Modelling and Battling COVID-19

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Abstract

Battling the COVID-19 pandemic is complicated by political questions in addition to many medical questions. Many people do not understand the methodology of modelling, its benefits, and its limitations. This paper describes a simple model that can be used to model epidemics and present its relevance to the COVID-19 Pandemic. The model is complex enough to describe some key strategies for managing a pandemic and can be easily used by anyone interested in understanding the dynamics of COVID-19. A key feature of the paper is the inclusion of both Excel-based and a Python-based software that people can modify freely to create their own models.

This paper introduces compartmental models. In a compartmental model, we partition the members of our group into compartments and establish rules on how individuals move from one compartment to another. We assume that the behavior of all individuals in a given compartment is the same. Usually, the more compartments we establish, the more accurate the model. In principle, the most accurate model would be a model where each compartment consisted of a single individual. Of course, such a model is infeasible – we could never collect all the data that we would need for such a model and we would not have the computing power to run such a model even if we could collect all the data.

To build a model, one must make some assumptions. Making assumptions is both the strength and weakness of modelling. One can test assumptions by creating models and seeing how they agree with reality. If assumptions are poorly chosen, the outcomes predicted by the model could be wildly inaccurate. We show how the model can be used to come up with strategies to mitigate the effects of the pandemic.

We look at some real-world data to see how well the model describes what we see. A fuller treatment of these topics and the software described here can be found on the author's website https://docgm.com/cyber-society-lab-cysola/covid-19/, which also includes a video explaining the extended results.

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