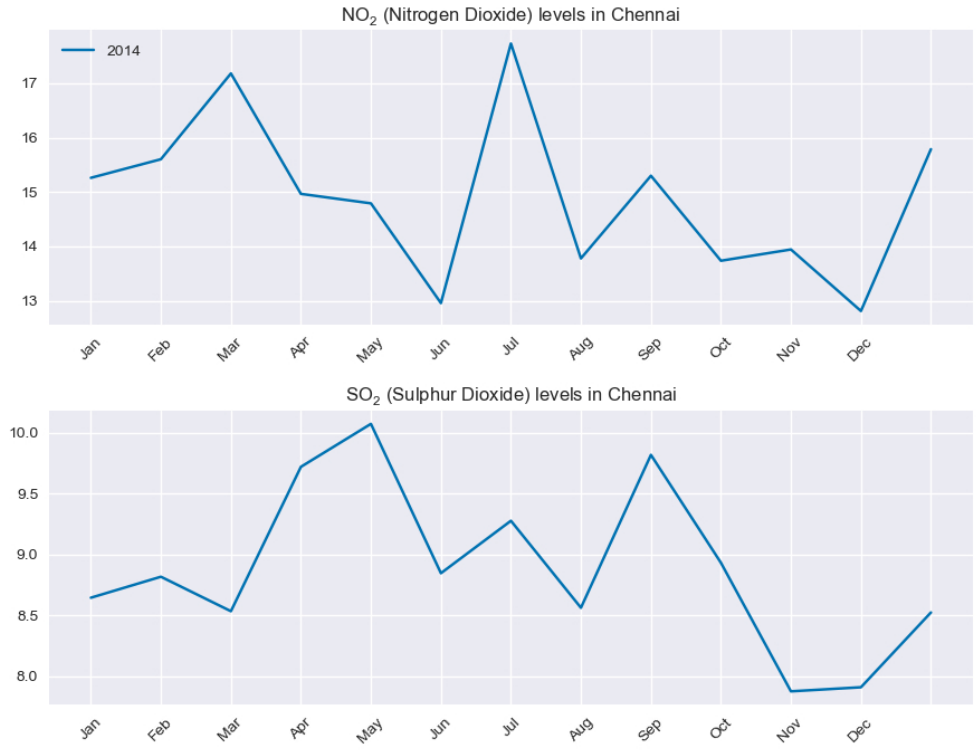
Sampling Date	Stn Code	SO2	NO2	RSPM/PM10
	110.711297	8.643460	15.260359	59.258403
01-10	109.521739	8.815797	15.602319	96.050725
02-10	112.120000	8.532667	17.179667	62.920000
03-10	107.192308	9.718590	14.965385	62.692308
04-10	107.838710	10.071505	14.791398	38.354839
05-10	112.620690	8.844943	12.957126	47.160920
06-10	102.461538	9.275385	17.729744	57.980769
07-10	101.206897	8.560920	13.778736	60.172414
08-10	104.592593	9.816667	15.298765	52.253086
09-10	108.272727	8.930455	13.735859	40.035354
10-10	110.500000	7.874479	13.942969	87.015625
11-10	111.185185	7.908025	12.811728	61.364198
12-10	107.242424	8.522396	15.786979	53.166667

In [245]:
```
plt.figure(figsize=(9, 7))
plt.subplot(211)
```

```
plt.subplot(211)
plt.cla()
plotter = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun','Jul', 'Aug', 'Sep',
           'Oct', 'Nov', 'Dec']
x = np.arange(0,len(data["NO2"]),1)
ax = plt.gca()
ax.plot(x, data["NO2"])
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.set_xticks(x)
plt.xticks(rotation=45)
plt.subplots_adjust(bottom=0.2)
plt.legend([2014],loc=2)
plt.title("$\mathregular{NO_2}$ (Nitrogen Dioxide) levels in Chennai")
ax.set_xticklabels(plotter)

plt.subplot(212)
plt.cla()
plotter = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun','Jul', 'Aug', 'Sep',
           'Oct', 'Nov', 'Dec']
x = np.arange(0,len(data["SO2"]),1)
ax = plt.gca()
ax.plot(x, data["SO2"])
ax.spines['top'].set_visible(False)
ax.spines['right'].set_visible(False)
ax.set_xticks(x)
plt.xticks(rotation=45)
plt.title("$\mathregular{SO_2}$ (Sulphur Dioxide) levels in Chennai")
ax.set_xticklabels(plotter)

plt.tight_layout()
#plt.show()
```



In [319]:
```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
```

In [320]:
```
forecast_len = 3
x=np.array(data.drop(['NO2'],1))
x=x[:-forecast_len]

y=np.array(data['NO2'])
y=y[:-forecast_len]
```

In [321]:
```
sc = MinMaxScaler(feature_range=(0,1))
x = sc.fit_transform(x)


x_train = []
y_train = []
for i in range(3,10):
    x_train.append(x[i-3:i,0])
    y_train.append(x[i,0])
```

