# Data Visualisation about Covid 19 in Switzerland

**Meiwei Zhang**

A00268988

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Master of Science

Software Engineer

Athlone Institute of Technology

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| **Author** | **Course** | **Time** |
|---|---|---|
| Meiwei Zhang | Data Virtualization | April 2020 |

**Work Title**

Data Visualisation about Covid 19 in Switzerland

**Supervisor**

Mark

**Abstract**

This paper explains the situation of Covid 19 in Switzerland from three aspects. First, from the distribution of the epidemic in Switzerland, combined with the distribution of Swiss population and resources, give some suggestions for the coordination of internal resources in Switzerland. Second, from several countries similar to the Swiss epidemic, do some epidemic analysis and comparison. Third, use statistical knowledge to analyze Switzerland's effectiveness in epidemic prevention and control, while using machine learning algorithms to make simple epidemic development predictions.

**Objectives:**

1. Analysis the situation in Switzerland and their resource.
2. Compared with other similar countries, including Ireland.
3. Using Poisson distribution to verify the effectiveness of Swiss epidemic control
4. Using sample machine learning algorithm to predict the future situation.

**Keywords**

Covid 19, Switzerland, Poisson distribution, machine learning

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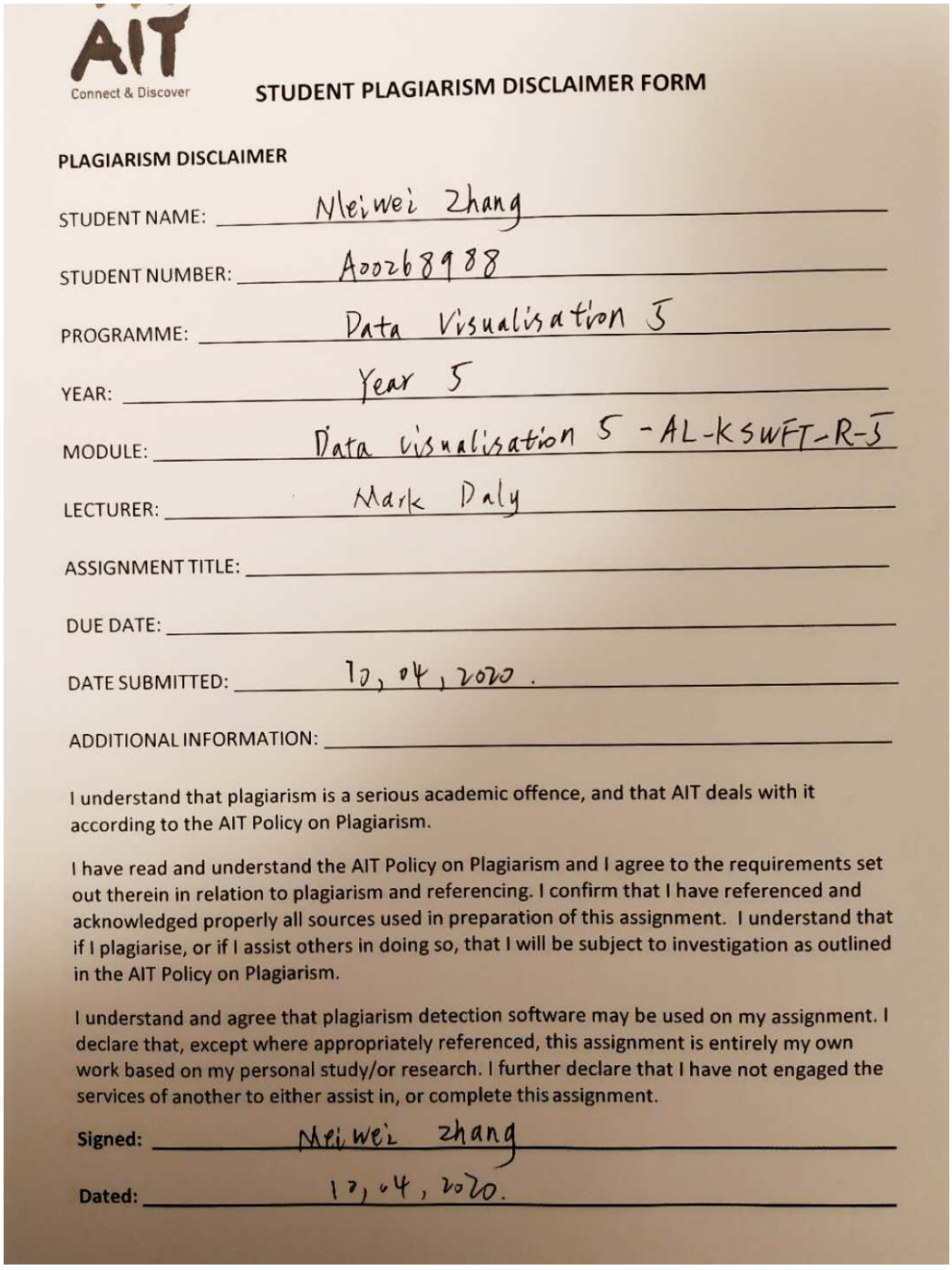

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Figure 1: statement

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# Chapter 1

# Introduction

## 1.1 Background

Corona Virus Disease 2019 (COVID-19), referred to as "new coronary pneumonia" for short, is named "2019 Coronavirus Disease" by the World Health Organization [1], and refers to pneumonia caused by new-type coronavirus infection in 2019. Since December 2019, some hospitals in Wuhan City, Hubei Province have successively found multiple cases of unexplained pneumonia with a history of South China seafood market exposure, which have now been confirmed as acute respiratory infections caused by new coronavirus infections in 2019. On February 11, 2020, the Director-General of the World Health Organization, Tan Desai, announced in Geneva, Switzerland, that the new coronavirus-infected pneumonia was named "COVID-19". On February 21, 2020, the National Health and Health Commission issued a notice on revising the English naming of new coronavirus pneumonia, and decided to revise the English name of "new coronavirus pneumonia" to "COVID-19", which is consistent with the name of the World Health Organization. The Chinese name remains unchanged.

## 1.2 Objective

This article mainly introduces the development of Covid 19 infectious jiqiang disease in Switzerland. In order to assess the situation of the Swiss epidemic in many ways, I have selected several countries with similar numbers of epidemic

developments in Switzerland, including Belgium, Britain, and the Netherlands. For comparison, it also gives us some references for the prevention and control of the outbreak in Ireland.

## 1.3 Motivation

This paper is inspired by China 's epidemic prevention and control, because we see that China 's epidemic situation has been effectively controlled, so I hope that the analysis of some data will help Switzerland to more effectively stop the spread of the epidemic situation. At the same time, I can analyze several countries with the same number of confirmed patients in Switzerland to help Switzerland determine the trend of the epidemic. Finally, I hope to use statistics and machine learning knowledge to make some analysis and predictions, which can provide reference for Swiss epidemic prevention work.

# Chapter 2

# Data

## 2.1 Data Sources

Disclaimer: The population data in the databases are from the World Bank. and this paper downloads from the European Centre for Disease Prevention and Control [2] At the same time, in order to analyze the domestic epidemic situation and resources in Switzerland, the data of this website was also borrowed. Included in the analysis of geographical distribution data, borrowed latitude and longitude data from the Swiss cantons [3].

## 2.2 Data Format

The URL provide csv, json ,xml typres dataset. the details can be seen by the followings:

CSV version:

```
dateRep,day,month,year,cases,deaths,countriesAndTerritories,
    geoId,countryterritoryCode,popData2018
30/03/2020,30,3,2020,8,1,Afghanistan,AF,AFG,37172386
29/03/2020,29,3,2020,15,1,Afghanistan,AF,AFG,37172386
28/03/2020,28,3,2020,16,1,Afghanistan,AF,AFG,37172386
27/03/2020,27,3,2020,0,0,Afghanistan,AF,AFG,37172386
26/03/2020,26,3,2020,33,0,Afghanistan,AF,AFG,37172386
...
```

Json verison:

```
{
    "records":
    [
      {
      "dateRep": "02/04/2020",
      "day": "2",
```

```
        "month": "4",
        "year": "2020",
        "cases": "26",
        "deaths": "0",
        "countriesAndTerritories": "Afghanistan",
        "geoId": "AF",
        "countryterritoryCode": "AFG",
        "popData2018": "37172386"
        },
        ...
}
```


## 2.3 Data parameter

The report was completed around April 4, 2020. So the data collected from 22.01.2020 to 30.03.2020. At the same time, because a more appropriate source of daily recovery numbers is not found in Switzerland, this report does not analyze recovery data. In addition, combined with China 's epidemic prevention and control, the number of people recovering is relatively small during the outbreak. Generally, the number of patients recovering gradually after the peak of the number of people. The Swiss and some other European countries in this article have not completed the report The number of infections peaked before the day. The same is true in Ireland, where there is almost no data on recovery patients. Finally, this report also hopes to analyze the epidemic situation from the two negative aspects of the number of infected people and the number of fatalities, and hopes to help Switzerland better carry out epidemic prevention work. and the data set cols including:

- dateRep
- day
- month
- year
- cases

- deaths
- countriesAndTerritories
- geoId
- countryterritoryCode
- popData2018

# Chapter 3

# Software

For this report, I use some third party python package to help me to do the virtualization work. and the whole important software including the followings:

- pandas
- matplotlib
- numpy
- plotly

Here, I want to introduce the powerful software plotly, which is helping leading organizations close the gap between Data Science teams and the rest of the organization [4].

# Chapter 4

# Analysis

## 4.1 Switzerland self analysis

There are a total of 26 cantons in Switzerland. Based on the latitude and longitude of each canton, we first count the number of people infected in each canton, and then combine the population density of each canton and the distribution of medical resources to analyze whether Switzerland has unequal resource allocation problems. the following picture can display the inflection between cantons, and the code is the following:

```
token = 'token from website' # you will need your own token
import pandas as pd
us_cities = pd.read_csv("map.csv")
import plotly.express as px
fig = px.scatter_mapbox(us_cities, lat="lat", lon="lon",
    hover_name="City", hover_data=["State", "Inflection"],
                        color_discrete_sequence=["fuchsia"],
    zoom=3, height=500)
fig.update_layout(mapbox_style="dark", mapbox_accesstoken=
    token)
fig.update_layout(margin={"r":0,"t":0,"l":0,"b":0})
fig.show()
```

However, we can see the more details from 4.5 between different cantons in Switzerland [5]:

According to the number of hospital beds and the number of infected people in each canton of Switzerland, we made the following statistics and found that some cantons have been overloaded, and some cantons are idle, so we can consider the appropriate transfer of patients. Similarly, I counted the vertical charts of the population data of each canton and found that there is a certain corre-

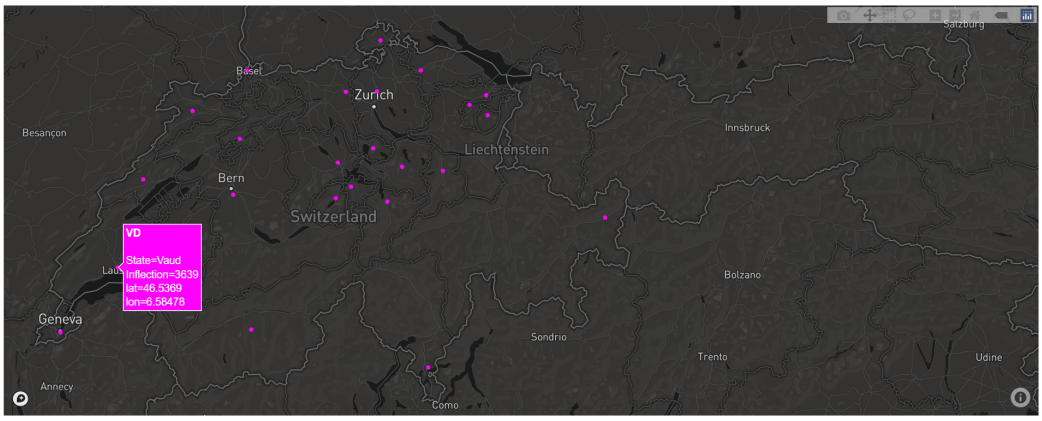


Figure 4.1: Inflection distribution in Switzerland 1

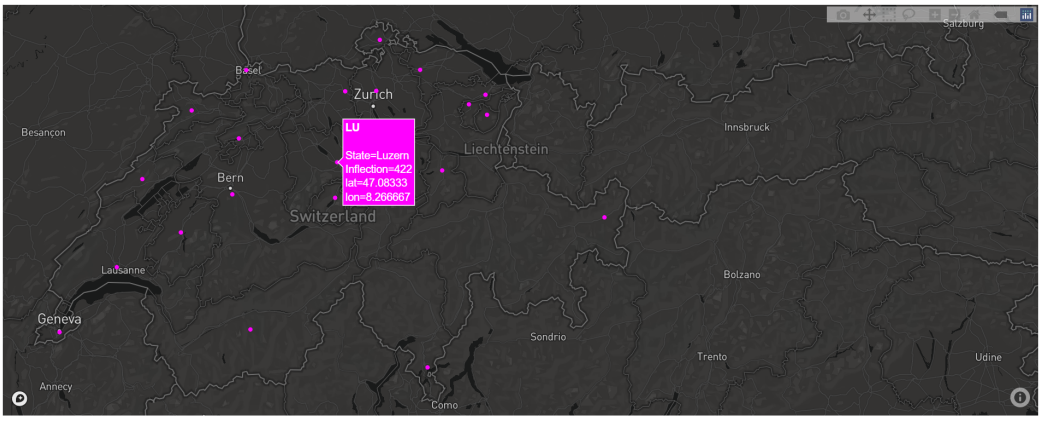


Figure 4.2: Inflection distribution in Switzerland 2

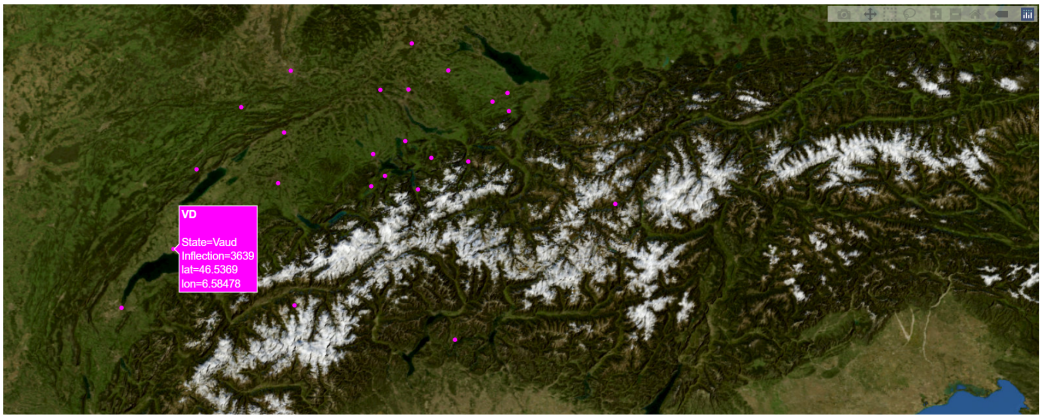


Figure 4.3: Inflection distribution in Switzerland 3


Figure 4.4: Inflection distribution in Switzerland 4

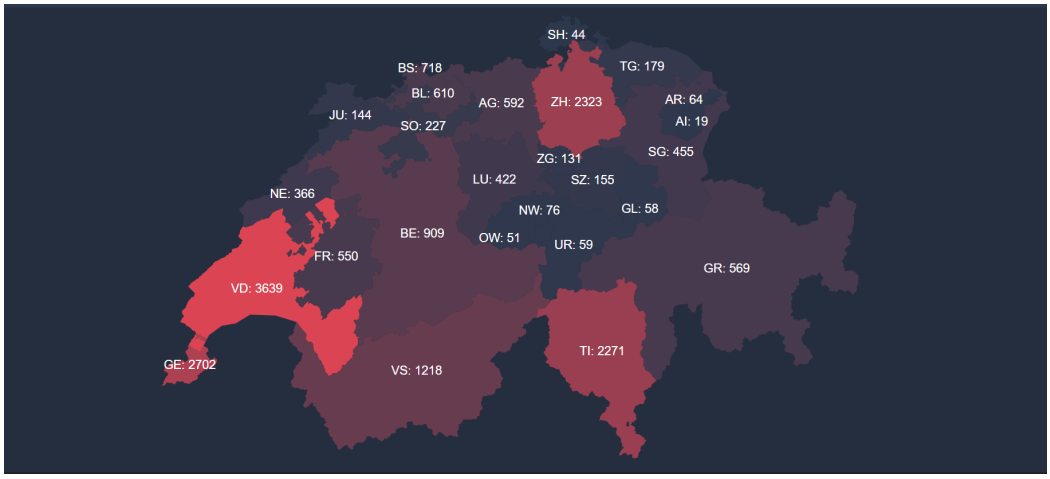


Figure 4.5: Inflection distribution in Switzerland 5

lation between the population density and the number of infected people. It is recommended that when allocating medical resources, Switzerland can consider population density as an important factor

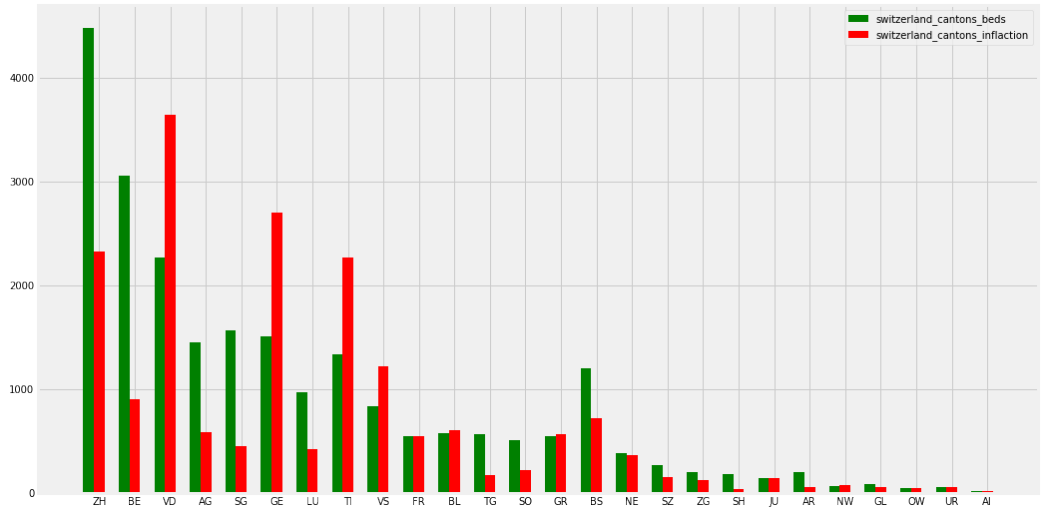


Figure 4.6: Beds and Inflection comparison in Switzerland

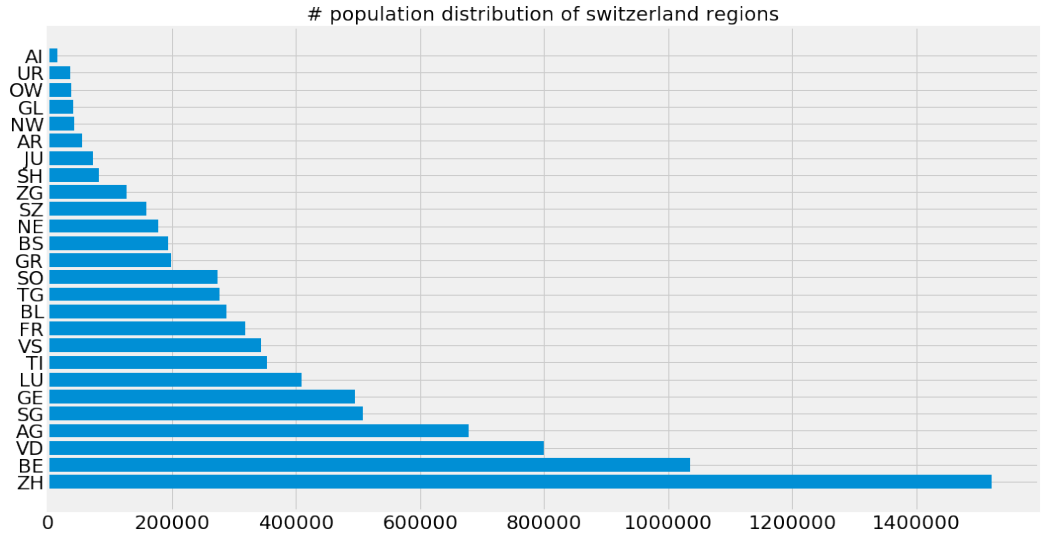


Figure 4.7: Cantons population in Switzerland

Next, I will analyze the increase in the number of patients in Switzerland, including changes in growth rates and mortality. According to statistical knowledge, both the number of infections and the number of deaths should follow the Gaussian distribution. If we find that a Gaussian distribution has not been formed according to the infection curve, then we can determine that the peak number

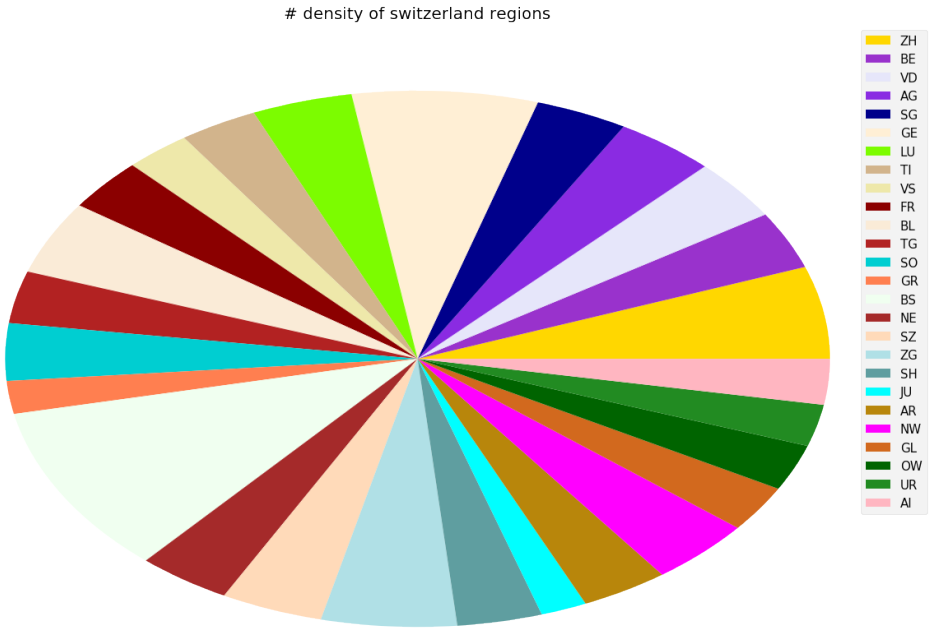


Figure 4.8: Cantons density in Switzerland

of infections and deaths in Switzerland have not yet arrived. The epidemic prevention work will still face huge challenges. In addition, according to curve Fig 4.9, 4.11, we can see the change and mean value of infection rate and lethal rate. Through curve Fig 4.10, 4.12, we can see that lethal rate and infection rate are rising, which is consistent with the results of my statistics.

Moreover, the daily inflaction and death can be see from the Fig 4.13, 4.14

## 4.2 Switzerland compared with others

I will compare the data of Belgium, the Netherlands, the United Kingdom, and Ireland with Switzerland. The dimensions of comparison are from the number of infected people, the number of fatalities, the infection rate, and the mortality rate. I did not choose to compare it with the world. There are two main reasons. First, because there is a time difference in the development of epidemics in different regions of the world. For example, the epidemic situation in Asian countries is currently in the stage of controlling decay, and Europe is still in the development stage. Not big. Second, European countries have more similarities in national

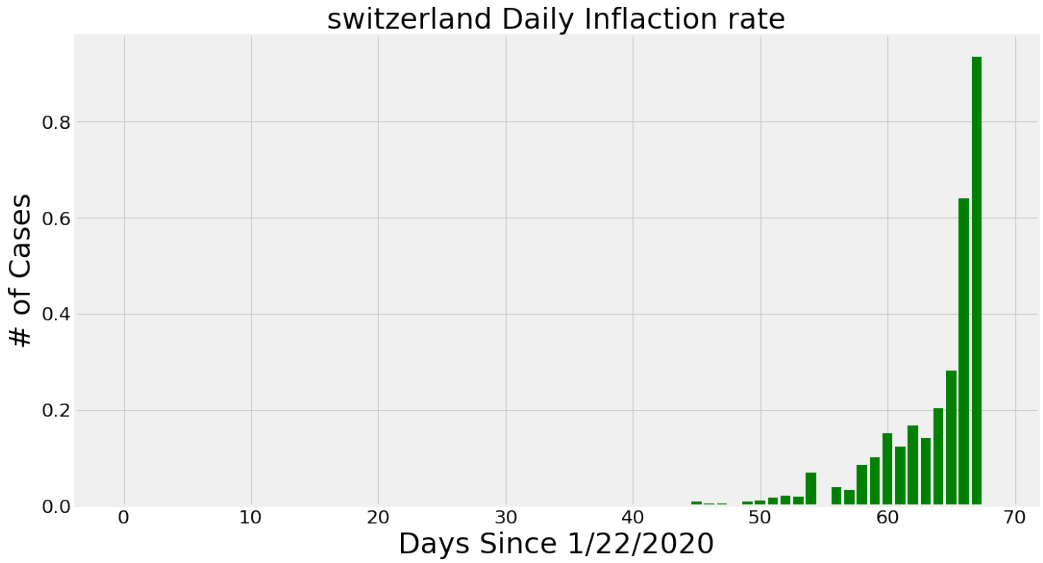


Figure 4.9: inflection rate bar in Switzerland

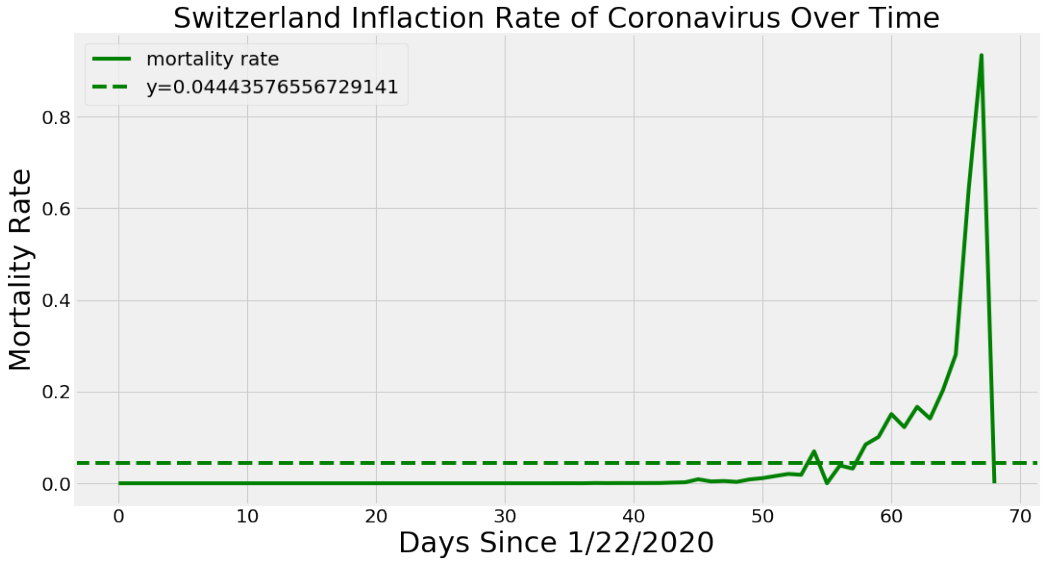


Figure 4.10: inflection rate average curve in Switzerland

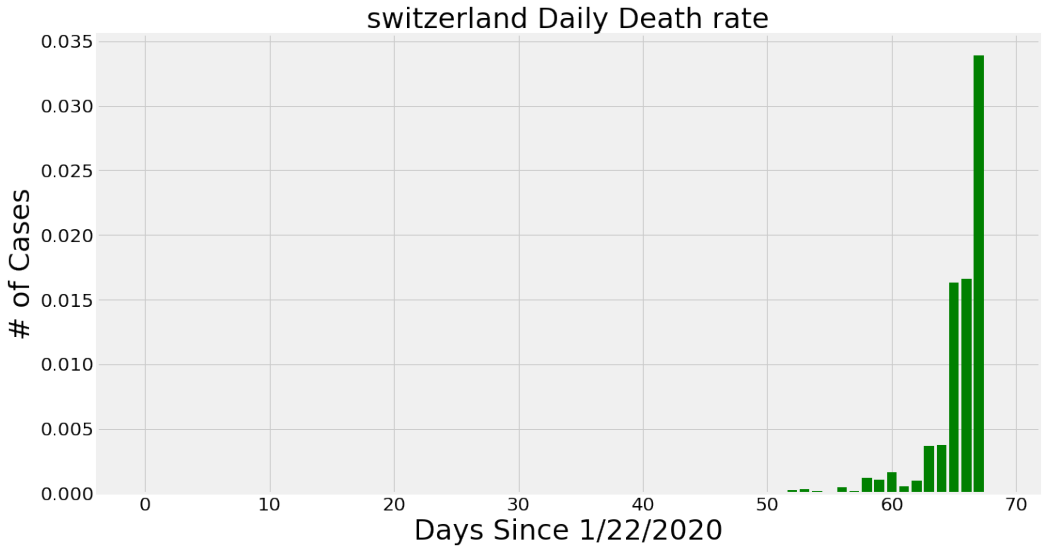


Figure 4.11: death rate bar in Switzerland

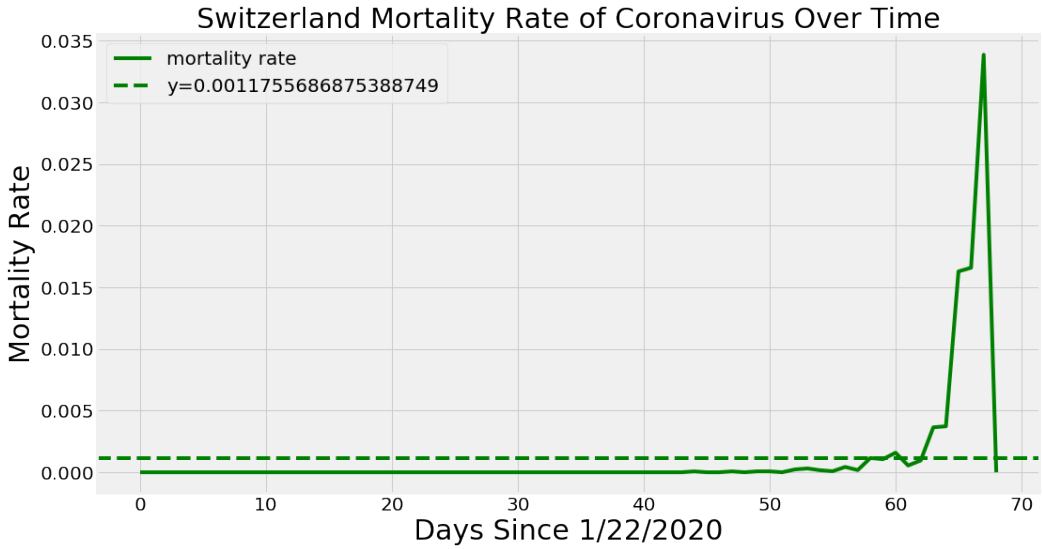


Figure 4.12: death rate average curve in Switzerland

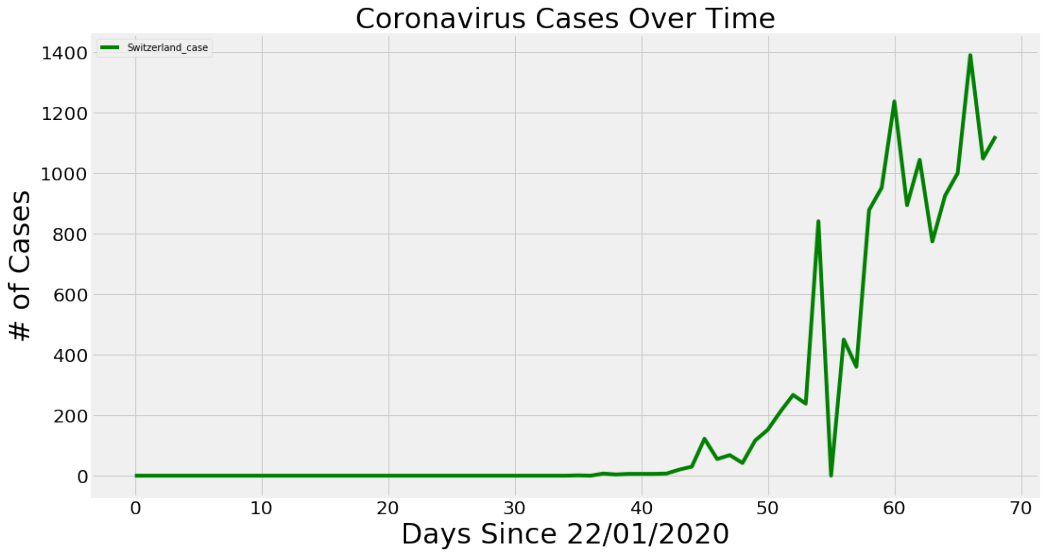


Figure 4.13: daily inflection in Switzerland

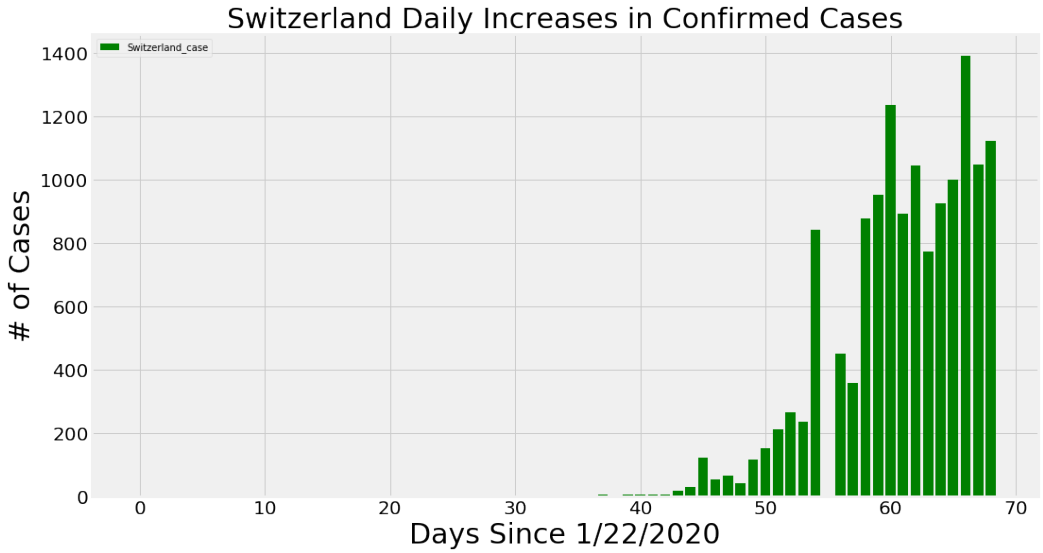


Figure 4.14: daily death in Switzerland

systems, prevention and control policies, and population genes, so comparisons between European countries are more meaningful than comparisons worldwide.

Firstly, I compare the daily cases increase curve with the different countries. Fig 4.15, 4.16

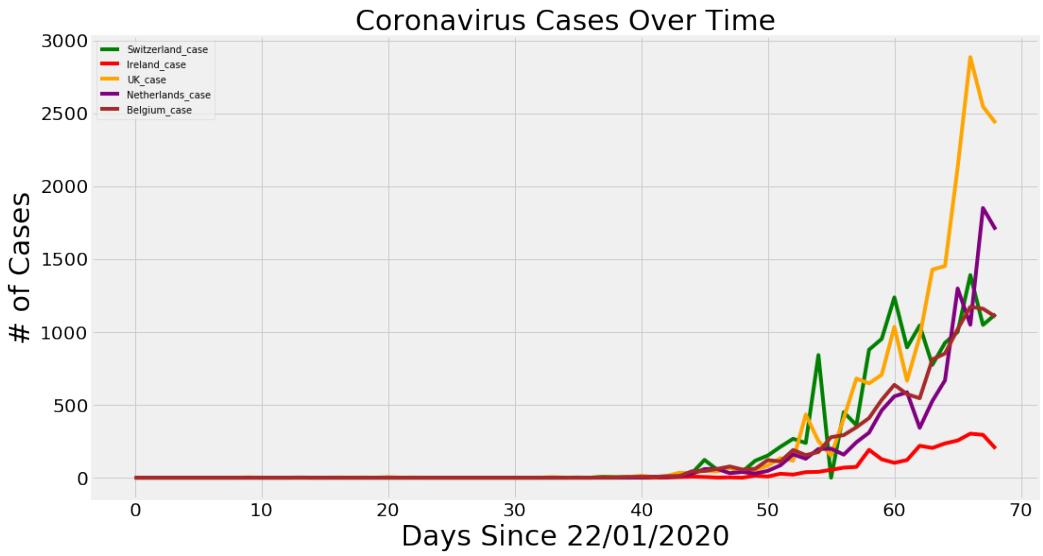


Figure 4.15: daily increase comparison

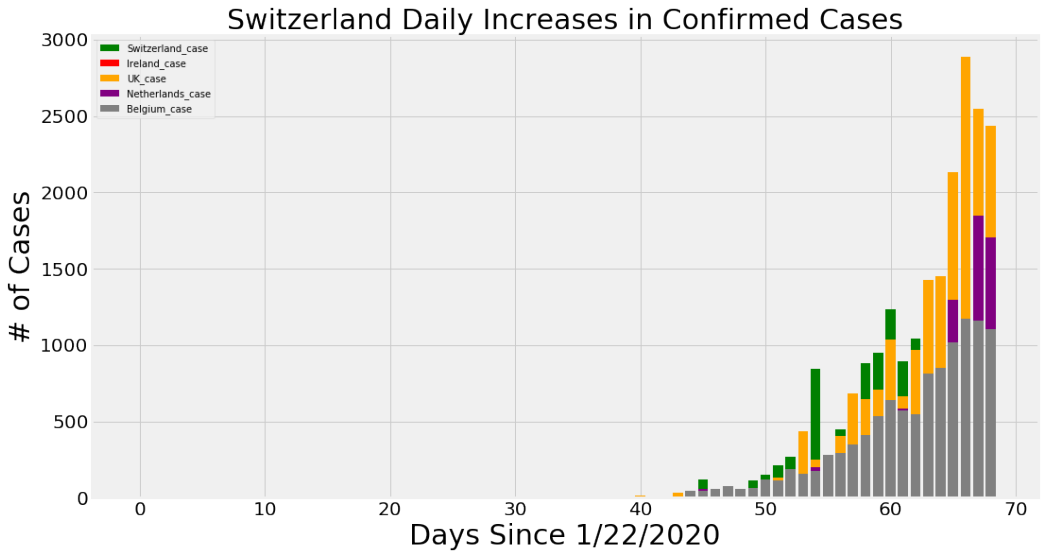


Figure 4.16: daily increase comparison2

Secondly, I compare the daily death increase curve with the different countries.

Finally, I compared the inflection rate and death rate with these countries.

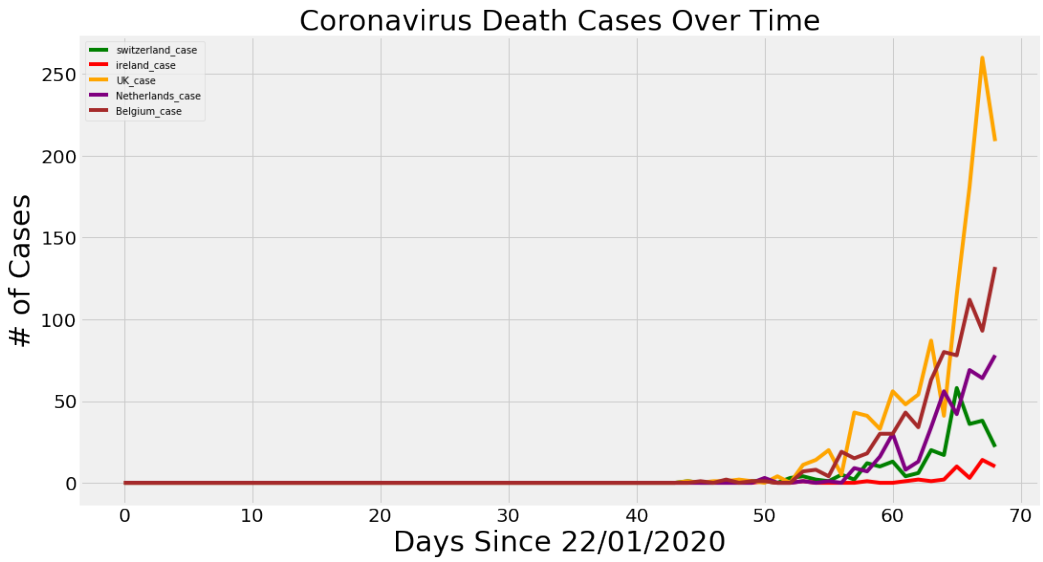


Figure 4.17: daily death comparison2

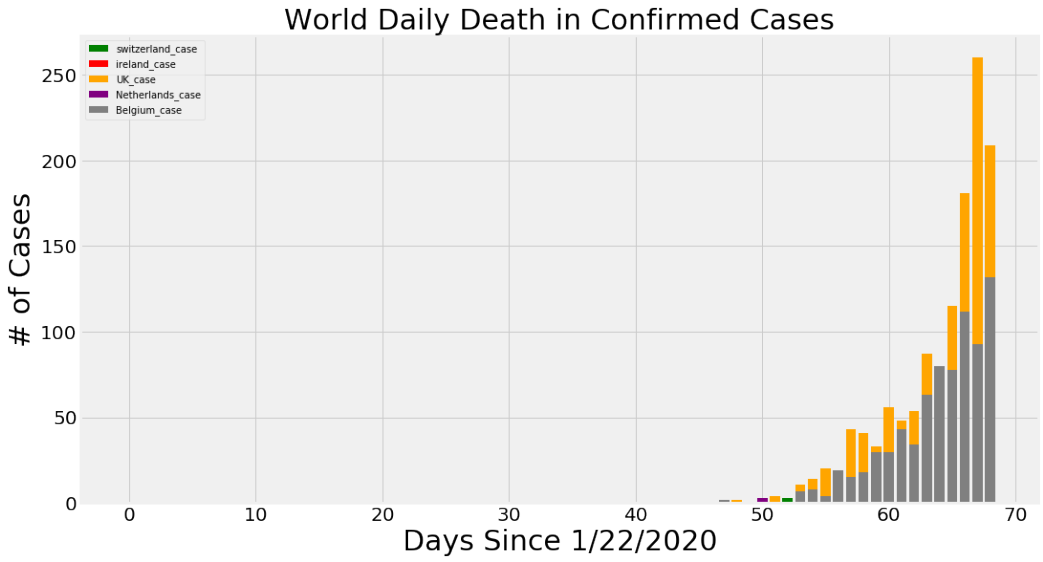


Figure 4.18: daily death comparison2

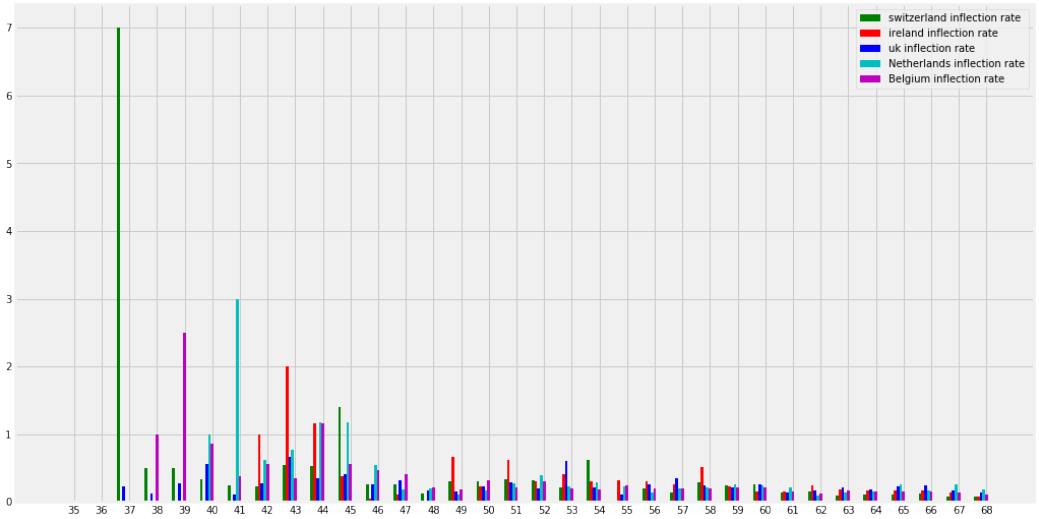


Figure 4.19: daily inflection rate comparison

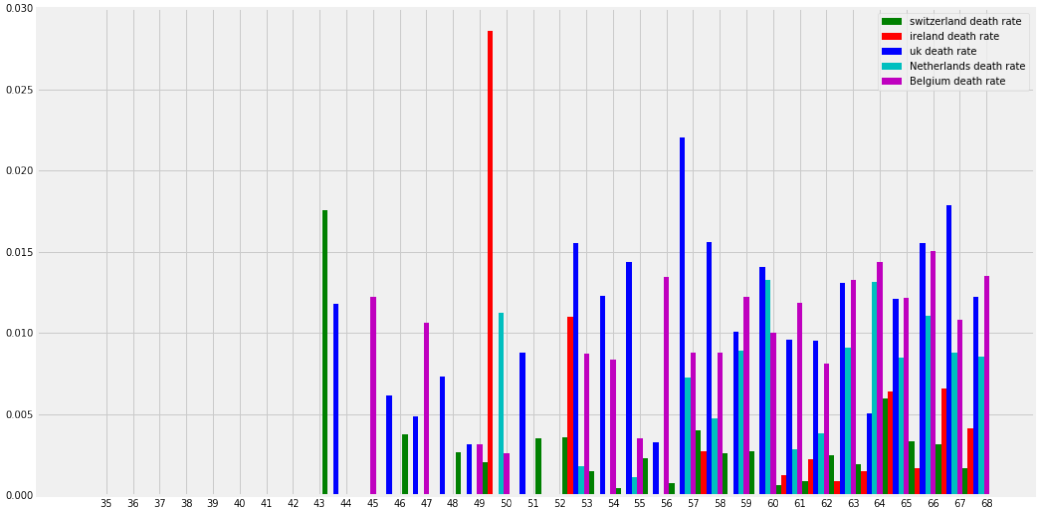


Figure 4.20: daily death rate comparison

Table 4.1: death number from latest week

| death number within one day in Switzerland | number of day |
|---|---|
| <= 10 | 1 |
| 10∼20 | 1 |
| 20∼30 | 2 |
| >=30 | 3 |

## 4.3 Statistical analysis and prediction

I think the death toll in Switzerland is subject to Poisson distribution. Because only three conditions are required to obey the Poisson distribution. Small probability events, independent events, stable probability. For death, the probability is not high and things are independent of each other, but I analyze from the side, if the mortality rate of Swiss infected patients is unstable, then it proves that its distribution no longer follows the Poisson distribution, that is to say, the situation in Switzerland Deteriorating, or that Switzerland needs to pay extra attention to critically ill patients, because for severe patients, the situation is getting worse. This is my core idea for analyzing changes in Swiss mortality. Data are calculated from latest week. According to calculations, the average daily death toll $\lambda = 28$ Count the distribution of daily deaths in the last week. The approximate interval method is used here to conveniently describe the overall change.

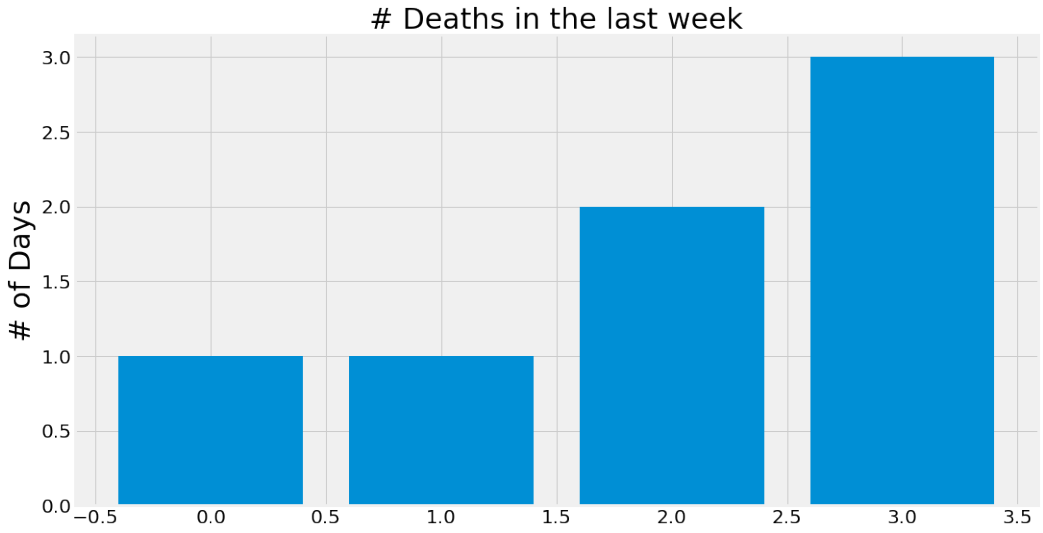


Figure 4.21: daily death for latest week, the x represents 10,20,30,40

The probability curve of the Poisson distribution. The curve uses the online tool. You only need to set the parameters and obtain the curve automatically [6]. Poisson distribution is:

$$P(X = k) = \frac{e^{\lambda} * \lambda^{k}}{k!} \tag{4.1}$$

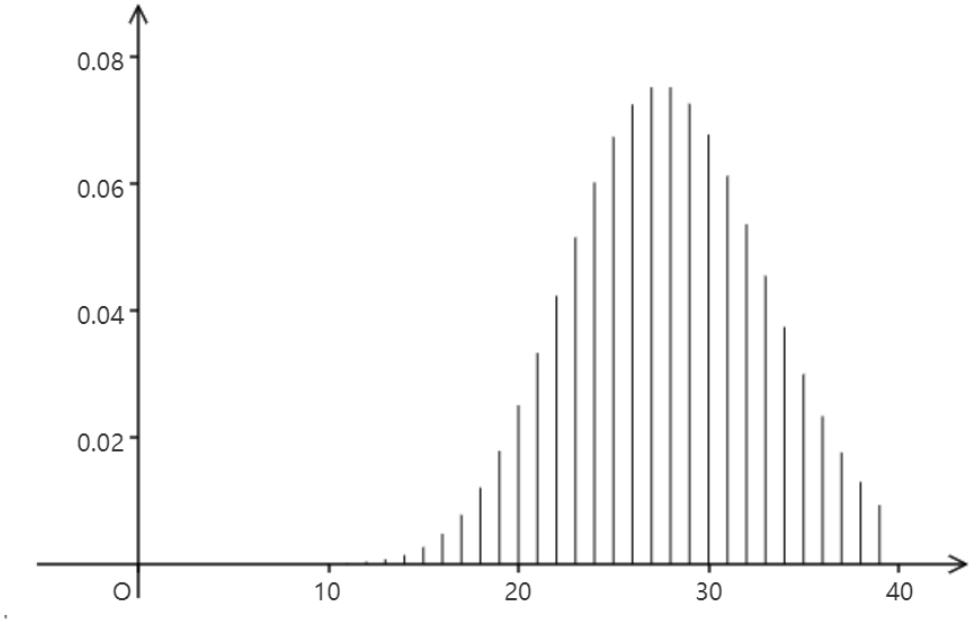


Figure 4.22: daily death rate comparison

Comparing the fig 4.21 and fig 4.22. Obviously, the distribution of the number of death days in the most recent week does not obey the corresponding Poisson distribution [7]. It can be considered that for Switzerland, the mortality rate is changing and needs extra attention.

Regarding prediction, I tried a simple Bayesian model [8]. Here, my selection of variables is very simple. I only made predictions on the time series, but if I want to get a more accurate prediction model, I think that additional feature engineering is needed. To consider more factors that affect the spread of the epidemic.

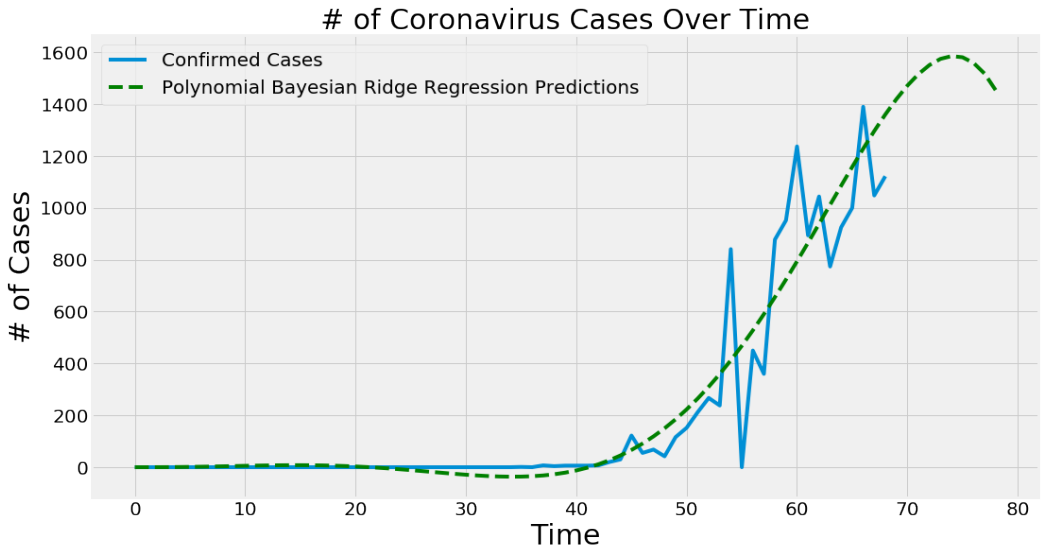


Figure 4.23: inflection prediction in Switzerland

# Chapter 5

# Conclusion

## 5.1 Switzerland self analysis

- From Fig 4.1,4.2,4.3,4.4,4.5, we can conclude VD,ZH,GE are the most serious cantons in Switzerland. The goverment should pay more attention for that.

- From Fig 4.6, we can conclude that the cantons VD, GE, TI, VS is short of beds, on the contrary, ZH, BE,AG, SG have enough beds. considering the distance between different cantons(if the government decide transfer patients to other cantons), I can suggest transfer VD's patient to BE.

- From fig 4.11, 4.12, we can conclude that the inflection rate and death rate are increasing now, there will be more inflection and death in the near future.

- Based on the above conclusions, it can be predicted that in the next time, the epidemic situation in Switzerland will continue to develop and become more serious. Switzerland should respond well in advance and adhere to the prevention and control recommendations given by the World Health Organization.

## 5.2 Switzerland compared with others

- From Fig 4.15 - 4.18.Compared with the United Kingdom and the Netherlands, Switzerland's epidemic growth is not so bad, but it is worse than that of Ireland and Belgium. Therefore, it is recommended that Switzerland can absorb the deficiencies in the prevention and control measures of the United Kingdom and the Netherlands. At the same time, it is recommended that Ireland can always pay attention to the prevention and control measures of countries with severe epidemics and try to prevent the spread of the epidemic.

- From fig 4.19, The daily infection rate in the Netherlands is increasing in a small area, and Switzerland and Ireland are relatively stable.

- From fig 4.20, The fatality rate in the UK and Belgium is relatively high, and the fatality rate in Switzerland and Ireland is relatively small. This should be related to the age of the population. At the same time, it can also tell Ireland and Switzerland that because the fatality rate is not so high, more resources can be allocated. In patient detection, strive for early detection and early treatment. In contrast, Britain and Belgium should pay more attention to the recovery of critically ill patients.

## 5.3 Statistical analysis and prediction

- From Fig 4.21 and 4.22.Although the mortality rate in Switzerland is relatively low and stable compared with the United Kingdom and Belgium, further statistical analysis has found that the mortality rate is not stable. Therefore, it is recommended that Switzerland pay extra attention to the recent critically ill patients.

- From the simple Bayesian model prediction, fig 4.23, the epidemic in Switzerland has not reached its peak, and Switzerland needs to take more stringent

measures to organize the spread of the epidemic

# Appendices

all the code and dataset can be found from my personal github address:

https://github.com/Chriszhangmw/Covid-analysis-in-Switzerland

# References


[1] who, "world health organization," https://www.who.int/, accessed April 4, 2020.

[2] ecdc, "European centre for disease prevention and control," https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide, accessed April 4, 2020.

[3] Switzerland, "Covid 19 in switzerland," https://www.corona-data.ch/, accessed April 4, 2020.

[4] plotly, "plotly api documents," https://plotly.com/, accessed April 4, 2020.

[5] corona, "cantons in switzerland," https://www.corona-data.ch/, accessed April 4, 2020.

[6] osgeo, "curve draw," https://www.osgeo.cn/app/sb131, accessed April 4, 2020.

[7] R. Flowerdew and M. Aitkin, "A method of fitting the gravity model based on the poisson distribution," *Journal of regional science*, vol. 22, no. 2, pp. 191–202, 1982.

[8] E. F. Halpern, "Polynomial regression from a bayesian approach," *Journal of the American Statistical Association*, vol. 68, no. 341, pp. 137–143, 1973.