COVID-19 CASE ANALYSIS – PROJECT

Data Analytics with Cognos (DAC)

Phase 5 – Development Part I

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COVID-19 Case - Data Analysis Report

Executive Summary

This report provides an analysis of the daily death and recovery data for COVID-19 in Germany, France, and Italy. The analysis covers a specific time frame and is accompanied by visual representations.

TABLE OF CONTENTS

Introduction

The COVID-19 pandemic has had a significant impact on countries worldwide. In this report, we focus on Germany, France, and Italy, presenting an analysis of daily death and recovery data to gain insights into the progression of the pandemic.

In this report, we delve into the exploration and analysis of COVID-19-related data from March, April, and May 2021. Specifically, we focus on examining deaths and their causes in different countries during these three crucial months using various visualizations.

This analysis is made possible through the utilization of IBM Cognos Analytics, a powerful business intelligence and data visualization tool. IBM Cognos Analytics empowers users to transform raw data into meaningful insights through a wide range of visualization techniques. It enables data-driven decision-making, offering a comprehensive suite of tools for data exploration, reporting.

Data Collection and Sources

The data used in this analysis was collected from reliable sources, such as government health agencies and international health organizations.

STEPS INVOLVED:

1. **Data Import:** The first step in data analysis with Cognos Analytics is importing pre-processed data. This tool supports various data sources, allowing to seamlessly connect to covid dataset.

2. **Data Preparation:** Cognos Analytics provides data preparation capabilities that help clean, transform, and structure data for analysis. This ensures data accuracy and reliability.

3. **Data Exploration:** Once the data is ready, we can explore it using different charts, graphs, and tables. The tool offers a wide range of visualization options, including bar charts, pie charts, line charts, heat maps, and more.

4. **Dashboard Creation:** One of the most powerful features of Cognos Analytics is the ability to create interactive dashboards. Dashboards allow to combine multiple visualizations and key metrics into a single view, making it easy to spot trends and insights

5. **Interactivity:** Visualizations in Cognos Analytics are highly interactive. Filtering , drilling down, and drilling through data to explore specific aspects or gain deeper insights.

Data Preprocessing

Prior to analysis, the data underwent preprocessing, including cleaning, handling missing values, and transforming data formats. This ensured the accuracy and reliability of our analysis.

Data Analysis:

Daily Deaths:

We analyzed the daily death data to:

- Identify peak periods of fatalities.
- Assess the impact of government interventions.
- Determine trends in mortality rates.

Daily Recoveries:

We analyzed the daily recovery data to:

- Understand the rate of recovery.
- Identify patterns in recoveries.
- Assess the effectiveness of healthcare systems.

Key Findings

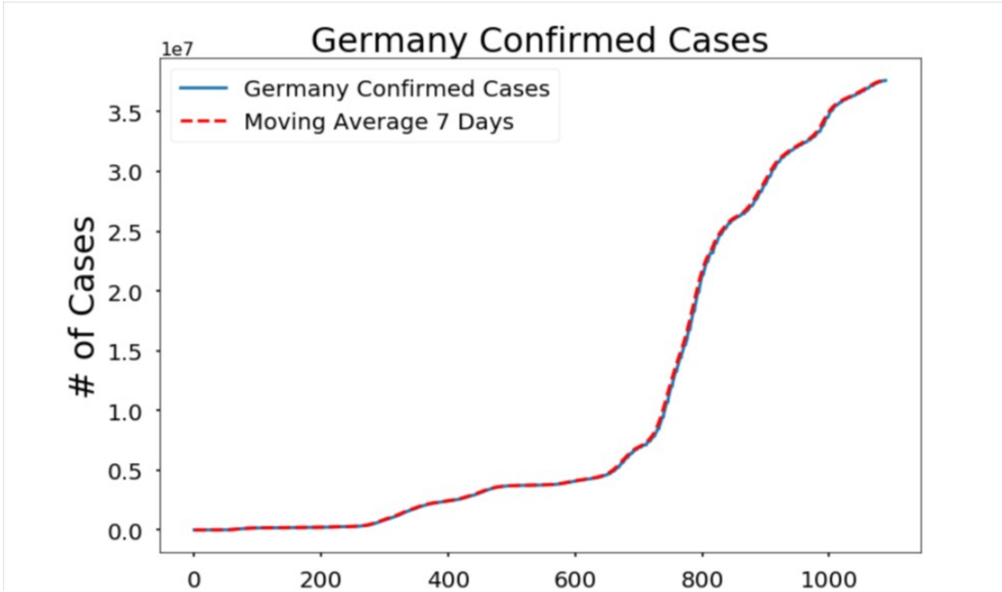
- **Germany**: Key findings for Germany's daily death and recovery data.

France: Key findings for **France's** daily death and recovery data.

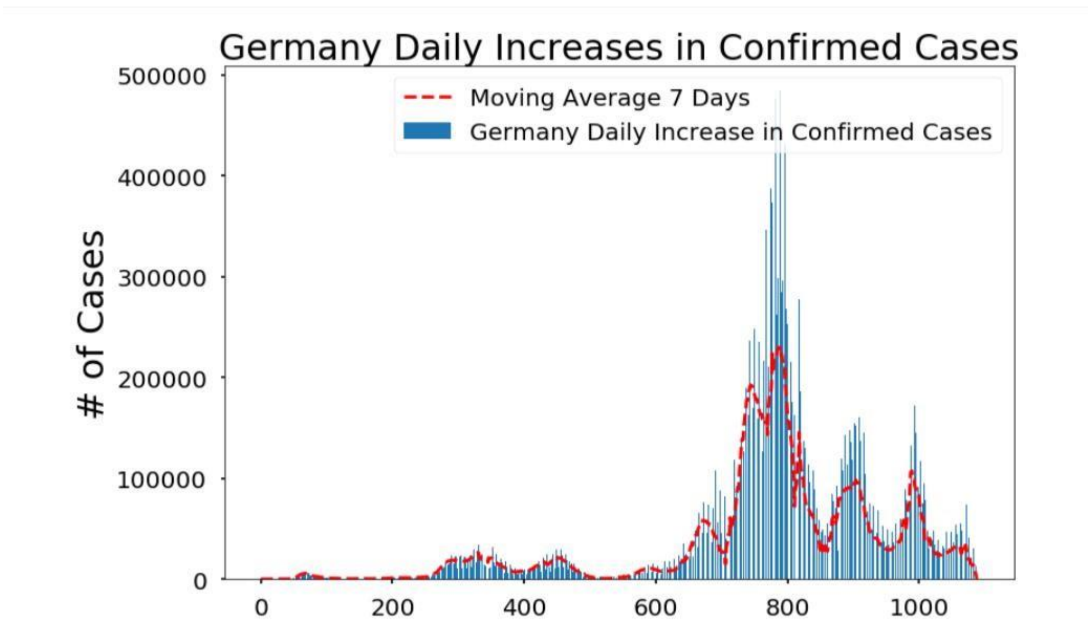
- **Italy**: Key findings for Italy's daily death and recovery data.

