covid-19-analysis-1

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PROJECT NAME : Coronavirus (COVID-19) Visualization & Prediction Analysis.

Coronavirus (COVID-19) Visualization & Prediction

Coronavirus is a family of viruses that are named after their spiky crown. The novel coronavirus, also known as SARS-CoV-2, is a contagious respiratory virus that first reported in Wuhan, China. On 2/11/2020, the World Health Organization designated the name COVID-19 for the disease caused by the novel coronavirus. This notebook aims at exploring COVID-19 through data analysis and projections.

[6]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import matplotlib.colors as mcolors
import random
import math
import time
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.svm import SVR
from sklearn.preprocessing import PolynomialFeatures
from sklearn.metrics import mean_squared_error,mean_absolute_error
import datetime
import operator
plt.style.use('fivethirtyeight')
%matplotlib inline
```

[7]:
```
confirmed_cases = pd.read_csv('https://raw.githubusercontent.com/CSSEGISandData/
↪COVID-19/master/csse_covid_19_data/csse_covid_19_time_series/
↪time_series_covid19_confirmed_global.csv')
```

[8]:
```
confirmed_cases.head()
```

[8]:
```
  Province/State Country/Region       Lat       Long  1/22/20  1/23/20  \
0            NaN    Afghanistan  33.93911  67.709953        0        0
1            NaN        Albania  41.15330  20.168300        0        0
2            NaN        Algeria  28.03390   1.659600        0        0
```

```
3            NaN        Andorra  42.50630   1.521800        0        0
4            NaN         Angola -11.20270  17.873900        0        0

   1/24/20  1/25/20  1/26/20  1/27/20  …  2/28/23  3/1/23  3/2/23  3/3/23  \
0        0        0        0        0  …   209322  209340  209358  209362
1        0        0        0        0  …   334391  334408  334408  334427
2        0        0        0        0  …   271441  271448  271463  271469
3        0        0        0        0  …    47866   47875   47875   47875
4        0        0        0        0  …   105255  105277  105277  105277

   3/4/23  3/5/23  3/6/23  3/7/23  3/8/23  3/9/23
0  209369  209390  209406  209436  209451  209451
1  334427  334427  334427  334427  334443  334457
2  271469  271477  271477  271490  271494  271496
3   47875   47875   47875   47875   47890   47890
4  105277  105277  105277  105277  105288  105288

[5 rows x 1147 columns]
```

[9]:
```
death_reported = pd.read_csv('https://raw.githubusercontent.com/CSSEGISandData/
↪COVID-19/master/csse_covid_19_data/csse_covid_19_time_series/
↪time_series_covid19_deaths_global.csv')
```

[10]:
```
death_reported.head()
```

[10]:
```
  Province/State Country/Region       Lat       Long  1/22/20  1/23/20  \
0            NaN    Afghanistan  33.93911  67.709953        0        0
1            NaN        Albania  41.15330  20.168300        0        0
2            NaN        Algeria  28.03390   1.659600        0        0
3            NaN        Andorra  42.50630   1.521800        0        0
4            NaN         Angola -11.20270  17.873900        0        0

   1/24/20  1/25/20  1/26/20  1/27/20  …  2/28/23  3/1/23  3/2/23  3/3/23  \
0        0        0        0        0  …     7896    7896    7896    7896
1        0        0        0        0  …     3598    3598    3598    3598
2        0        0        0        0  …     6881    6881    6881    6881
3        0        0        0        0  …      165     165     165     165
4        0        0        0        0  …     1933    1933    1933    1933

   3/4/23  3/5/23  3/6/23  3/7/23  3/8/23  3/9/23
0    7896    7896    7896    7896    7896    7896
1    3598    3598    3598    3598    3598    3598
2    6881    6881    6881    6881    6881    6881
3     165     165     165     165     165     165
4    1933    1933    1933    1933    1933    1933

[5 rows x 1147 columns]
```

[11]:
```
recovered_cases = pd.read_csv('https://raw.githubusercontent.com/CSSEGISandData/
↪COVID-19/master/csse_covid_19_data/csse_covid_19_time_series/
↪time_series_covid19_recovered_global.csv')
```

[12]:
```
recovered_cases.head()
```

[12]:
```
  Province/State Country/Region       Lat       Long  1/22/20  1/23/20  \
0            NaN    Afghanistan  33.93911  67.709953        0        0
1            NaN        Albania  41.15330  20.168300        0        0
2            NaN        Algeria  28.03390   1.659600        0        0
3            NaN        Andorra  42.50630   1.521800        0        0
4            NaN         Angola -11.20270  17.873900        0        0

   1/24/20  1/25/20  1/26/20  1/27/20  …  2/28/23  3/1/23  3/2/23  3/3/23  \
0        0        0        0        0  …        0       0       0       0
1        0        0        0        0  …        0       0       0       0
2        0        0        0        0  …        0       0       0       0
3        0        0        0        0  …        0       0       0       0
4        0        0        0        0  …        0       0       0       0

   3/4/23  3/5/23  3/6/23  3/7/23  3/8/23  3/9/23
0       0       0       0       0       0       0
1       0       0       0       0       0       0
2       0       0       0       0       0       0
3       0       0       0       0       0       0
4       0       0       0       0       0       0

[5 rows x 1147 columns]
```

[13]:
```
latest_data = pd.read_csv('https://raw.githubusercontent.com/CSSEGISandData/
↪COVID-19/master/csse_covid_19_data/csse_covid_19_daily_reports/12-31-2020.
↪csv')
```

[14]:
```
latest_data.head()
```

[14]:
```
   FIPS Admin2 Province_State Country_Region          Last_Update       Lat  \
0   NaN    NaN            NaN    Afghanistan  2021-01-01 05:23:07  33.93911
1   NaN    NaN            NaN        Albania  2021-01-01 05:23:07  41.15330
2   NaN    NaN            NaN        Algeria  2021-01-01 05:23:07  28.03390
3   NaN    NaN            NaN        Andorra  2021-01-01 05:23:07  42.50630
4   NaN    NaN            NaN         Angola  2021-01-01 05:23:07 -11.20270

       Long_  Confirmed  Deaths  Recovered  Active Combined_Key  \
0  67.709953      52330    2189      41727    8414  Afghanistan
1  20.168300      58316    1181      33634   23501      Albania
2   1.659600      99610    2756      67127   29727      Algeria
3   1.521800       8049      84       7432     533      Andorra
```

