Modeling COVID19 16/04/2020

Interface

1. The countries provide a given CSV containing dates and number of incidents like the following:

DATES	INCIDENTS
Type: Date/Month/Year	Type: Integer
29/03/2020	10
...	...

Given this CSV, we can immediately model and visualize the following results:

1. R_t, the rate of transmission
    a. This is calculated using sliding weekly windows, with a parametric serial interval based on a mean of $\mu_{si} = 4.8$ and standard deviation $\sigma_{si} = 2.3$
2. Epidemic curves (number of incidents) as a function of time t
3. Estimated R_t as a function of time t with 95% confidence intervals

The interface should be able to dynamically produce the results mentioned above for every new CSV file uploaded. Then, we can create a tool available for countries to use on their own in monitoring transmission rates and creating quarantine measures.

Once we finish the interface, we can differentiate on the basis of regional data for a given country.

Techniques

1. R package for model: EpiEstim
    a. https://rdrr.io/cran/EpiEstim/f/vignettes/demo.Rmd
    b. https://timchurches.github.io/blog/posts/2020-02-18-analysing-covid-19-2019-ncov-outbreak-data-with-r-part-1/
    c. https://cmmid.github.io/topics/covid19/current-patterns-transmission/global-time-varying-transmission.html
2. Interface: RShiny
    a. https://shiny.rstudio.com/

Measuring Intervention

As we work towards creating a robust interface using the techniques mentioned above, we can also think more broadly about how to measure efficacy of public health measures and social distancing intervensions.

We can take in the following additional inputs:

1. Isolation of the sick population, questions to answer with model:
    a. How many people who get infected get sick?
    b. Out of the sick people, how many are isolated?
    c. How can we measure the effectiveness of this isolation?
        i. $R_t - R_{t-1}$, differences in rate of transmission between consecutive days
        ii. $R_t - R_0$, differences in rate of transmission between day of isolation R_t and initial day of incidence R_0
        iii. $\frac{R_0 - R_t}{R_0}$, the percentage reduction of transmission
2. We use estimated R_t to estimate R_0, the unknown rate of transmission of the first day of incidence
3. The model should separate the effects of isolating sick patients (known variable) and the effects social distancing (unknown variable) on R_t
4. Assumption: we assume $R_t = R_0$ if there's no social distancing intervention