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Motivation

Try to understand the factors affecting the spreading of Covid-19 and why it's spreading more in some countries than others.

And the factors affecting increase or decrease in the number of daily cases in a country

Class 1

Exponential equation is $f(x) = A \cdot e^{b * x}$ where x is the number of days since pandemic started and y is the number of daily cases

Egypt Model

Data taken from March 22 till May 10

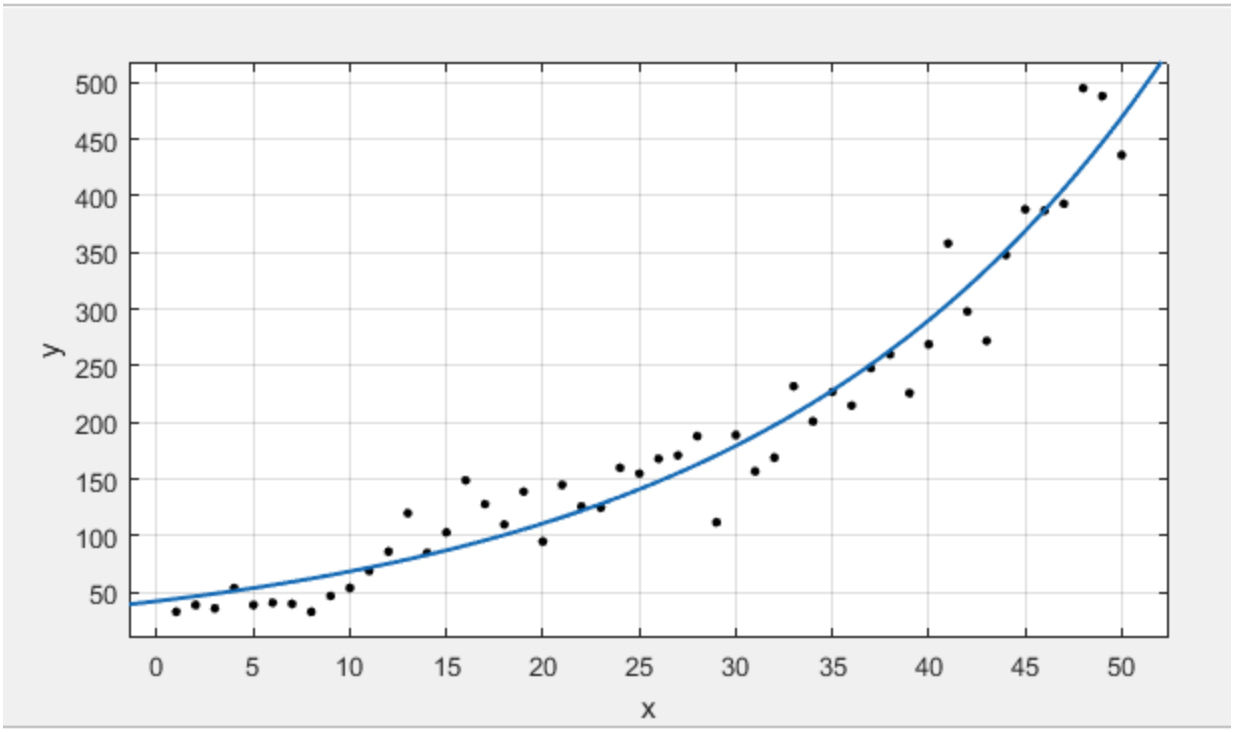
	A	B
1	Number of days since march 22	Daily cases
2	1	33
3	2	39
4	3	36
5	4	54
6	5	39
7	6	41
8	7	40
9	8	33
10	9	47
11	10	54
12	11	69
13	12	86
14	13	120
15	14	85
16	15	103
17	16	149
18	17	128
19	18	110

39	38	260
40	39	226
41	40	269
42	41	358
43	42	298
44	43	272
45	44	348
46	45	388
47	46	387
48	47	393
49	48	495
50	49	488
51	50	436
52		