```
4  17.873900      17553     405      11044    6104       Angola

   Incident_Rate  Case_Fatality_Ratio
0     134.426484             4.183069
1    2026.409062             2.025173
2     227.155372             2.766790
3   10417.394681             1.043608
4      53.407342             2.307298
```

[15]:
```python
#fetching all the columns from confirmed dataset
cols = confirmed_cases.keys()
cols
```

[15]:
```
Index(['Province/State', 'Country/Region', 'Lat', 'Long', '1/22/20', '1/23/20',
       '1/24/20', '1/25/20', '1/26/20', '1/27/20',
       …
       '2/28/23', '3/1/23', '3/2/23', '3/3/23', '3/4/23', '3/5/23', '3/6/23',
       '3/7/23', '3/8/23', '3/9/23'],
      dtype='object', length=1147)
```

[16]:
```python
#extracting the date columns
confirmed = confirmed_cases.loc[:, cols[4]:cols[-1]]
deaths = death_reported.loc[:, cols[4]:cols[-1]]
recoveries = recovered_cases.loc[:, cols[4]:cols[-1]]
```

[17]:
```python
confirmed
```

[17]:
```
     1/22/20  1/23/20  1/24/20  1/25/20  1/26/20  1/27/20  1/28/20  1/29/20  \
0          0        0        0        0        0        0        0        0
1          0        0        0        0        0        0        0        0
2          0        0        0        0        0        0        0        0
3          0        0        0        0        0        0        0        0
4          0        0        0        0        0        0        0        0
..       …        …        …        …        …        …        …        …
284        0        0        0        0        0        0        0        0
285        0        0        0        0        0        0        0        0
286        0        0        0        0        0        0        0        0
287        0        0        0        0        0        0        0        0
288        0        0        0        0        0        0        0        0

     1/30/20  1/31/20  …  2/28/23  3/1/23  3/2/23  3/3/23  3/4/23  3/5/23  \
0          0        0  …   209322  209340  209358  209362  209369  209390
1          0        0  …   334391  334408  334408  334427  334427  334427
2          0        0  …   271441  271448  271463  271469  271469  271477
3          0        0  …    47866   47875   47875   47875   47875   47875
4          0        0  …   105255  105277  105277  105277  105277  105277
..       …        …  …       …       …       …       …       …       …
```

```
284        0        0  …   703228  703228  703228  703228  703228  703228
285        0        0  …      535     535     535     535     535     535
286        0        0  …    11945   11945   11945   11945   11945   11945
287        0        0  …   343012  343012  343079  343079  343079  343135
288        0        0  …   263921  264127  264127  264127  264127  264127

     3/6/23  3/7/23  3/8/23  3/9/23
0    209406  209436  209451  209451
1    334427  334427  334443  334457
2    271477  271490  271494  271496
3     47875   47875   47890   47890
4    105277  105277  105288  105288
..      …       …       …       …
284  703228  703228  703228  703228
285     535     535     535     535
286   11945   11945   11945   11945
287  343135  343135  343135  343135
288  264127  264127  264276  264276

[289 rows x 1143 columns]
```

[18]:
```
dates = confirmed.keys()
world_cases = []
total_deaths = []
mortality_rate = []
total_recovered = []
total_active = []
recovery_rate = []

china_cases = []
china_deaths = []
china_recoveries = []
china_active = []

india_cases = []
india_deaths = []
india_recoveries = []
india_active = []

italy_cases = []
italy_deaths = []
italy_recoveries = []
italy_active = []

us_cases = []
us_deaths = []
us_recoveries = []
```

```
us_active = []

spain_cases = []
spain_deaths = []
spain_recoveries = []
spain_active = []

france_cases = []
france_deaths = []
france_recoveries = []
france_active = []

germany_cases = []
germany_deaths = []
germany_recoveries = []
germany_active = []

uk_cases = []
uk_deaths = []
uk_recoveries = []
uk_active = []

russia_cases = []
russia_deaths = []
russia_recoveries = []
russia_active = []
```

[19]:
```
for i in dates:
  confirmed_sum = confirmed[i].sum()
  death_sum = deaths[i].sum()
  recovered_sum = recoveries[i].sum()

  world_cases.append(confirmed_sum)
  total_deaths.append(death_sum)
  total_recovered.append(recovered_sum)
  mortality_rate.append(death_sum/confirmed_sum)
  recovery_rate.append(recovered_sum/confirmed_sum)
  total_active.append(confirmed_sum-death_sum-recovered_sum)

  china_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='China'][i].sum())
  china_deaths.append(death_reported[death_reported['Country/
↪Region']=='China'][i].sum())
  china_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='China'][i].sum())
```

```
china_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='China'][i].sum()-death_reported[death_reported['Country/
↪Region']=='China'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='China'][i].sum())
india_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='India'][i].sum())
india_deaths.append(death_reported[death_reported['Country/
↪Region']=='India'][i].sum())
india_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='India'][i].sum())
india_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='India'][i].sum()-death_reported[death_reported['Country/
↪Region']=='India'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='India'][i].sum())
italy_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Italy'][i].sum())
italy_deaths.append(death_reported[death_reported['Country/
↪Region']=='Italy'][i].sum())
italy_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='Italy'][i].sum())
italy_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Italy'][i].sum()-death_reported[death_reported['Country/
↪Region']=='Italy'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='Italy'][i].sum())
us_cases.append(confirmed_cases[confirmed_cases['Country/Region']=='US'][i].
↪sum())
us_deaths.append(death_reported[death_reported['Country/Region']=='US'][i].
↪sum())
us_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='US'][i].sum())
us_active.append(confirmed_cases[confirmed_cases['Country/Region']=='US'][i].
↪sum()-death_reported[death_reported['Country/Region']=='US'][i].
↪sum()-recovered_cases[recovered_cases['Country/Region']=='US'][i].sum())
spain_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Spain'][i].sum())
spain_deaths.append(death_reported[death_reported['Country/
↪Region']=='Spain'][i].sum())
spain_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='Spain'][i].sum())
spain_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Spain'][i].sum()-death_reported[death_reported['Country/
↪Region']=='Spain'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='Spain'][i].sum())
france_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='France'][i].sum())
```