VISUALIZATIONS

Germany:

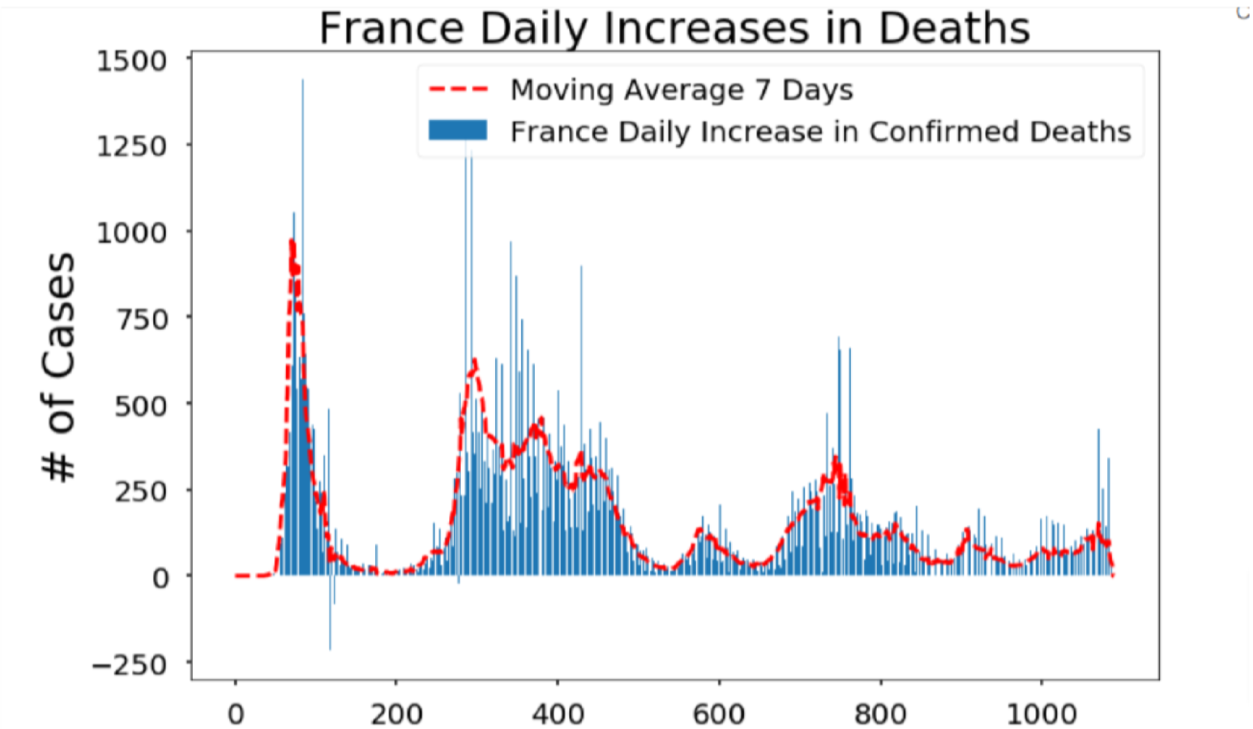


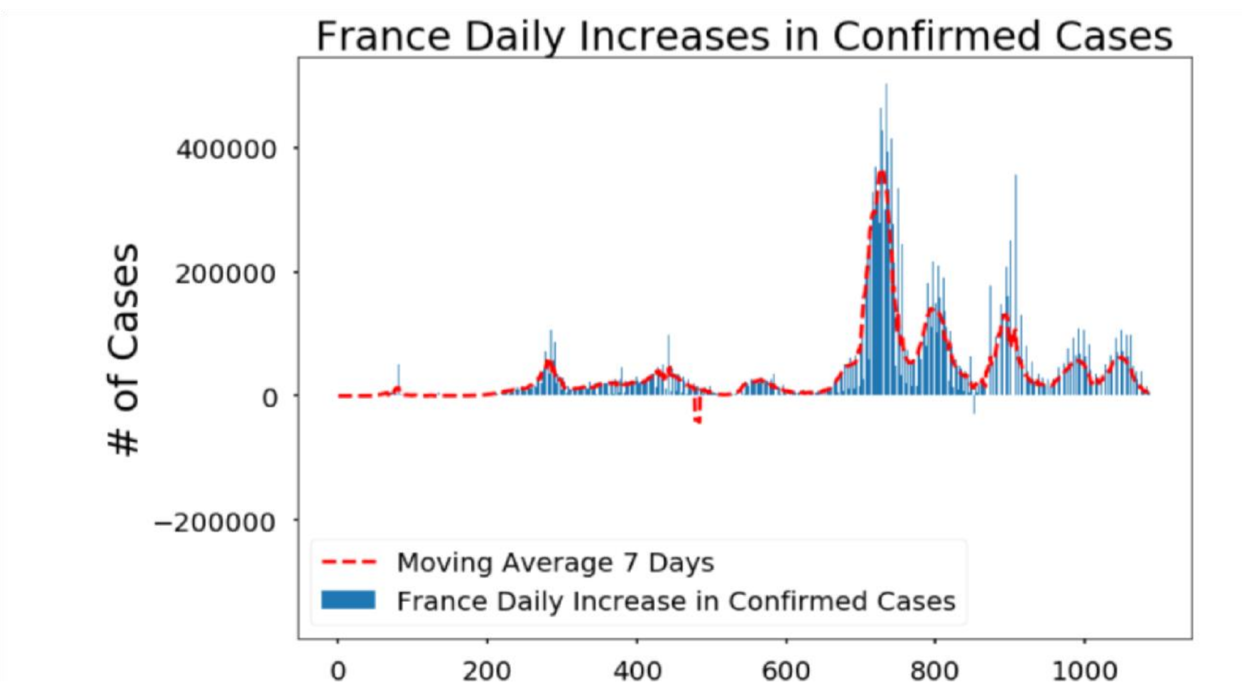
Germany Confirmed Cases
1e7
Germany Confirmed Cases
Moving Average 7 Days
# of Cases
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000

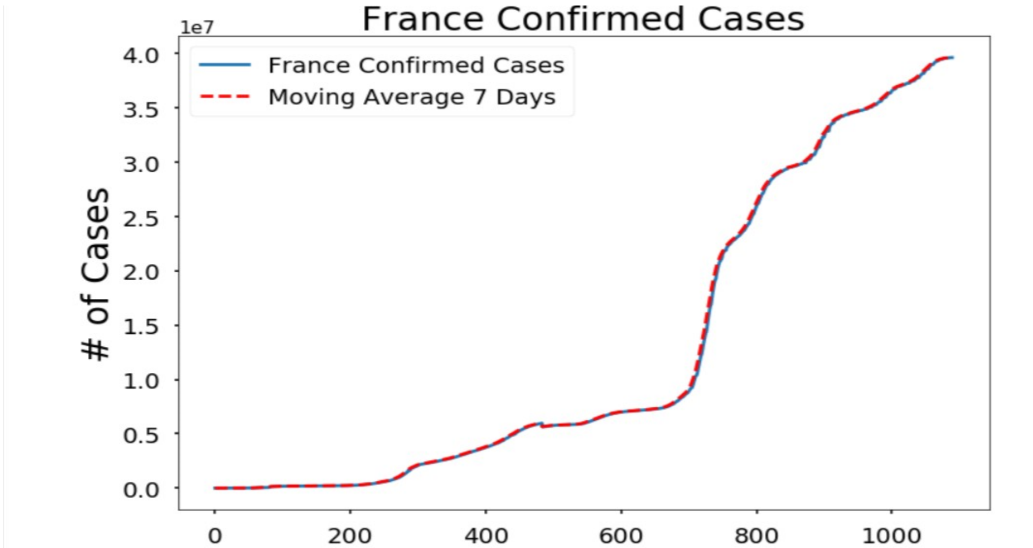


Germany Daily Increases in Confirmed Cases
Moving Average 7 Days
Germany Daily Increase in Confirmed Cases
# of Cases
500000
400000
300000
200000
100000
0
0
200
400
600
800
1000