Exponential curve fitting

Base model

A = 42.43, b = 0.048, sum squared error = 0.0003861


500
450
400
350
300
250
200
150
100
50
y
0
5
10
15
20
25
30
35
40
45
50
x

Italy Model

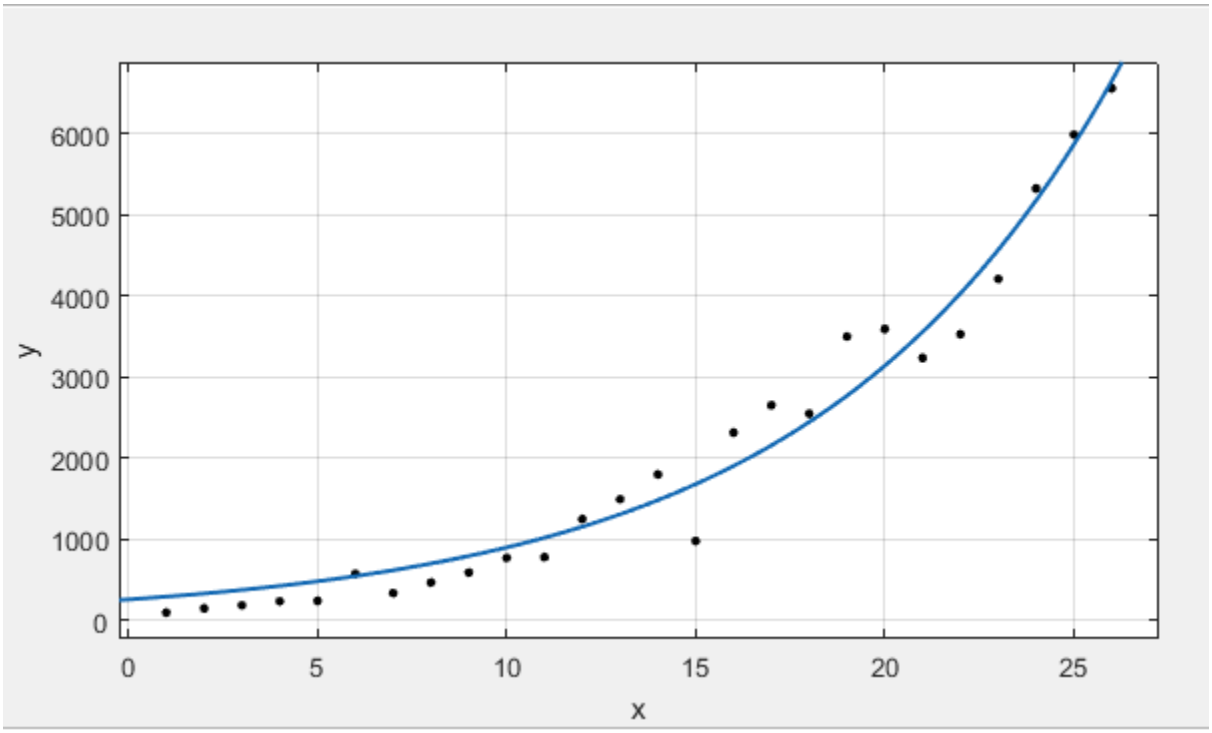
Data taken from February 25 till March 21

D	E
number of days from feb 25	daily cases
1	94
2	147
3	185
4	234
5	239
6	573
7	335
8	466
9	587
10	769
11	778
12	1247
13	1492
14	1797
15	977
16	2313
17	2651
18	2547
19	3497
20	3590
21	3233
22	3526
23	4207
24	5322
25	5986
26	6557

Exponential curve fitting

Base model

A = 256.8, b = 0.125, sum squared error = 0.00000278



Results

Couldn’t find any external factors that actually affect the increase or decrease in the number of daily cases

It was random in my opinion and doesn’t depend on a specific environmental daily factor in any of the two countries

Class 2

Total cases

Factors chosen:

1-Total population: chose total population instead of population density because some countries like Russia have very low population density as some areas are uninhabitable because it is frozen tundra but it is top 10 country in the total cases.

Same for the US which have relatively low population density but is the highest total cases country

2-GDP/capita: because it represents how strong the economy of the country and this would attract people to visit the country which lead to more spreading

3-Average temperature in April: because of African countries which have high population and relatively high GDP/capita but very small total cases

Training Data collected on April 25

	A	B	C	D	E	F
1	**country**	**Tot population**	**GDP capita**	**April Average temp**	**Total cases**	
2	USA	331,002,651	59,939	10.6	960,896	
3	mexico	128,932,753	9,224	25.9	13,842	
4	uk	67,886,011	39,532	9.7	148,377	
5	belgium	11,589,623	43,325	8.9	46,134	
6	netherlands	17,134,872	48,796	6	37,845	
7	spain	46,754,778	28,175	14.6	223,759	
8	ireland	4,937,786	69,727	8.2	18,561	
9	sweden	10,099,265	54,075	5	18,640	
10	Austria	9,006,398	47,261	10	15,225	
11	Panama	4,314,767	15,166	20	5,538	
12	Slovenia	2,078,938	23,488	10	1,396	
13	qatar	2,881,053	61,264	26.1	10,287	
14	Ghana	31,072,940	2,026	27.4	1,550	