```
 france_deaths.append(death_reported[death_reported['Country/
↪Region']=='France'][i].sum())
 france_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='France'][i].sum())
 france_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='France'][i].sum()-death_reported[death_reported['Country/
↪Region']=='France'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='France'][i].sum())
 germany_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Germany'][i].sum())
 germany_deaths.append(death_reported[death_reported['Country/
↪Region']=='Germany'][i].sum())
 germany_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='Germany'][i].sum())
 germany_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Germany'][i].sum()-death_reported[death_reported['Country/
↪Region']=='Germany'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='Germany'][i].sum())
 uk_cases.append(confirmed_cases[confirmed_cases['Country/Region']=='United␣
↪Kingdom'][i].sum())
 uk_deaths.append(death_reported[death_reported['Country/Region']=='United␣
↪Kingdom'][i].sum())
 uk_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='United Kingdom'][i].sum())
 uk_active.append(confirmed_cases[confirmed_cases['Country/Region']=='United␣
↪Kingdom'][i].sum()-death_reported[death_reported['Country/Region']=='United␣
↪Kingdom'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='United Kingdom'][i].sum())
 russia_active.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Russia'][i].sum()-death_reported[death_reported['Country/
↪Region']=='Russia'][i].sum()-recovered_cases[recovered_cases['Country/
↪Region']=='Russia'][i].sum())
 russia_cases.append(confirmed_cases[confirmed_cases['Country/
↪Region']=='Russia'][i].sum())
 russia_deaths.append(death_reported[death_reported['Country/
↪Region']=='Russia'][i].sum())
 russia_recoveries.append(recovered_cases[recovered_cases['Country/
↪Region']=='Russia'][i].sum())
```

[20]:
```
world_cases
```

[20]:
```
[557,
 657,
 944,
 1437,
 2120,
```

2929,
5580,
6169,
8237,
9927,
12038,
16787,
19887,
23899,
27644,
30806,
34400,
37131,
40162,
42771,
44814,
45232,
60384,
66912,
69055,
71238,
73273,
75155,
75655,
76216,
76846,
78608,
78990,
79558,
80412,
81384,
82728,
84152,
86023,
88402,
90382,
92994,
95338,
98078,
102062,
106199,
109997,
114292,
119051,
126527,
133283,
146477,

157365,
168598,
183165,
198339,
215900,
242987,
272517,
304944,
339156,
381711,
423594,
475075,
535889,
599820,
669402,
725918,
790929,
869371,
955728,
1038176,
1122386,
1182507,
1254222,
1328948,
1397886,
1480062,
1567243,
1653665,
1729180,
1847761,
1919593,
2004226,
2082482,
2176950,
2264830,
2343082,
2419404,
2495886,
2571973,
2654011,
2736728,
2820291,
2903496,
2974291,
3045275,
3121107,
3198435,

3282087,
3371033,
3449295,
3523292,
3600929,
3680614,
3771036,
3860174,
3950657,
4035000,
4110223,
4186364,
4271644,
4355992,
4451634,
4547536,
4641426,
4719789,
4808921,
4904739,
5010162,
5116135,
5223477,
5327627,
5420843,
5509066,
5601428,
5703984,
5823977,
5945413,
6080456,
6183316,
6283580,
6406221,
6517437,
6655667,
6789073,
6918403,
7029415,
7132463,
7258445,
7395607,
7531793,
7659267,
7793175,
7925122,
8050034,

8193933,
8337135,
8480229,
8661225,
8847108,
8940170,
9082502,
9250625,
9422061,
9601576,
9794066,
9970478,
10138935,
10291617,
10475388,
10690516,
10895486,
11098124,
11287838,
11474058,
11642331,
11851900,
12067186,
12291782,
12524663,
12737483,
12930415,
13124893,
13345920,
13575706,
13820618,
14058038,
14293379,
14505270,
14713414,
14956435,
15231791,
15511422,
15794928,
16044485,
16256294,
16490680,
16754567,
17024801,
17306582,
17594044,
17840315,

18070926,
18276983,
18542287,
18817443,
19104145,
19386579,
19651806,
19884801,
20118013,
20383576,
20658646,
20948740,
21255813,
21504839,
21714880,
21927762,
22187166,
22464640,
22736119,
22998072,
23261601,
23464360,
23692460,
23937668,
24219359,
24506622,
24790561,
25051295,
25271033,
25535340,
25802224,
26084114,
26369544,
26671276,
26944997,
27173995,
27391278,
27637790,
27923100,
28227493,
28543855,
28832580,
29081415,
29348555,
29629107,
29934059,
30249632,

30576278,
30869397,
31124526,
31384435,
31668754,
31980407,
32301360,
32631974,
32918085,
33165079,
33426328,
33709128,
34033675,
34352787,
34682292,
34979647,
35240179,
35551524,
35867647,
36216841,
36576162,
36936565,
37292089,
37581583,
37871608,
38190980,
38571764,
38978760,
39389280,
39761413,
40092656,
40467606,
40856480,
41296091,
41778168,
42272069,
42728414,
43087247,
43570291,
44038754,
44560523,
45111898,
45683640,
46155745,
46594934,
47143303,
47708817,

48200961,
48820295,
49443478,
50042669,
50533518,
51043324,
51614069,
52238734,
52878929,
53539863,
54126889,
54617117,
55142751,
55745063,
56367328,
57021314,
57695345,
58287916,
58785996,
59320006,
59910792,
60527871,
61117132,
61812474,
62420041,
62915662,
63422239,
64037142,
64677389,
65367986,
66064345,
66706697,
67250638,
67785484,
68416150,
69081500,
70576907,
71282658,
71931348,
72470142,
73021298,
73669919,
74387461,
75126063,
75847501,
76483006,
77030307,

77576529,
78227986,
78910081,
79603472,
80096696,
80629340,
81042534,
81541719,
82213594,
82938894,
83778622,
84342314,
84946690,
85467020,
86024461,
86765351,
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[61]:
```
def daily_increase(data):
  d = []
  for i in range(len(data)):
    if i == 0:
      d.append(data[0])
    else:
      d.append(data[i]-data[i-1])
```

```
    return d
```

[62]:
```
#confirmed cases
world_daily_increase = daily_increase(world_cases)
china_daily_increase = daily_increase(china_cases)
india_daily_increase = daily_increase(india_cases)
italy_daily_increase = daily_increase(italy_cases)
us_daily_increase = daily_increase(us_cases)
spain_daily_increase = daily_increase(spain_cases)
france_daily_increase = daily_increase(france_cases)
germany_daily_increase = daily_increase(germany_cases)
uk_daily_increase = daily_increase(uk_cases)
russia_daily_increase = daily_increase(russia_cases)
```

[63]:
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world_daily_increase
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[73]:
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#deaths
world_daily_death = daily_increase(total_deaths)
china_daily_death = daily_increase(china_deaths)
india_daily_death = daily_increase(india_deaths)
italy_daily_death = daily_increase(italy_deaths)
```

```
us_daily_death = daily_increase(us_deaths)
spain_daily_death = daily_increase(spain_deaths)
france_daily_death = daily_increase(france_deaths)
germany_daily_death = daily_increase(germany_deaths)
uk_daily_death = daily_increase(uk_deaths)
russia_daily_death = daily_increase(russia_deaths)
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[74]:
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world_daily_death
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world_daily_recovery = daily_increase(total_recovered)
china_daily_recovery = daily_increase(china_recoveries)
india_daily_recovery = daily_increase(india_recoveries)
italy_daily_recovery = daily_increase(italy_recoveries)
us_daily_recovery = daily_increase(us_recoveries)
spain_daily_recovery = daily_increase(spain_recoveries)
france_daily_recovery = daily_increase(france_recoveries)
germany_daily_recovery = daily_increase(germany_recoveries)
uk_daily_recovery = daily_increase(uk_recoveries)
russia_daily_recovery = daily_increase(russia_recoveries)
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'Denmark',
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'Dominica',
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'Grenada',
'Guatemala',
'Guinea',
'Guinea-Bissau',
'Guyana',
'Haiti',
'Holy See',
'Honduras',
'Hungary',
'Iceland',
'India',
'Indonesia',
'Iran',
'Iraq',
'Ireland',
'Israel',
'Italy',
'Jamaica',
'Japan',
'Jordan',
'Kazakhstan',
'Kenya',
'Korea, South',
'Kosovo',
'Kuwait',
'Kyrgyzstan',
'Laos',
'Latvia',
'Lebanon',
'Lesotho',
'Liberia',
'Libya',
'Liechtenstein',
'Lithuania',
'Luxembourg',
'MS Zaandam',
'Madagascar',
'Malawi',
'Maldives',
'Mali',
```

```
'Malta',
'Marshall Islands',
'Mauritania',
'Mauritius',
'Mexico',
'Moldova',
'Monaco',
'Mongolia',
'Montenegro',
'Morocco',
'Mozambique',
'Namibia',
'Nepal',
'Netherlands',
'New Zealand',
'Nicaragua',
'Niger',
'Nigeria',
'North Macedonia',
'Norway',
'Oman',
'Pakistan',
'Panama',
'Papua New Guinea',
'Paraguay',
'Peru',
'Philippines',
'Poland',
'Portugal',
'Qatar',
'Romania',
'Russia',
'Rwanda',
'Saint Kitts and Nevis',
'Saint Lucia',
'Saint Vincent and the Grenadines',
'Samoa',
'San Marino',
'Sao Tome and Principe',
'Saudi Arabia',
'Senegal',
'Serbia',
'Seychelles',
'Sierra Leone',
'Singapore',
'Slovakia',
'Slovenia',
```

```
 'Solomon Islands',
 'Somalia',
 'South Africa',
 'South Sudan',
 'Spain',
 'Sri Lanka',
 'Sudan',
 'Suriname',
 'Sweden',
 'Switzerland',
 'Syria',
 'Taiwan*',
 'Tajikistan',
 'Tanzania',
 'Thailand',
 'Timor-Leste',
 'Togo',
 'Trinidad and Tobago',
 'Tunisia',
 'Turkey',
 'US',
 'Uganda',
 'Ukraine',
 'United Arab Emirates',
 'United Kingdom',
 'Uruguay',
 'Uzbekistan',
 'Vanuatu',
 'Venezuela',
 'Vietnam',
 'West Bank and Gaza',
 'Yemen',
 'Zambia',
 'Zimbabwe',
 'Kiribati',
 'Palau',
 'Summer Olympics 2020',
 'Malaysia',
 'Tonga',
 'Winter Olympics 2022',
 'Antarctica',
 'Korea, North',
 'Nauru',
 'Tuvalu']
```