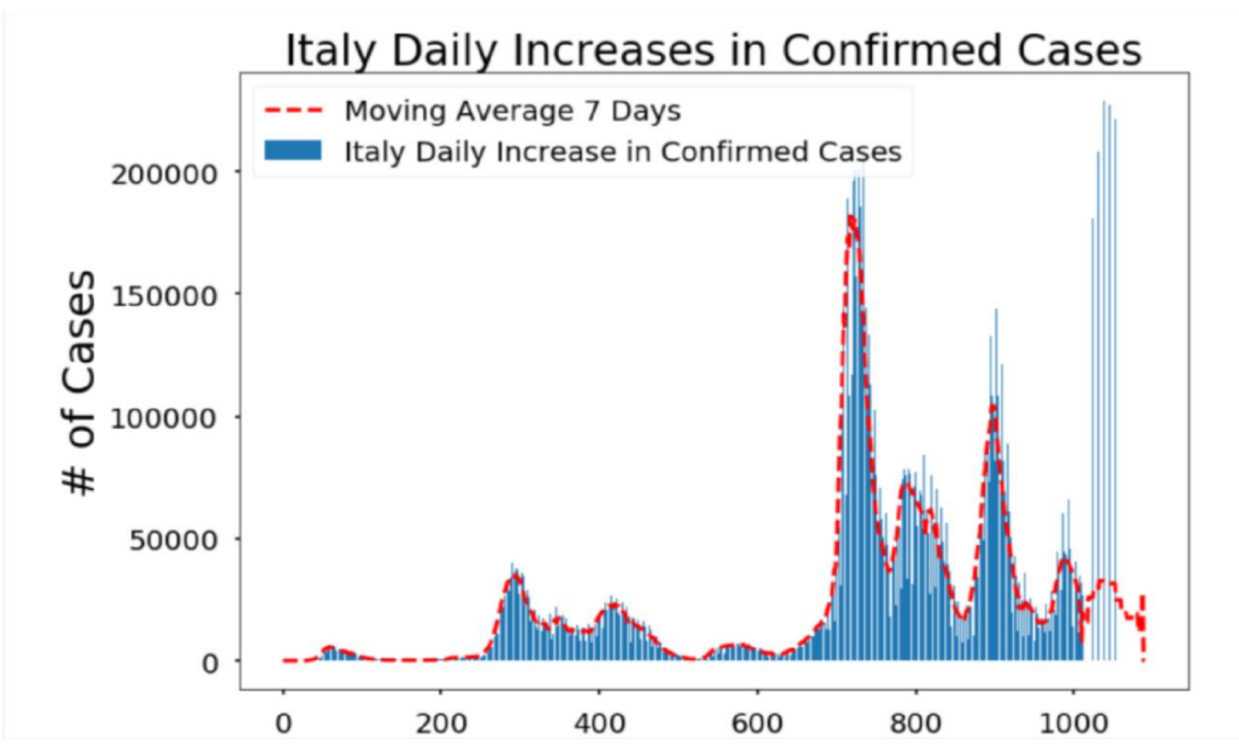
France:

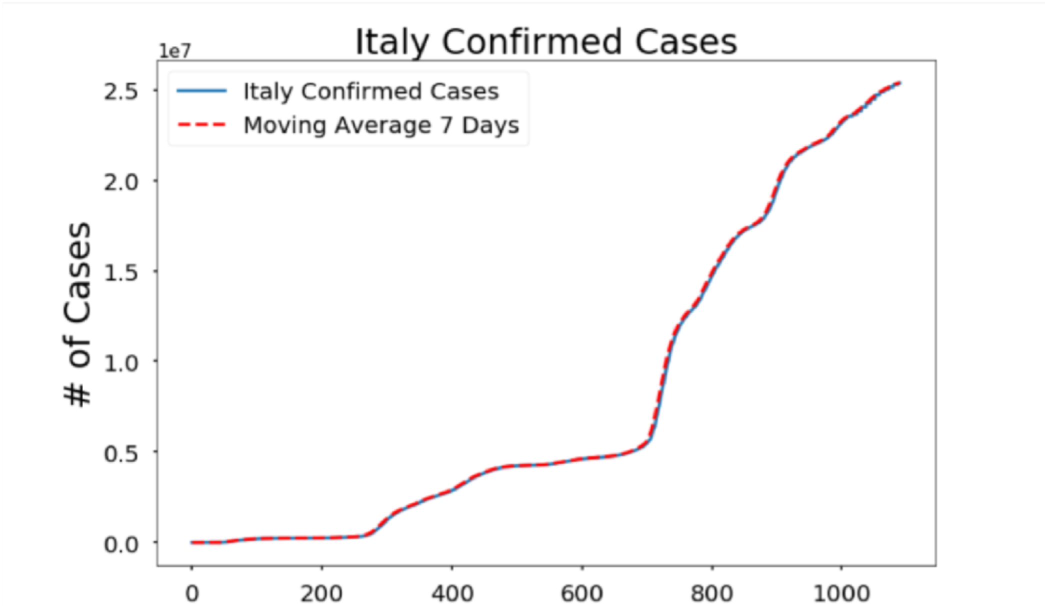

France Daily Increases in Deaths
Moving Average 7 Days
France Daily Increase in Confirmed Deaths
# of Cases
1500
1250
1000
750
500
250
0
−250
0
200
400
600
800
1000


France Daily Increases in Confirmed Cases
# of Cases
400000
200000
0
−200000
Moving Average 7 Days
France Daily Increase in Confirmed Cases
0
200
400
600
800
1000

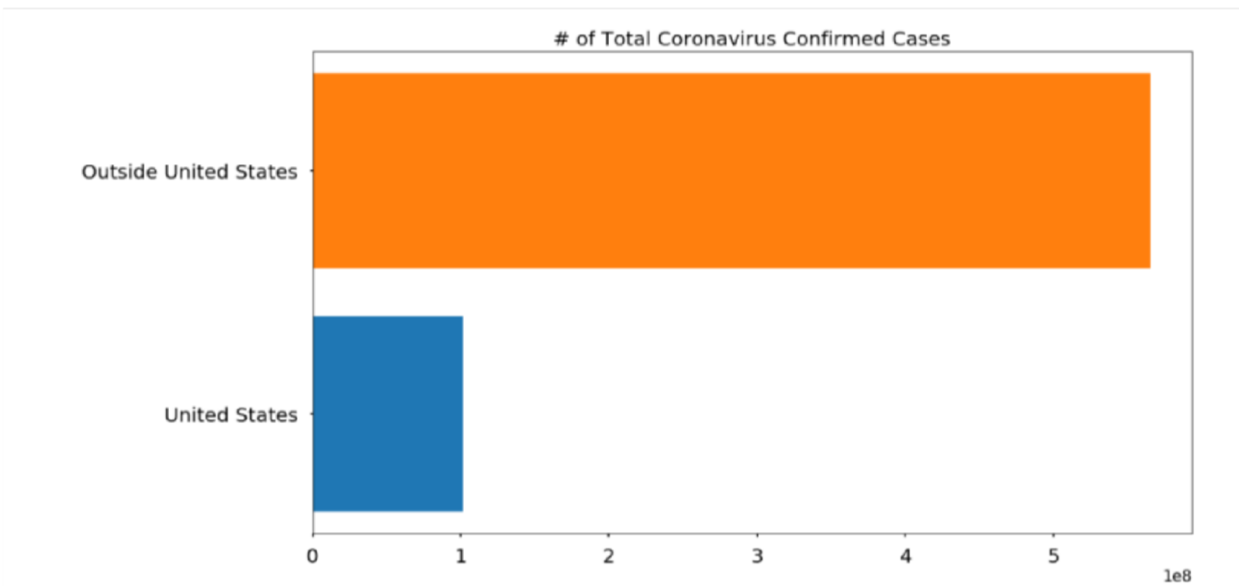

France Confirmed Cases
1e7
France Confirmed Cases
Moving Average 7 Days
# of Cases
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000