Neural network Model Training

```
# %% [code]
import keras
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)


import os
df = pd.read_csv('../input/total cases.csv')

df.head()

# Any results you write to the current directory are saved as output.

# %% [code]

X = df[['Tot population', 'GDP capita', 'April Average temp']]
Y = df[['Total cases']]

# %% [code]
model = keras.Sequential()
model.add(keras.layers.Dense(32, activation='relu', input_shape=(3,)))
model.add(keras.layers.Dense(32, activation='relu'))
model.add(keras.layers.Dense(32, activation='relu'))
model.add(keras.layers.Dense(32, activation='relu'))
model.add(keras.layers.Dense(32, activation='relu'))
model.add(keras.layers.Dense(32, activation='relu'))

model.add(keras.layers.Dense(1))

model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])


# %% [code]
model.fit(X, Y, epochs=20, callbacks=[keras.callbacks.EarlyStopping(patience=5)])

# %% [code]
test_data = np.array([331002651, 59939, 10.6])
print(model.predict(test_data.reshape(1,3), batch_size=1))                    # numbers for USA
```

Prediction Code for test Countries

```
import keras
import tensorflow as tf
from time import sleep
from keras.utils import to_categorical
from keras.models import Sequential
from keras.layers import Dense,Conv2D,MaxPool2D,Dropout,Flatten,BatchNormalization,MaxPooling2D,Activation
from keras.optimizers import RMSprop,Adam
from tensorflow.keras.callbacks import EarlyStopping
from keras import backend as k# Input data files are available in the "../input/" directory.
# For example, running this (by clicking run or pressing Shift+Enter) will list all files under the input directory

model = tf.keras.models.load_model('../input/thirdmodel/model3.h5')


italy = np.array([60461826, 32038, 13.7])     # italy numbers
france = np.array([65273511, 39827, 10.8])     # france numbers
portugal = np.array([10196709, 21316, 13.3])     # portugal numbers
egypt = np.array([102334404, 2441, 20.7])     # egypt numbers
singapore = np.array([5850342, 56746, 27.2])     # singapore numbers
switzerland = np.array([8654622, 80296, 8.6])     # switzerland numbers
bangladesh = np.array([164689383, 1564, 29])     # bangladesh numbers
bosnia = np.array([3280819, 5387, 9.9])     # bosnia numbers

print("preidcted numbers for Italy is",int(model.predict(italy.reshape(1,3), batch_size=1)))
print("preidcted numbers for France is",int(model.predict(france.reshape(1,3), batch_size=1)))
print("preidcted numbers for portugal is",int(model.predict(portugal.reshape(1,3), batch_size=1)))
print("preidcted numbers for egypt is",int(model.predict(egypt.reshape(1,3), batch_size=1)))
print("preidcted numbers for singapore is",int(model.predict(singapore.reshape(1,3), batch_size=1)))
print("preidcted numbers for switzerland is",int(model.predict(switzerland.reshape(1,3), batch_size=1)))
print("preidcted numbers for bangladesh is",int(model.predict(bangladesh.reshape(1,3), batch_size=1)))
print("preidcted numbers for bosnia is",int(model.predict(bosnia.reshape(1,3), batch_size=1)))
```

```
preidcted numbers for Italy is 174882
preidcted numbers for France is 188515
preidcted numbers for portugal is 28633
preidcted numbers for egypt is 298793
preidcted numbers for singapore is 14024
preidcted numbers for switzerland is 20942
preidcted numbers for bangladesh is 480983
preidcted numbers for bosnia is 9292
```

Comparing Prediction data with the actual data on the test Countries

Test Countries	Tot population	GDP /capita	April Average temp	Total cases	Prediction from Model
italy	60,461,826	32,038	13.7	195,351	174,882
france	65,273,511	39,827	10.8	161,488	188,515
portugal	10,196,709	21,316	13.3	23,864	28,633
Egypt	102,334,404	2,441	20.7	4,319	298,793
singapore	5,850,342	56,746	27.2	13,624	14,024
switzerland	8,654,622	80,296	8.6	28,894	20,942
bangladesh	164,689,383	1,564	29	5,416	480,983
Bosnia	3,280,819	5,387	9.9	1,516	9,292

Comments

From the results it looks like the Model gave the highest weight of prediction to the Total number of population in the country.

So model did well in predicting total cases with countries that have high population and high cases or countries with low population and low cases.

But did poorly for countries that had very high population numbers but low actual cases like Egypt and Bangladesh. That's because it gave the highest weight on the population number of the country

More data would be better of course to cover all the cases for training.