[96]:
```
country_confirmed_cases = []
country_death_cases = []
```

```
country_active_cases = []
country_recovery_cases = []
country_mortality_rate = []
country_recovery_rate = []

no_case = []
for i in unique_countries:
  cases = latest_data[latest_data['Country_Region']==i]['Confirmed'].sum()
  if cases > 0:
    country_confirmed_cases.append(cases)
  else:
    no_case.append(i)

for i in no_case:
  unique_countries.remove(i)


#sort countries  by the number of confirmed cases
unique_countries = [k for k, v in sorted(zip(unique_countries,␣
 ↪country_confirmed_cases), key=operator.itemgetter(1), reverse=True)]
for i in range(len(unique_countries)):
  country_confirmed_cases[i] =␣
 ↪latest_data[latest_data['Country_Region']==unique_countries[i]]['Confirmed'].
 ↪sum()
  country_death_cases.
 ↪append(latest_data[latest_data['Country_Region']==unique_countries[i]]['Deaths'].
 ↪sum())
  country_recovery_cases.
 ↪append(latest_data[latest_data['Country_Region']==unique_countries[i]]['Recovered'].
 ↪sum())
  country_active_cases.
 ↪append(latest_data[latest_data['Country_Region']==unique_countries[i]]['Active'].
 ↪sum())
  country_mortality_rate.append(country_death_cases[i]/
 ↪country_confirmed_cases[i])
  country_recovery_rate.append(country_recovery_cases[i]/
 ↪country_confirmed_cases[i])
```

[97]:
```
country_df = pd.DataFrame({'countrie name':unique_countries, 'numbeer of␣
 ↪confirmed cases':country_confirmed_cases, 'number of deaths':
 ↪country_death_cases, 'number of recoveries':country_recovery_cases, 'number␣
 ↪of active cases':country_active_cases, 'mortality rate':
 ↪country_mortality_rate, 'recovery rate':country_recovery_rate})

#number of cases per country/region
```

```
country_df.style.background_gradient(cmap='Blues')
```

[97]: <pandas.io.formats.style.Styler at 0x7b03c344beb0>

[98]:
```
unique_provinces =  list(latest_data['Province_State'].unique())
unique_provinces
```

[98]:
```
[nan,
 'Australian Capital Territory',
 'New South Wales',
 'Northern Territory',
 'Queensland',
 'South Australia',
 'Tasmania',
 'Victoria',
 'Western Australia',
 'Antwerp',
 'Brussels',
 'East Flanders',
 'Flemish Brabant',
 'Hainaut',
 'Liege',
 'Limburg',
 'Luxembourg',
 'Namur',
 'Unknown',
 'Walloon Brabant',
 'West Flanders',
 'Acre',
 'Alagoas',
 'Amapa',
 'Amazonas',
 'Bahia',
 'Ceara',
 'Distrito Federal',
 'Espirito Santo',
 'Goias',
 'Maranhao',
 'Mato Grosso',
 'Mato Grosso do Sul',
 'Minas Gerais',
 'Para',
 'Paraiba',
 'Parana',
 'Pernambuco',
 'Piaui',
 'Rio Grande do Norte',
```

```
'Rio Grande do Sul',
'Rio de Janeiro',
'Rondonia',
'Roraima',
'Santa Catarina',
'Sao Paulo',
'Sergipe',
'Tocantins',
'Alberta',
'British Columbia',
'Diamond Princess',
'Grand Princess',
'Manitoba',
'New Brunswick',
'Newfoundland and Labrador',
'Northwest Territories',
'Nova Scotia',
'Nunavut',
'Ontario',
'Prince Edward Island',
'Quebec',
'Repatriated Travellers',
'Saskatchewan',
'Yukon',
'Antofagasta',
'Araucania',
'Arica y Parinacota',
'Atacama',
'Aysen',
'Biobio',
'Coquimbo',
'Los Lagos',
'Los Rios',
'Magallanes',
'Maule',
'Metropolitana',
'Nuble',
'OHiggins',
'Tarapaca',
'Valparaiso',
'Anhui',
'Beijing',
'Chongqing',
'Fujian',
'Gansu',
'Guangdong',
'Guangxi',
```

```
'Guizhou',
'Hainan',
'Hebei',
'Heilongjiang',
'Henan',
'Hong Kong',
'Hubei',
'Hunan',
'Inner Mongolia',
'Jiangsu',
'Jiangxi',
'Jilin',
'Liaoning',
'Macau',
'Ningxia',
'Qinghai',
'Shaanxi',
'Shandong',
'Shanghai',
'Shanxi',
'Sichuan',
'Tianjin',
'Tibet',
'Xinjiang',
'Yunnan',
'Zhejiang',
'Antioquia',
'Arauca',
'Atlantico',
'Bolivar',
'Boyaca',
'Caldas',
'Capital District',
'Caqueta',
'Casanare',
'Cauca',
'Cesar',
'Choco',
'Cordoba',
'Cundinamarca',
'Guainia',
'Guaviare',
'Huila',
'La Guajira',
'Magdalena',
'Meta',
'Narino',
```

```
'Norte de Santander',
'Putumayo',
'Quindio',
'Risaralda',
'San Andres y Providencia',
'Santander',
'Sucre',
'Tolima',
'Valle del Cauca',
'Vaupes',
'Vichada',
'Faroe Islands',
'Greenland',
'French Guiana',
'French Polynesia',
'Guadeloupe',
'Martinique',
'Mayotte',
'New Caledonia',
'Reunion',
'Saint Barthelemy',
'Saint Pierre and Miquelon',
'St Martin',
'Baden-Wurttemberg',
'Bayern',
'Berlin',
'Brandenburg',
'Bremen',
'Hamburg',
'Hessen',
'Mecklenburg-Vorpommern',
'Niedersachsen',
'Nordrhein-Westfalen',
'Rheinland-Pfalz',
'Saarland',
'Sachsen',
'Sachsen-Anhalt',
'Schleswig-Holstein',
'Thuringen',
'Andaman and Nicobar Islands',
'Andhra Pradesh',
'Arunachal Pradesh',
'Assam',
'Bihar',
'Chandigarh',
'Chhattisgarh',
'Dadra and Nagar Haveli and Daman and Diu',
```

```
'Delhi',
'Goa',
'Gujarat',
'Haryana',
'Himachal Pradesh',
'Jammu and Kashmir',
'Jharkhand',
'Karnataka',
'Kerala',
'Ladakh',
'Lakshadweep',
'Madhya Pradesh',
'Maharashtra',
'Manipur',
'Meghalaya',
'Mizoram',
'Nagaland',
'Odisha',
'Puducherry',
'Punjab',
'Rajasthan',
'Sikkim',
'Tamil Nadu',
'Telangana',
'Tripura',
'Uttar Pradesh',
'Uttarakhand',
'West Bengal',
'Abruzzo',
'Basilicata',
'Calabria',
'Campania',
'Emilia-Romagna',
'Friuli Venezia Giulia',
'Lazio',
'Liguria',
'Lombardia',
'Marche',
'Molise',
'P.A. Bolzano',
'P.A. Trento',
'Piemonte',
'Puglia',
'Sardegna',
'Sicilia',
'Toscana',
'Umbria',
```

```
"Valle d'Aosta",
'Veneto',
'Aichi',
'Akita',
'Aomori',
'Chiba',
'Ehime',
'Fukui',
'Fukuoka',
'Fukushima',
'Gifu',
'Gunma',
'Hiroshima',
'Hokkaido',
'Hyogo',
'Ibaraki',
'Ishikawa',
'Iwate',
'Kagawa',
'Kagoshima',
'Kanagawa',
'Kochi',
'Kumamoto',
'Kyoto',
'Mie',
'Miyagi',
'Miyazaki',
'Nagano',
'Nagasaki',
'Nara',
'Niigata',
'Oita',
'Okayama',
'Okinawa',
'Osaka',
'Port Quarantine',
'Saga',
'Saitama',
'Shiga',
'Shimane',
'Shizuoka',
'Tochigi',
'Tokushima',
'Tokyo',
'Tottori',
'Toyama',
'Wakayama',
```

```
'Yamagata',
'Yamaguchi',
'Yamanashi',
'Aguascalientes',
'Baja California',
'Baja California Sur',
'Campeche',
'Chiapas',
'Chihuahua',
'Ciudad de Mexico',
'Coahuila',
'Colima',
'Durango',
'Guanajuato',
'Guerrero',
'Hidalgo',
'Jalisco',
'Mexico',
'Michoacan',
'Morelos',
'Nayarit',
'Nuevo Leon',
'Oaxaca',
'Puebla',
'Queretaro',
'Quintana Roo',
'San Luis Potosi',
'Sinaloa',
'Sonora',
'Tabasco',
'Tamaulipas',
'Tlaxcala',
'Veracruz',
'Yucatan',
'Zacatecas',
'Aruba',
'Bonaire, Sint Eustatius and Saba',
'Curacao',
'Drenthe',
'Flevoland',
'Friesland',
'Gelderland',
'Groningen',
'Noord-Brabant',
'Noord-Holland',
'Overijssel',
'Sint Maarten',
```

```
'Utrecht',
'Zeeland',
'Zuid-Holland',
'Azad Jammu and Kashmir',
'Balochistan',
'Gilgit-Baltistan',
'Islamabad',
'Khyber Pakhtunkhwa',
'Sindh',
'Ancash',
'Apurimac',
'Arequipa',
'Ayacucho',
'Cajamarca',
'Callao',
'Cusco',
'Huancavelica',
'Huanuco',
'Ica',
'Junin',
'La Libertad',
'Lambayeque',
'Lima',
'Loreto',
'Madre de Dios',
'Moquegua',
'Pasco',
'Piura',
'Puno',
'San Martin',
'Tacna',
'Tumbes',
'Ucayali',
'Adygea Republic',
'Altai Krai',
'Altai Republic',
'Amur Oblast',
'Arkhangelsk Oblast',
'Astrakhan Oblast',
'Bashkortostan Republic',
'Belgorod Oblast',
'Bryansk Oblast',
'Buryatia Republic',
'Chechen Republic',
'Chelyabinsk Oblast',
'Chukotka Autonomous Okrug',
'Chuvashia Republic',
```

'Dagestan Republic',
'Ingushetia Republic',
'Irkutsk Oblast',
'Ivanovo Oblast',
'Jewish Autonomous Okrug',
'Kabardino-Balkarian Republic',
'Kaliningrad Oblast',
'Kalmykia Republic',
'Kaluga Oblast',
'Kamchatka Krai',
'Karachay-Cherkess Republic',
'Karelia Republic',
'Kemerovo Oblast',
'Khabarovsk Krai',
'Khakassia Republic',
'Khanty-Mansi Autonomous Okrug',
'Kirov Oblast',
'Komi Republic',
'Kostroma Oblast',
'Krasnodar Krai',
'Krasnoyarsk Krai',
'Kurgan Oblast',
'Kursk Oblast',
'Leningrad Oblast',
'Lipetsk Oblast',
'Magadan Oblast',
'Mari El Republic',
'Mordovia Republic',
'Moscow',
'Moscow Oblast',
'Murmansk Oblast',
'Nenets Autonomous Okrug',
'Nizhny Novgorod Oblast',
'North Ossetia - Alania Republic',
'Novgorod Oblast',
'Novosibirsk Oblast',
'Omsk Oblast',
'Orel Oblast',
'Orenburg Oblast',
'Penza Oblast',
'Perm Krai',
'Primorsky Krai',
'Pskov Oblast',
'Rostov Oblast',
'Ryazan Oblast',
'Saint Petersburg',
'Sakha (Yakutiya) Republic',

'Sakhalin Oblast',
'Samara Oblast',
'Saratov Oblast',
'Smolensk Oblast',
'Stavropol Krai',
'Sverdlovsk Oblast',
'Tambov Oblast',
'Tatarstan Republic',
'Tomsk Oblast',
'Tula Oblast',
'Tver Oblast',
'Tyumen Oblast',
'Tyva Republic',
'Udmurt Republic',
'Ulyanovsk Oblast',
'Vladimir Oblast',
'Volgograd Oblast',
'Vologda Oblast',
'Voronezh Oblast',
'Yamalo-Nenets Autonomous Okrug',
'Yaroslavl Oblast',
'Zabaykalsky Krai',
'Andalusia',
'Aragon',
'Asturias',
'Baleares',
'C. Valenciana',
'Canarias',
'Cantabria',
'Castilla - La Mancha',
'Castilla y Leon',
'Catalonia',
'Ceuta',
'Extremadura',
'Galicia',
'La Rioja',
'Madrid',
'Melilla',
'Murcia',
'Navarra',
'Pais Vasco',
'Blekinge',
'Dalarna',
'Gavleborg',
'Gotland',
'Halland',
'Jamtland Harjedalen',

```
'Jonkoping',
'Kalmar',
'Kronoberg',
'Norrbotten',
'Orebro',
'Ostergotland',
'Skane',
'Sormland',
'Stockholm',
'Uppsala',
'Varmland',
'Vasterbotten',
'Vasternorrland',
'Vastmanland',
'Vastra Gotaland',
'Alabama',
'Alaska',
'Arizona',
'Arkansas',
'California',
'Colorado',
'Connecticut',
'Delaware',
'District of Columbia',
'Florida',
'Georgia',
'Guam',
'Hawaii',
'Idaho',
'Illinois',
'Indiana',
'Iowa',
'Kansas',
'Kentucky',
'Louisiana',
'Maine',
'Maryland',
'Massachusetts',
'Michigan',
'Minnesota',
'Mississippi',
'Missouri',
'Montana',
'Nebraska',
'Nevada',
'New Hampshire',
'New Jersey',
```

```
'New Mexico',
'New York',
'North Carolina',
'North Dakota',
'Northern Mariana Islands',
'Ohio',
'Oklahoma',
'Oregon',
'Pennsylvania',
'Puerto Rico',
'Recovered',
'Rhode Island',
'South Carolina',
'South Dakota',
'Tennessee',
'Texas',
'Utah',
'Vermont',
'Virgin Islands',
'Virginia',
'Washington',
'West Virginia',
'Wisconsin',
'Wyoming',
'Cherkasy Oblast',
'Chernihiv Oblast',
'Chernivtsi Oblast',
'Crimea Republic*',
'Dnipropetrovsk Oblast',
'Donetsk Oblast',
'Ivano-Frankivsk Oblast',
'Kharkiv Oblast',
'Kherson Oblast',
'Khmelnytskyi Oblast',
'Kiev',
'Kiev Oblast',
'Kirovohrad Oblast',
'Luhansk Oblast',
'Lviv Oblast',
'Mykolaiv Oblast',
'Odessa Oblast',
'Poltava Oblast',
'Rivne Oblast',
'Sevastopol*',
'Sumy Oblast',
'Ternopil Oblast',
'Vinnytsia Oblast',
```

```
 'Volyn Oblast',
 'Zakarpattia Oblast',
 'Zaporizhia Oblast',
 'Zhytomyr Oblast',
 'Anguilla',
 'Bermuda',
 'British Virgin Islands',
 'Cayman Islands',
 'Channel Islands',
 'England',
 'Falkland Islands (Malvinas)',
 'Gibraltar',
 'Isle of Man',
 'Montserrat',
 'Northern Ireland',
 'Saint Helena, Ascension and Tristan da Cunha',
 'Scotland',
 'Turks and Caicos Islands',
 'Wales',
 'Cook Islands',
 'Johor',
 'Kedah',
 'Kelantan',
 'Melaka',
 'Negeri Sembilan',
 'Pahang',
 'Perak',
 'Perlis',
 'Pulau Pinang',
 'Sabah',
 'Sarawak',
 'Selangor',
 'Terengganu',
 'W.P. Kuala Lumpur',
 'W.P. Labuan',
 'W.P. Putrajaya',
 'Jersey',
 'Guernsey',
 'Niue',
 'Pitcairn Islands']
```

[99]:
```
province_confirmed_cases = []
province_country = []
province_death_cases = []
province_active_cases = []
province_recovery_cases = []
province_mortality_rate = []
```

```
province_recovery_rate = []

no_case = []
for i in unique_provinces:
  cases = latest_data[latest_data['Province_State']==i]['Confirmed'].sum()
  if cases > 0:
    province_confirmed_cases.append(cases)
  else:
    no_case.append(i)

#remove areas with no confirmed case
for i in no_case:
  unique_provinces.remove(i)

#sort countries  by the number of confirmed cases

unique_countries = [k for k, v in sorted(zip(unique_provinces,␣
 ↪province_confirmed_cases), key=operator.itemgetter(1), reverse=True)]
for i in range(len(unique_provinces)):
  province_confirmed_cases[i] =␣
 ↪latest_data[latest_data['Province_State']==unique_provinces[i]]['Confirmed'].
 ↪sum()
  province_country.
 ↪append(latest_data[latest_data['Province_State']==unique_provinces[i]]['Country_Region'].
 ↪unique()[0])
  province_death_cases.
 ↪append(latest_data[latest_data['Province_State']==unique_provinces[i]]['Deaths'].
 ↪sum())
  province_recovery_cases.
 ↪append(latest_data[latest_data['Province_State']==unique_provinces[i]]['Recovered'].
 ↪sum())
  province_active_cases.
 ↪append(latest_data[latest_data['Province_State']==unique_provinces[i]]['Active'].
 ↪sum())
  province_mortality_rate.append(province_death_cases[i]/
 ↪province_confirmed_cases[i])
  province_recovery_rate.append(province_recovery_cases[i]/
 ↪province_confirmed_cases[i])
```

[100]:
```
#number of cases per province/state/city
province_df = pd.DataFrame({'province/state name':unique_provinces, 'country':
 ↪province_country, 'numbeer of confirmed cases':province_confirmed_cases,␣
 ↪'number of deaths':province_death_cases, 'number of recoveries':
 ↪province_recovery_cases, 'number of active cases':province_active_cases,␣
 ↪'mortality rate':province_mortality_rate, 'recovery rate':
 ↪province_recovery_rate})
```

```
#number of cases per country/region

province_df.style.background_gradient(cmap='Reds')
```

[100]: <pandas.io.formats.style.Styler at 0x7b0405908be0>

[101]:
```
#Dealing with missing values
nan_indices = []
for i in range(len(unique_provinces)):
  if type(unique_provinces[i]) == float:
    nan_indices.append(i)

unique_provinces = list(unique_provinces)
provinces_confirmed_cases = list(province_confirmed_cases)
for i in nan_indices:
  unique_provinces.pop(i)
  province_confirmed_cases.pop(i)
```

[102]:
```
USA_confirmed = latest_data[latest_data['Country_Region']=='US']['Confirmed'].
 ↪sum()
outside_USA_confirmed = np.sum(country_confirmed_cases) - USA_confirmed
plt.figure(figsize=(16, 9))
plt.barh('Outside USA', outside_USA_confirmed)
plt.title('Number of Coronavirus Confirmed Cases', size=20)
plt.xticks(size=20)
plt.yticks(size=20)
plt.show()
```

[103]:
```
print('Outside USA{} Cases:'.format( outside_USA_confirmed))
print('USA:{} Cases'.format(USA_confirmed))
print('Total:{} Cases'.format(USA_confirmed+outside_USA_confirmed))
```

```
Outside USA63550557 Cases:
USA:20219881 Cases
Total:83770438 Cases
```

[104]:
```
#Only show 10 countries with the most confirmed cases,the rest are grouped into␣
↪the other category
visual_unique_countries = []
visual_confirmed_cases = []
others = np.sum(country_confirmed_cases[10:])
for i in range(len(country_confirmed_cases[:10])):
  visual_unique_countries.append(unique_countries[i])
  visual_confirmed_cases.append(country_confirmed_cases[i])
visual_unique_countries.append('Others')
visual_confirmed_cases.append(others)
```

[105]:
```
def plot_bar_graphs(x, y, title):
  plt.figure(figsize=(16, 9))
  plt.barh(x, y)
  plt.title(title, size=20)
  plt.xticks(size=20)
  plt.yticks(size=20)
  plt.show()
```

[106]:
```
plot_bar_graphs(visual_unique_countries, visual_confirmed_cases, 'Number of␣
↪Covid-19 Confirmed Cases in Countries/Regions')
```

[107]:
```
def plot_pie_chart(x, y, title):
    c = random.choices(list(mcolors.CSS4_COLORS.values()),␣
 ↪k=len(unique_countries))
    plt.figure(figsize=(16, 9))
    plt.title(title, size=20)
    plt.pie(y, labels=x, colors=c)
    plt.legend(x, loc='best', fontsize=15)
    plt.show()
```

[108]:
```
plot_pie_chart(visual_unique_countries, visual_confirmed_cases, 'Covid-19␣
 ↪Confirmed Cases per Country')
```

[109]:
```
#only show 10 provinces with the most confirmed cases, the rest are grouped␣
↪into the others category
visual_unique_provinces = []
visual_confirmed_cases2 = []
others = np.sum(province_confirmed_cases[10:])
for i in range(len(province_confirmed_cases[:10])):
  visual_unique_provinces.append(unique_provinces[i])
  visual_confirmed_cases2.append(province_confirmed_cases[i])
visual_unique_provinces.append('Others')
visual_confirmed_cases2.append(others)
```

[110]:
```
plot_bar_graphs(visual_unique_provinces, visual_confirmed_cases2, 'Number of␣
↪Coronavirus Confirmed Cases in Provinces/States')
```

[111]:
```
def plot_pie_country_with_regions(country_name,title):
    regions =␣
↪list(latest_data[latest_data['Country_Region']==country_name]['Province_State'].
↪unique())
    confirmed_cases = []
    no_case = []
    for i in regions:
      cases = latest_data[latest_data['Province_State']==i]['Confirmed'].sum()
      if cases > 0:
        confirmed_cases.append(cases)
      else:
        no_case.append(i)

    for i in no_case:
      regions.remove(i)
```

```
    regions = [k for k, v in sorted(zip(regions, confirmed_cases), key=operator.
↪itemgetter(1), reverse=True)]
    for i in range(len(regions)):
      confirmed_cases[i] =␣
↪latest_data[latest_data['Province_State']==regions[i]]['Confirmed'].sum()
      if(len(regions) >10):
        regions_10 = regions[:10]
        regions_10.append('Others')
        confirmed_cases_10 = confirmed_cases[:10]
        confirmed_cases_10.append(np.sum(confirmed_cases[10:]))
        plot_pie_chart(regions_10, confirmed_cases_10, title)
      else:
        plot_pie_chart(regions, confirmed_cases, title)
```

[112]:
```
plot_pie_country_with_regions('US', 'Covid-19 Confirmed Cases in the United␣
↪States')
```

Covid-19 Confirmed Cases in the United States
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Illinois
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Tennessee
North Carolina
Others

Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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Covid-19 Confirmed Cases in the United States
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[113]:
```
plot_pie_country_with_regions('India', 'Covid-19 Confirmed Cases in India')
```

Covid-19 Confirmed Cases in India
Uttar Pradesh
West Bengal
Delhi
Kerala
Tamil Nadu
Andhra Pradesh
Karnataka
Odisha
Rajasthan
Maharashtra
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
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Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Tamil Nadu
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Covid-19 Confirmed Cases in India
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Covid-19 Confirmed Cases in India
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Covid-19 Confirmed Cases in India
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Covid-19 Confirmed Cases in India
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Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Delhi
Maharashtra
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Delhi
Maharashtra
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Delhi
Maharashtra
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Maharashtra
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Maharashtra
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Tamil Nadu
Karnataka
Kerala
Maharashtra
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Kerala
Maharashtra
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Maharashtra
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Maharashtra
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Maharashtra
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Maharashtra
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

Covid-19 Confirmed Cases in India
Andhra Pradesh
Karnataka
Tamil Nadu
Maharashtra
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others
Maharashtra
Karnataka
Andhra Pradesh
Tamil Nadu
Kerala
Delhi
Uttar Pradesh
West Bengal
Odisha
Rajasthan
Others

[114]:
```
plot_pie_country_with_regions('china', 'Covid-19 Confirmed Cases in china')
```

[115]:
```
plot_pie_country_with_regions('Italy', 'Covid-19 Confirmed Cases in Italy')
```

Covid-19 Confirmed Cases in Italy
Campania
Piemonte
Veneto
Emilia-Romagna
Lazio
Toscana
Lombardia
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Campania
Veneto
Emilia-Romagna
Lazio
Lombardia
Toscana
Sicilia
Puglia
Liguria
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Others
Liguria
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Emilia-Romagna
Lombardia
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Veneto
Piemonte
Campania
Lombardia
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Veneto
Piemonte
Campania
Lombardia
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Piemonte
Veneto
Campania
Lombardia
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Veneto
Piemonte
Campania
Lombardia
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Veneto
Piemonte
Campania
Lombardia
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Veneto
Piemonte
Lombardia
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Lombardia

Covid-19 Confirmed Cases in Italy
Lombardia
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others
Veneto
Piemonte
Campania
Emilia-Romagna
Lazio
Toscana
Sicilia
Puglia
Liguria
Others

[116]:
```
plot_pie_country_with_regions('Spain', 'Covid-19 Confirmed Cases in Spain')
```

Covid-19 Confirmed Cases in Spain
Castilla y Leon
C. Valenciana
Andalusia
Catalonia
Pais Vasco
Castilla - La Mancha
Aragon
Madrid
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Madrid
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Madrid
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Madrid
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Madrid
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Andalusia
Catalonia
C. Valenciana
Castilla y Leon
Madrid
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Andalusia
Catalonia
C. Valenciana
Madrid
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
C. Valenciana
Madrid
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
Madrid
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
Madrid
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
Madrid
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
Madrid
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Catalonia
Andalusia
Madrid
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid

Covid-19 Confirmed Cases in Spain
Catalonia
Madrid
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

Covid-19 Confirmed Cases in Spain
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Others

Covid-19 Confirmed Cases in Spain
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Madrid
Others

Covid-19 Confirmed Cases in Spain
Madrid
Catalonia
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others
Madrid
Andalusia
C. Valenciana
Castilla y Leon
Pais Vasco
Castilla - La Mancha
Aragon
Galicia
Murcia
Others

[117]:
```
plot_pie_country_with_regions('France', 'Covid-19 Confirmed Cases in France')
```

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
French Guiana
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
Reunion
St Martin
Mayotte
Guadeloupe
Martinique

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
St Martin
Mayotte
Martinique
Guadeloupe
Reunion

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
Reunion
St Martin
Mayotte
Guadeloupe
Martinique

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Guiana
French Polynesia
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
Reunion
St Martin
Mayotte
Guadeloupe
Martinique

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Guiana
French Polynesia
Reunion
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
St Martin
Guadeloupe
Mayotte
Martinique

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
Saint Pierre and Miquelon
St Martin
Mayotte
Martinique
Guadeloupe
Reunion

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
St Martin
Mayotte
Martinique
Guadeloupe
Reunion

Covid-19 Confirmed Cases in France
French Polynesia
French Guiana
Reunion
Guadeloupe
Martinique
Mayotte
St Martin
Saint Barthelemy
New Caledonia
Saint Pierre and Miquelon
French Polynesia
Saint Pierre and Miquelon
New Caledonia
Saint Barthelemy
St Martin
Mayotte
Martinique
Guadeloupe
Reunion

[118]:
```
plot_pie_country_with_regions('Germany', 'Covid-19 Confirmed Cases in Germany')
```

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Nordrhein-Westfalen
Berlin
Rheinland-Pfalz
Thuringen
Others
Brandenburg

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Nordrhein-Westfalen
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Nordrhein-Westfalen
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
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Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
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Nordrhein-Westfalen
Baden-Wurttemberg
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Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
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Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
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Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

Covid-19 Confirmed Cases in Germany
Nordrhein-Westfalen
Bayern
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others
Bayern
Nordrhein-Westfalen
Baden-Wurttemberg
Hessen
Sachsen
Niedersachsen
Berlin
Rheinland-Pfalz
Thuringen
Brandenburg
Others

[119]:
```
plot_pie_country_with_regions('United Kingdom', 'Covid-19 Confirmed Cases in␣
↪the United Kingdom')
```

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Unknown

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Wales
Others
Isle of Man
Unknown

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Wales
Scotland
Northern Ireland
Others
Isle of Man
Unknown

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Wales
Scotland
Northern Ireland
Others
Isle of Man
Unknown

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Isle of Man
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
England
Others
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
England
Others
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
Others
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
England
Others
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
England
Unknown
Northern Ireland
Scotland
Wales

Covid-19 Confirmed Cases in the United Kingdom
England
Wales
Scotland
Northern Ireland
Unknown
Jersey
Gibraltar
Turks and Caicos Islands
Bermuda
Isle of Man
Others
England
Caicos Islands
Unknown
Northern Ireland
Scotland
Wales

[120]:
```
plot_pie_country_with_regions('Russia', 'Covid-19 Confirmed Cases in Russia')
```

Covid-19 Confirmed Cases in Russia
Moscow
Others
Moscow
Saint Petersburg
Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Saint Petersburg
Moscow
Moscow
Saint Petersburg
Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
Khanty-Mansi Autonomous Okrug
Moscow
Moscow
Saint Petersburg
Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
Nizhny Novgorod Oblast
Khanty-Mansi Autonomous Okrug
Moscow
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Saint Petersburg
Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
Moscow
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Saint Petersburg
Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
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Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Nizhny Novgorod Oblast
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Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
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Arkhangelsk Oblast
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Krasnoyarsk Krai
Voronezh Oblast
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Others

Covid-19 Confirmed Cases in Russia
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Nizhny Novgorod Oblast
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Krasnoyarsk Krai
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
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Others

Covid-19 Confirmed Cases in Russia
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Krasnoyarsk Krai
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Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Krasnoyarsk Krai
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Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Khanty-Mansi Autonomous Okrug
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
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Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
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Khanty-Mansi Autonomous Okrug
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Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
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Khanty-Mansi Autonomous Okrug
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
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Others

Covid-19 Confirmed Cases in Russia
Moscow Oblast
Saint Petersburg
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
Arkhangelsk Oblast
Khanty-Mansi Autonomous Okrug
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Moscow Oblast
Nizhny Novgorod Oblast
Sverdlovsk Oblast
Rostov Oblast
Krasnoyarsk Krai
Voronezh Oblast
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[121]:
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plot_pie_country_with_regions('South Korea', 'Covid-19 Confirmed Cases in South␣
↪Korea')
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[122]:
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plot_pie_country_with_regions('Japan', 'Covid-19 Confirmed Cases in Japan')
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Others
Tokyo
Unknown
Osaka
Kanagawa
Aichi
Saitama
Hokkaido
Chiba
Hyogo
Fukuoka
Others

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[123]:
```
plot_pie_country_with_regions('Turkey', 'Covid-19 Confirmed Cases in Turkey')
```

[124]:
```
plot_pie_country_with_regions('Vietnam', 'Covid-19 Confirmed Cases in Vietnam')
```

[125]:
```
plot_pie_country_with_regions('Iran', 'Covid-19 Confirmed Cases in Iran')
```

[126]:
```
days_since_1_22 = np.array([i for i in range(len(confirmed_cases))]).
 ↪reshape(-1, 1)
world_cases = np.array(confirmed_cases).reshape(-1, 1)
total_deaths = np.array(total_deaths).reshape(-1, 1)
total_recovered = np.array(total_recovered).reshape(-1, 1)
```

[127]:
```
days_in_future = 20
future_forcast = np.array([i for i in␣
↪range(len(confirmed_cases)+days_in_future)]).reshape(-1, 1)
adjusted_dates = future_forcast[:-20]
```

[128]:
```
future_forcast
```

[128]:
```
array([[  0],
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```

[129]:
```
start = '1/22/2020'
start_date = datetime.datetime.strptime(start, '%m/%d/%Y')
future_forcast_dates = []
for i in range(len(future_forcast)):
  future_forcast_dates.append((start_date + datetime.timedelta(days=i)).
 ↪strftime('%m/%d/%Y'))
```

[130]:
```
# Ensure both arrays have the same length along the first axis
days_since_1_22 = np.array([i for i in range(len(confirmed_cases.iloc[:,0]))]).
 ↪reshape(-1, 1) # Use the length of the first column of confirmed_cases
world_cases = np.array(confirmed_cases.iloc[:,0]).reshape(-1, 1) # Extract the␣
 ↪first column of confirmed_cases
```

```
# Check the shape of both arrays
print(days_since_1_22.shape)
print(world_cases.shape)

# Proceed with train_test_split if the shapes are consistent
X_train_confirmed, X_test_confirmed, y_train_confirmed, y_test_confirmed = \
train_test_split(days_since_1_22, world_cases, test_size=0.25, shuffle=False)
```

```
(289, 1)
(289, 1)
```

[131]:
```
X_train_confirmed, X_test_confirmed, y_train_confirmed, y_test_confirmed = \
train_test_split(days_since_1_22, world_cases, test_size=0.25, shuffle=False)
```

[132]:
```
# Restore the future_forcast function
def future_forcast():
    # Add the logic for the future_forcast function here
    pass # Replace with your function logic

# Initialize future_forecast variable with some values
future_forecast_values = [10, 20, 30]  # Replace with actual values
future_forecast = np.array(future_forecast_values).reshape(-1, 1)

# transform our data for polynomial regression
poly = PolynomialFeatures(degree=3)
poly_X_train_confirmed = poly.fit_transform(X_train_confirmed)
poly_X_test_confirmed = poly.fit_transform(X_test_confirmed)
poly_future_forecast = poly.fit_transform(future_forecast) # Now␣
 ↪future_forecast is defined and populated
```