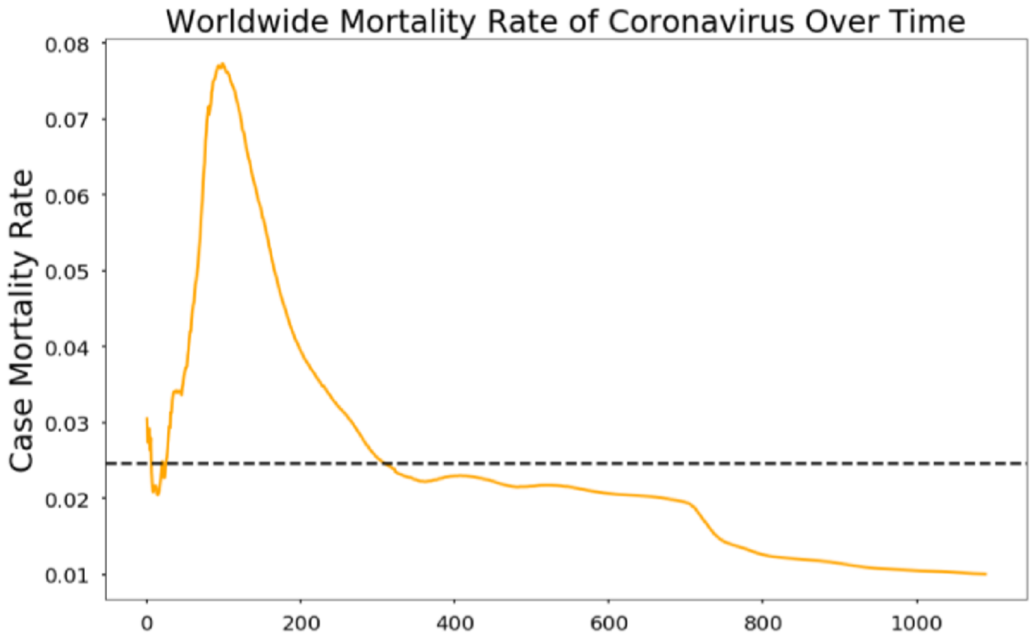
Italy


Italy Daily Increases in Confirmed Cases
Moving Average 7 Days
Italy Daily Increase in Confirmed Cases
# of Cases
200000
150000
100000
50000
0
0
200
400
600
800
1000

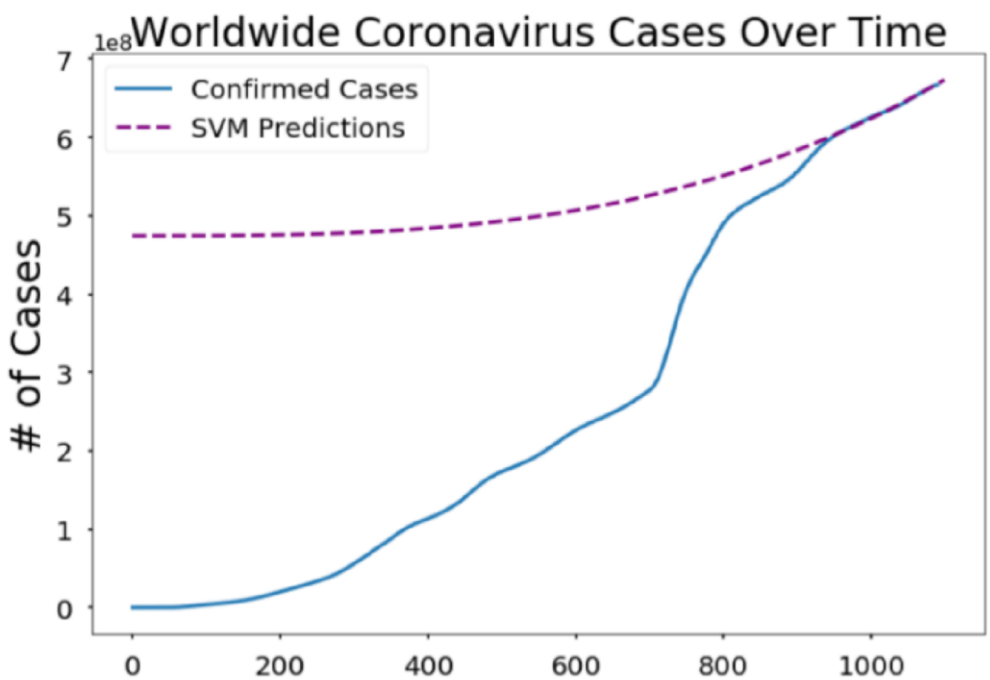

Italy Confirmed Cases
1e7
Italy Confirmed Cases
Moving Average 7 Days
# of Cases
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000

World trend:

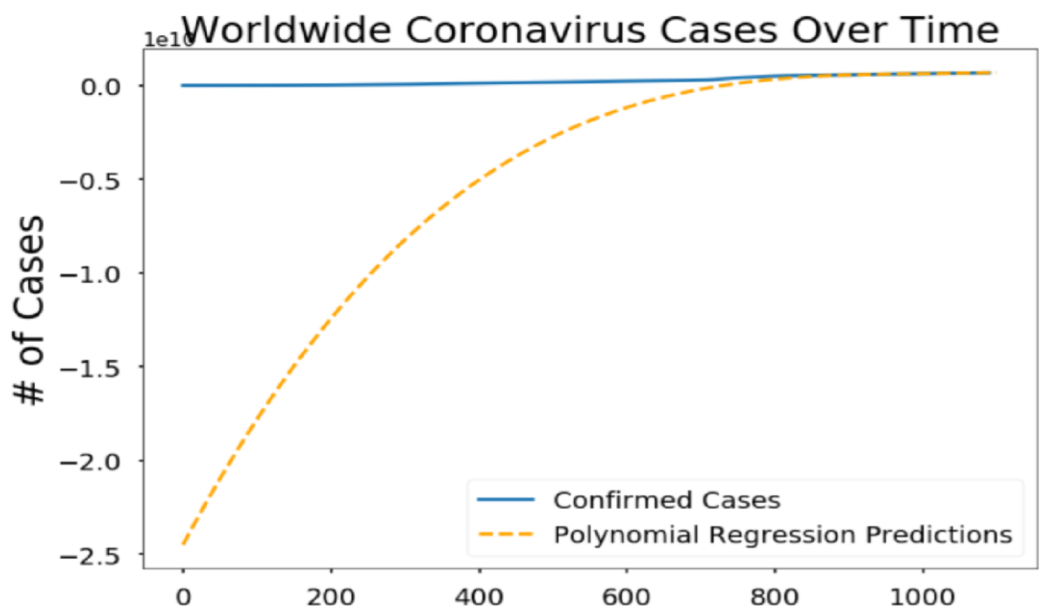

# of Total Coronavirus Confirmed Cases
Outside United States
United States
0
1
2
3
4
5
1e8



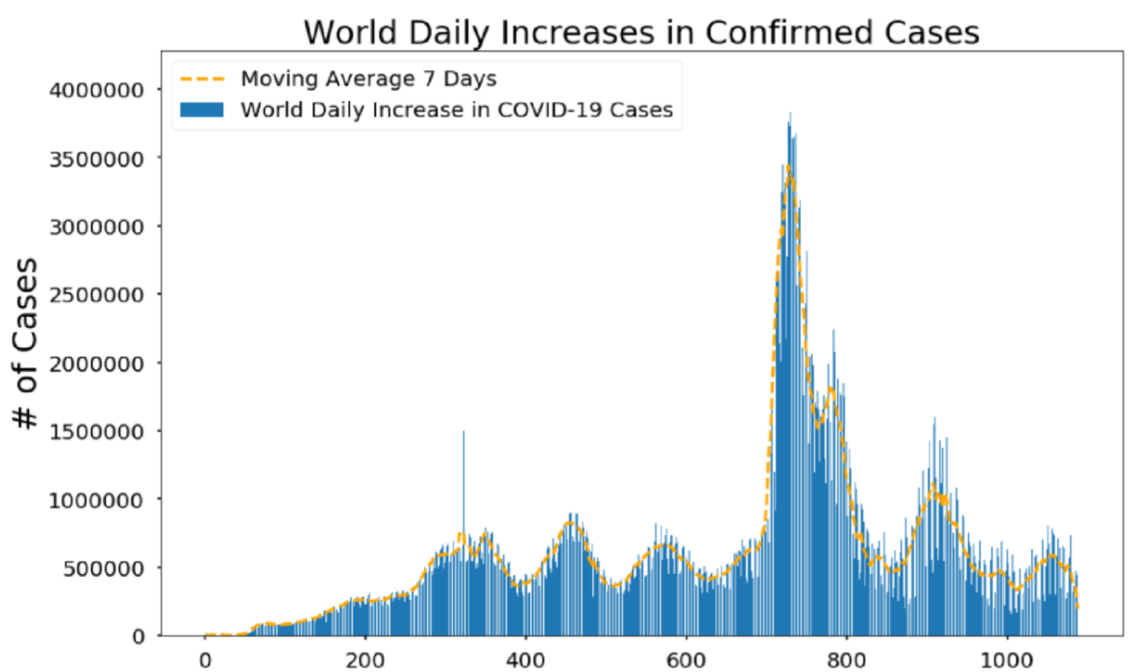
Worldwide Mortality Rate of Coronavirus Over Time
Case Mortality Rate
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
200
400
600
800
1000



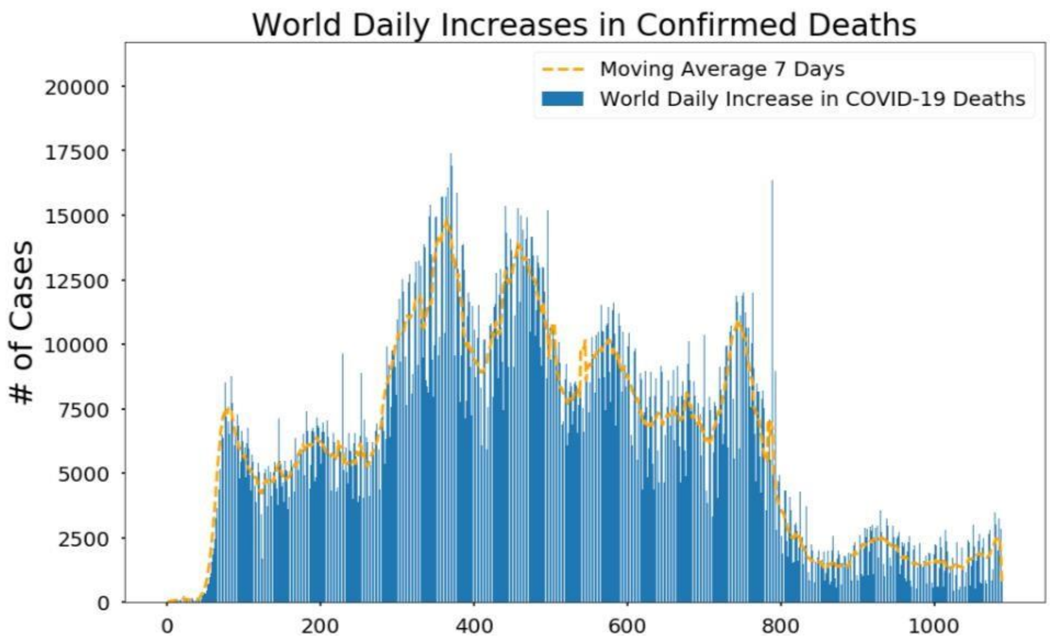
Worldwide Coronavirus Cases Over Time
1e8
# of Cases
Confirmed Cases
SVM Predictions
7
6
5
4
3
2
1
0
0
200
400
600
800
1000

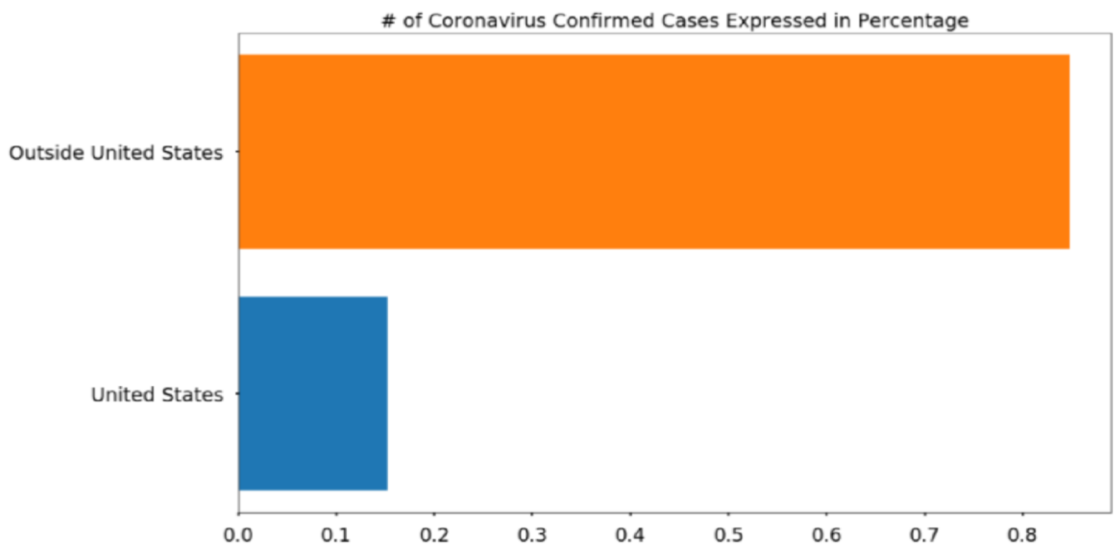


Worldwide Coronavirus Cases Over Time
1e10
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
# of Cases
0
200
400
600
800
1000
Confirmed Cases
Polynomial Regression Predictions

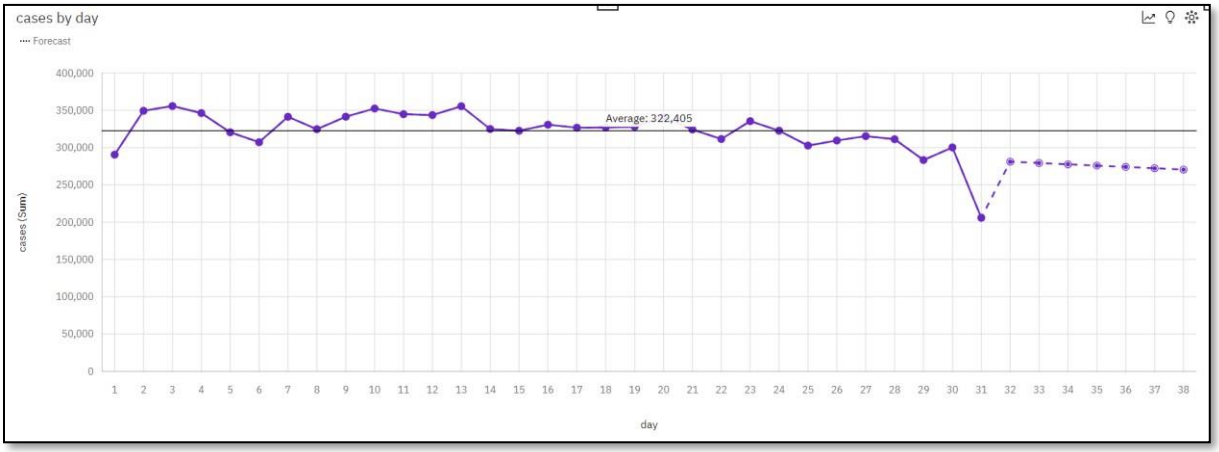


World Daily Increases in Confirmed Cases
Moving Average 7 Days
World Daily Increase in COVID-19 Cases
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
# of Cases
0
200
400
600
800
1000


World Daily Increases in Confirmed Deaths
Moving Average 7 Days
World Daily Increase in COVID-19 Deaths
# of Cases
20000
17500
15000
12500
10000
7500
5000
2500
0
0
200
400
600
800
1000


# of Coronavirus Confirmed Cases Expressed in Percentage
Outside United States
United States
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8

Line graph of cases vs days:



Line graph of cases and deaths vs countries and Territories:

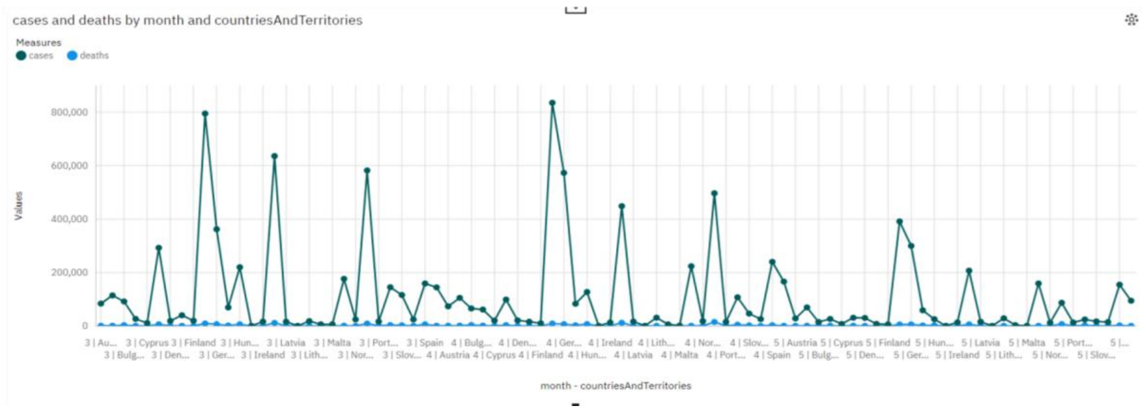
The value of **cases** at the last observed time point **31** is unusual. This may indicate incomplete data or a recent event that might require investigation.

cases has an unusually low value at time point **31**.

Over all **days**, the sum of **cases** is **nearly 10.0 million**.

cases ranges from **almost 206 thousand**, when **day** is **31**, to **nearly 356 thousand**, when **day** is **3**.

For **cases**, the most significant values of **day** are **3**, **13**, **10**, **2**, and **4**, whose respective **cases** values add up to **nearly 1.8 million**, or **17.6** % of the total.



month 3 has the highest total **cases** due to **countriesAndTerritories France**.

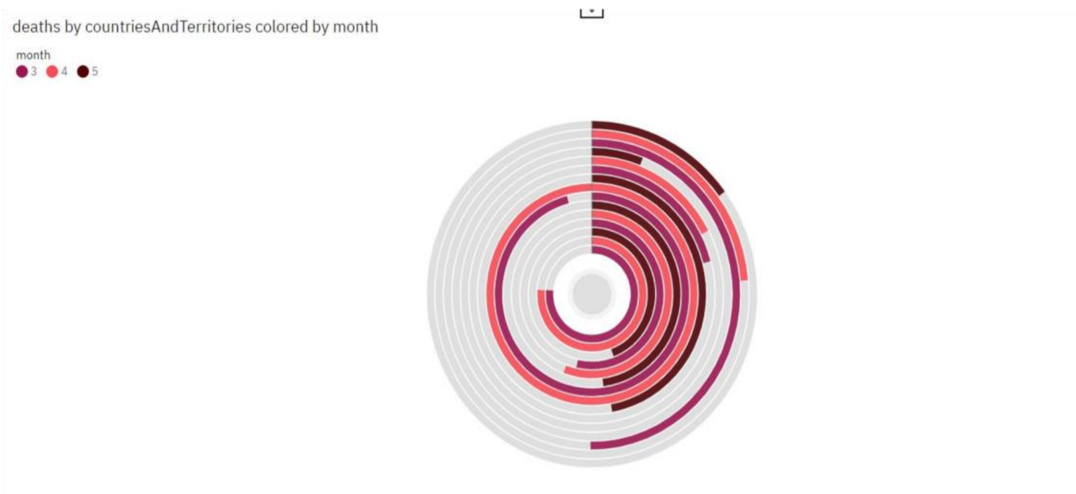
cases is unusually high when **month - countriesAndTerritories** is **4|France** and **3|France**.

It is projected that by **2021-06-19**, **France** will exceed **Germany** in **cases** by **over 14 thousand**.

It is projected that by **2021-06-19**, **3** will exceed **4** in **cases** by **nearly 251 thousand**.

countriesAndTerritories France has the highest **cases** at **over 2.0 million**, out of which **month 4** contributed the most at **over 835 thousand**.

Spiral graph of deaths Vs countries and Territories:



deaths is most unusual when **countriesAndTerritories** is **Slovakia** and **Italy**.

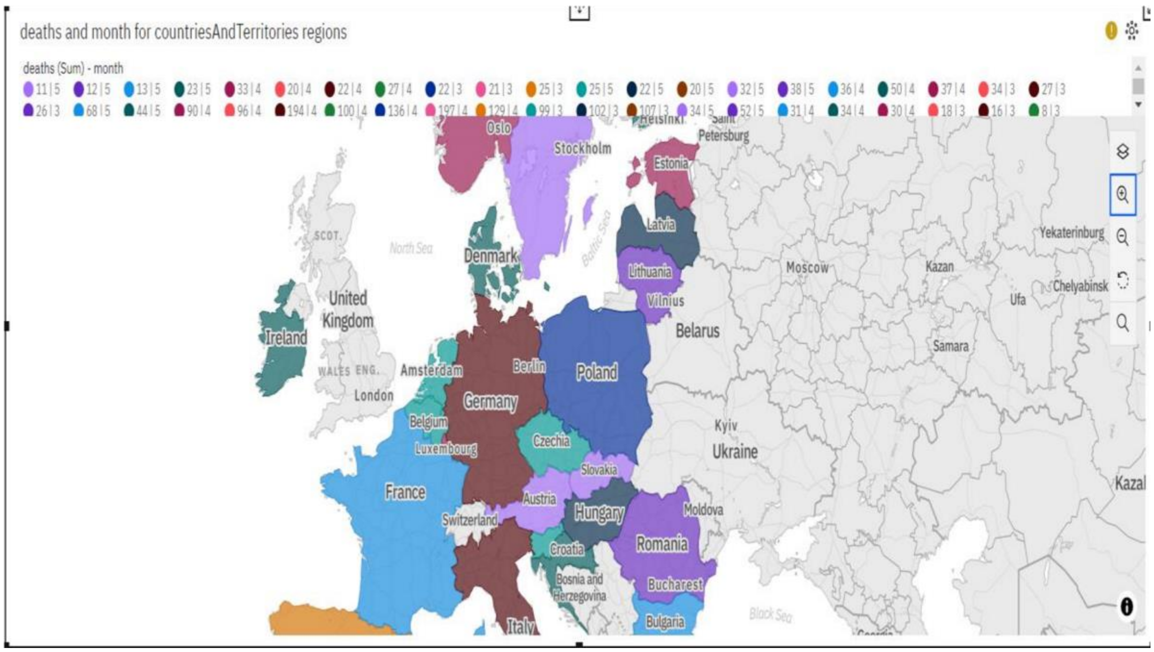
deaths is unusually low when **month** is **5**.

France has a **deaths** of **897** for **dateRep 2021-03-27**.

2021-04-10 dateRep accounted for **3%** of **Italy deaths** compared to **1%** for **France**.

4 month accounted for **41%** of **Italy deaths** compared to **39%** for **France**.

Maps of deaths and month Vs countries and Territories:

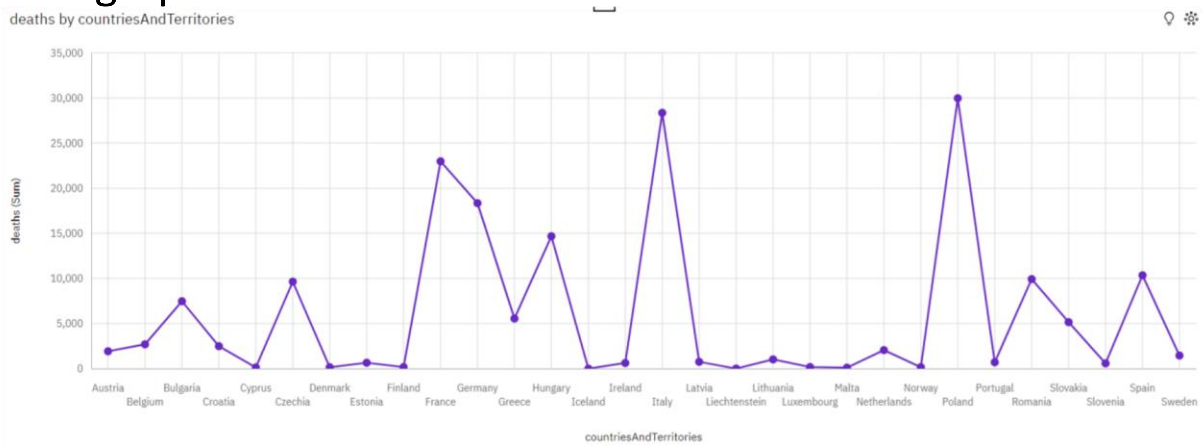


Suggested insights (2)

deaths 343 has the highest **Total cases** but is ranked #**107** in **Unaggregated countriesAndTerritories**.

deaths 0 has the highest **Unaggregated countriesAndTerritories** but is ranked #**10** in **Total cases**.

Line graph of deaths Vs Countries and Territories:



deaths is unusually high when **countriesAndTerritories** is **Poland, Italy** and **France**.

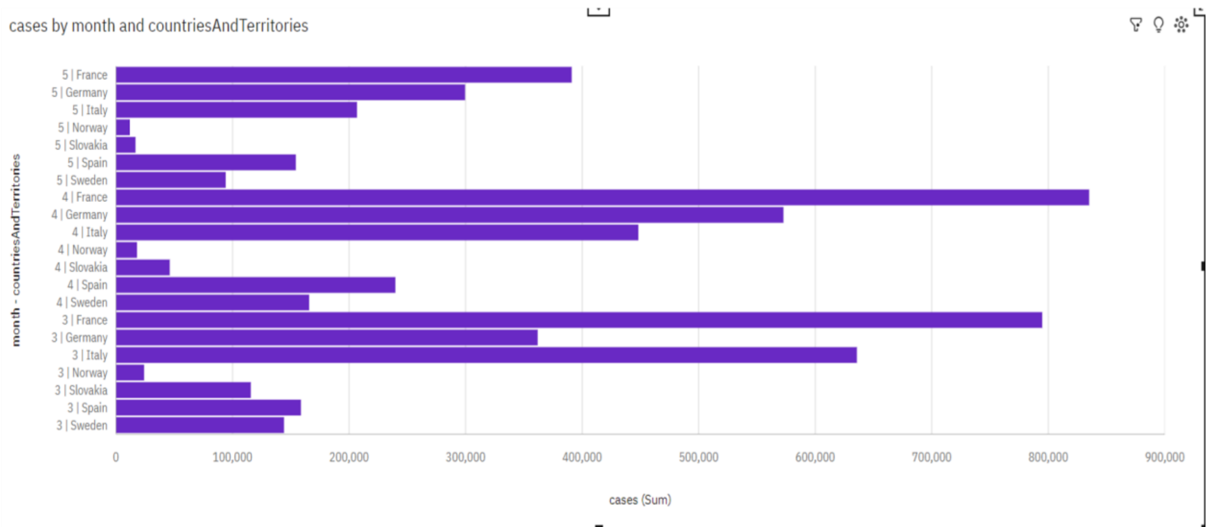
It is projected that by **2021-06-19, Germany** will exceed **Poland** in **deaths** by **45**.

From **2021-03-27** to **2021-03-28, France**'s **deaths** dropped by **79**%.

Across all values of **countriesAndTerritories,** the sum of **deaths** is **over 178 thousand**.

deaths ranges from **1**, when **countriesAndTerritories** is **Iceland,** to **almost 30 thousand**, when **countriesAndTerritories** is **Poland**.

Bar graph of cases Vs month and Countries and Territories:



month 4 has the highest total **cases** due to **countriesAndTerritories France**.

cases is unusually high when **month - countriesAndTerritories** is **4|France** and **3|France**.

It is projected that by **2021-06-19**, **France** will exceed **Germany** in **cases** by **over 14 thousand**.

It is projected that by **2021-06-19**, **3** will exceed **4** in **cases** by **almost 122 thousand**.

countriesAndTerritories France has the highest **cases** at **over 2.0 million**, out of which **month 4** contributed the most at **over 835 thousand**.

PROGRAM:

```
import numpy as np import matplotlib.pyplot as plt import pandas as pd

from sklearn.linear_model import LinearRegression, BayesianRidge from

sklearn.model_selection import RandomizedSearchCV, train_test_split from

sklearn.preprocessing import PolynomialFeatures from sklearn.svm import

SVR from sklearn.metrics import mean_squared_error,

mean_absolute_error import datetime


# Import and preprocess COVID-19 data confirmed_df

= pd.read_csv('confirmed_data_url') deaths_df =

pd.read_csv('deaths_data_url') latest_data =

pd.read_csv('latest_data_url') us_medical_data =

pd.read_csv('us_medical_data_url')


# Extract relevant columns confirmed_cols =

confirmed_df.keys() deaths_cols = deaths_df.keys()

confirmed = confirmed_df.loc[:, confirmed_cols[4]:]

deaths = deaths_df.loc[:, deaths_cols[4]:]


# Analyze global COVID-19 data
num_dates = len(confirmed.keys())

ck = confirmed.keys() dk =
```

```
deaths.keys() world_cases = []
total_deaths = [] mortality_rate =
[]


# Calculate total cases, deaths, and mortality rate
for i in range(num_dates):
    confirmed_sum = confirmed[ck[i]].sum()
death_sum = deaths[dk[i]].sum()
world_cases.append(confirmed_sum)
total_deaths.append(death_sum)
mortality_rate.append(death_sum / confirmed_sum)


# Define functions for data analysis and visualization
def daily_increase(data):     # Calculate daily increase
in 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


def moving_average(data, window_size):
```

```
    # Calculate moving average of data
moving_average = []

    for i in range(len(data)):        if i
+ window_size < len(data):

            moving_average.append(np.mean(data[i:i+window_size]))
        else:
            moving_average.append(np.mean(data[i:len(data)]))
return moving_average


# Specify window size for moving averages
window = 7


# Analyze and visualize COVID-19 cases and deaths world_daily_increase =
daily_increase(world_cases) world_confirmed_avg =
moving_average(world_cases, window) world_daily_increase_avg =
moving_average(world_daily_increase, window) world_daily_death =
daily_increase(total_deaths) world_death_avg =
moving_average(total_deaths, window) world_daily_death_avg =
moving_average(world_daily_death, window)


# Prepare data for regression modeling days_since_1_22 = np.array([i for i in
range(len(ck))]).reshape(-1, 1) world_cases = np.array(world_cases).reshape(-1, 1)
total_deaths = np.array(total_deaths).reshape(-1, 1) days_in_future = 10
```

```
future_forcast = np.array([i for i in range(len(ck) + days_in_future)]).reshape(-1, 1)

adjusted_dates = future_forcast[:-10]

start = '1/22/2020' start_date =

datetime.datetime.strptime(start, '%m/%d/%Y')

future_forcast_dates = []


# Generate future dates for forecasting

for i in range(len(future_forcast)):

   future_forcast_dates.append((start_date +
datetime.timedelta(days=i)).strftime('%m/%d/%Y'))


# Train and test data for regression models

days_to_skip = 830

X_train_confirmed, X_test_confirmed, y_train_confirmed, y_test_confirmed =
train_test_split(days_since_1_22[days_to_skip:], world_cases[days_to_skip:], test_size=0.10,
shuffle=False)


# Support Vector Regression (SVM) model for confirmed cases svm_confirmed =

SVR(shrinking=True, kernel='poly', gamma=0.01, epsilon=1, degree=3, C=0.1)

svm_confirmed.fit(X_train_confirmed, y_train_confirmed) svm_pred =

svm_confirmed.predict(future_forcast)


# Polynomial regression model for confirmed cases 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_forcast =
poly.fit_transform(future_forcast) linear_model =
LinearRegression(normalize=True, fit_intercept=False)
linear_model.fit(poly_X_train_confirmed, y_train_confirmed)
test_linear_pred = linear_model.predict(poly_X_test_confirmed)
linear_pred = linear_model.predict(poly_future_forcast)


# Bayesian Ridge Polynomial Regression model for confirmed cases
tol = [1e-6, 1e-5, 1e-4, 1e-3, 1e-2] alpha_1
= [1e-7, 1e-6, 1e-5, 1e-4, 1e-3] alpha_2 =
[1e-7, 1e-6, 1e-5, 1e-4, 1e-3] lambda_1 =
[1e-7, 1e-6, 1e-5, 1e-4, 1e-3] lambda_2 =
[1e-7, 1e-6, 1e-5, 1e-4, 1e-3] normalize =
[True, False]


bayesian_grid = {
    'tol': tol,
    'alpha_1': alpha_1,
    'alpha_2': alpha_2,
    'lambda_1': lambda_1,
    'lambda_2': lambda_2,
    'normalize': normalize
}


bayesian = BayesianRidge(fit_intercept=False)
```

```
bayesian_search = RandomizedSearchCV(bayesian, bayesian_grid,
scoring='neg_mean_squared_error', cv=3, return_train_score=True, n_jobs=-1, n_iter=40,
verbose=1) bayesian_search.fit(bayesian_poly_X_train_confirmed, y_train_confirmed)
bayesian_confirmed = bayesian_search.best_estimator_ test_bayesian_pred =
bayesian_confirmed.predict(bayesian_poly_X_test_confirmed) bayesian_pred =
bayesian_confirmed.predict(bayesian_poly_future_forcast)

# Visualize top 10 total COVID-19 cases for specific countries
countries = ['US', 'India', 'Brazil', 'France', 'Germany', 'United Kingdom', 'Italy', 'Korea, South',
'Russia', 'Turkey']


for country in countries:
    country_visualizations(country)


# Compare COVID-19 cases and deaths in selected countries compare_countries
= ['India', 'US', 'Brazil', 'Russia', 'United Kingdom', 'France'] graph_name =
['Coronavirus Confirmed Cases', 'Coronavirus Confirmed Deaths']



for num in range(2):
    plt.figure(figsize=(12, 8))
    for country in compare_countries:
        plt.plot(get_country_info(country)[num])
plt.legend(compare_countries, prop={'size': 20})
plt.xlabel('Days since 1/22/2020', size=30)
plt.ylabel('# of Cases', size=30)
plt.title(graph_name[num], size=30)
```

```
plt.xticks(size=20)
plt.yticks(size=20)
plt.show()
```

Conclusion

The analysis of daily death and recovery data for Germany, France, and Italy provides valuable insights into the COVID-19 pandemic's impact in these countries. Our findings offer information that can guide policy decisions, healthcare resource allocation, and public health meas