In [322]:
```
x=np.array(data.drop(['NO2'],1))
x=x[:-forecast_len]

y=np.array(data['NO2'])
y=y[:-forecast_len]
```

```
#x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2)

x_train,y_train = np.array(x_train),np.array(y_train)

x_train = np.reshape(x_train, (x_train.shape[0], x_train.shape[1], 1))
```

In [323]:
```
model = tf.keras.models.Sequential([
    tf.keras.layers.LSTM(128,return_sequences=True , input_shape = (x_train.shape[1],1)),
    tf.keras.layers.Dropout(0.5),
    tf.keras.layers.LSTM(256,return_sequences=True),
    tf.keras.layers.Dropout(0.4),
    tf.keras.layers.LSTM(256,return_sequences=True),
    tf.keras.layers.Dropout(0.3),
    tf.keras.layers.LSTM(64),
    tf.keras.layers.Dropout(0.2),
    tf.keras.layers.Dense(1)
])
```

In [324]:
```
model.compile(optimizer = 'adam',
              loss = 'mean_squared_error',
              metrics=['accuracy'])
```

In [325]:
```
model.summary()
```

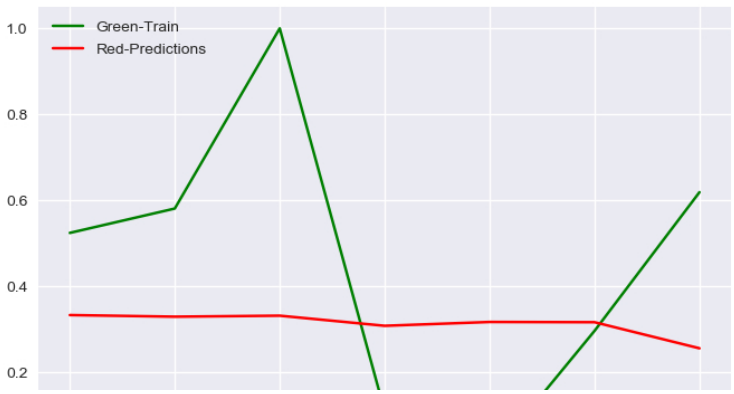
```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
lstm_72 (LSTM)               (None, 3, 128)            66560
_________________________________________________________________
dropout_72 (Dropout)         (None, 3, 128)            0
_________________________________________________________________
lstm_73 (LSTM)               (None, 3, 256)            394240
_________________________________________________________________
dropout_73 (Dropout)         (None, 3, 256)            0
_________________________________________________________________
lstm_74 (LSTM)               (None, 3, 256)            525312
_________________________________________________________________
dropout_74 (Dropout)         (None, 3, 256)            0
_________________________________________________________________
lstm_75 (LSTM)               (None, 64)                82176
_________________________________________________________________
dropout_75 (Dropout)         (None, 64)                0
_________________________________________________________________
dense_18 (Dense)             (None, 1)                 65
=================================================================
Total params: 1,068,353
Trainable params: 1,068,353
Non-trainable params: 0
_________________________________________________________________
```

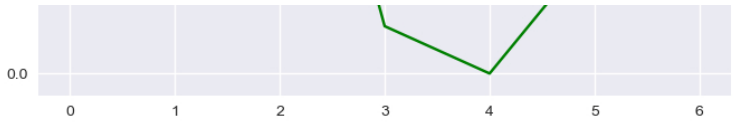
In [326]:
```
history = model.fit(x_train,y_train,epochs=10,batch_size = 1)
```

```
Epoch 1/10
7/7 [==============================] - 15s 2s/step - loss: 0.2912 - acc: 0.1429
Epoch 2/10
7/7 [==============================] - 1s 164ms/step - loss: 0.1860 - acc: 0.1429
Epoch 3/10
7/7 [==============================] - 1s 160ms/step - loss: 0.1031 - acc: 0.2857
Epoch 4/10
7/7 [==============================] - 1s 184ms/step - loss: 0.1134 - acc: 0.1429
Epoch 5/10
7/7 [==============================] - 1s 160ms/step - loss: 0.1012 - acc: 0.1429
Epoch 6/10
7/7 [==============================] - 1s 152ms/step - loss: 0.1151 - acc: 0.1429
Epoch 7/10
7/7 [==============================] - 1s 152ms/step - loss: 0.1122 - acc: 0.1429
Epoch 8/10
7/7 [==============================] - 1s 152ms/step - loss: 0.1465 - acc: 0.0000e+00
Epoch 9/10
7/7 [==============================] - 1s 152ms/step - loss: 0.0882 - acc: 0.1429
Epoch 10/10
7/7 [==============================] - 1s 173ms/step - loss: 0.1236 - acc: 0.1429
```

In [327]:
```
predictions = model.predict(x_train)
```

In [309]:
```
plt.plot(range(len(x_train)), y_train, c='g')
plt.plot(range(len(x_train)), predictions, c='r')
plt.legend(['Green-Train', 'Red-Predictions'], loc='upper left')
```





Out[309]: <matplotlib.legend.Legend at 0x133194556d8>

In [ ]: