Introduction to Computational Science
University of Amsterdam
October 2020

Project: Modelling the Spread of Covid-19

Due Friday October 23 2020 @ 23:59

Introduction

In this project you will work in pairs to model the spread of Covid-19. Your team can choose **one** of the two problems from below. The Grading criteria you will find at the end of this document and online (canvas). In the project you are expected to formulate your own research question from within this problem domain, investigate existing literature and models, investigate the potential data sources (where appropriate), then develop a model and set of experiments to help address your research question. This essentially gives you a feeling for the way real research projects (albeit simplified versions) would develop.
Keep in mind that we expect you to reuse code and existing libraries as much as possible.

Assessment

You are expected to write a max. 5 page report outlining your project, this should include:

- Introduction (~0.75 page)
- Background/Theory (~1 page)
- Experiment/Method (~1.5 pages)
- Discussion (~.75 pages)
- Refs (no page limit)

The precise grading criteria and rubric can be found at the end of this document.

Problems

Below you will find details of the problems you can choose. **Select only one of these**.

Problem 1: Networks Simulation In Buildings (E.G., Schools, Universities)

Think about transmission of Covid within a building. Using different model networks generate network structure(s) that might best represent person to person interaction inside a building. Choose a (SIR, SEIR, etc.) type model for the nodes in the network that

represent the state of individuals within the building. To make things simple consider a closed system (people don't leave or enter the building) and a static network (ignore the temporal component of the network). Study the transmission of COVID-19 using network simulation, where possible use real data (with sources) to estimate transmission terms. Try to develop a hypothesis about social distancing measures (e.g., reduction in capacity, reducing movement between rooms) and/or vaccination strategies and use your model to evaluate these.

Problem 2: Population Level SIR - Assessment Of Intervention In Different Countries

In this problem you will use compartmental models to analyse the spread of Covid in multiple countries. Here you will be expected to use real world data sources to fit your model of choice to data. This will help you estimate parameters for each country and perhaps look at different fits during different periods and strategies of lockdown. Think about estimating R_0 for different periods based on the lockdown regulations. Can you say something about the relative effectiveness of different strategies and also say something about how well different countries are doing in controlling the outbreak? Can you estimate future trends?

Resources

Here you will find some useful links for your project:

Data

- Our world in data: `https://ourworldindata.org/coronavirus`
- EU data: `https://data.europa.eu/euodp/en/data/dataset/covid-19-coronavirus-data`
- NL data: `https://data.rivm.nl/covid-19/`

Papers

- `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7321055/`
- `https://www.kaggle.com/lisphilar/covid-19-data-with-sir-model`
- `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7270519/`

Code

- NDlib with: SIR example
- covsirphy

Grading Schemes

Problem Formulation	
Motivation	*Motivate the work - understand why the simulation/experiments are of interest*
Clarity	*Clear idea of experimental value - what it does and what it doesn't achieve*
Hypothesis	*Clearly stated hypothesis/question to test*
Literature Review & Background	*Has the correct literature been reviewed sufficiently?*
Experiments	
Sufficient Experiments	*Were the correct/necessary experiments performed to test the hypothesis*
Experimental Presentation	*Was each experiment properly analysed i.e.,Graphs/Significance tests/repetition*
Clear Conclusion	*Good summary of major findings*
Research	
Achievements	*How much was achieved during the 2 week period*
Creativeness/Initiative	*Was the topic novel, did the team develop their own ideas*