Study Report of Week 3

John (Wei Jiang)

Study Content

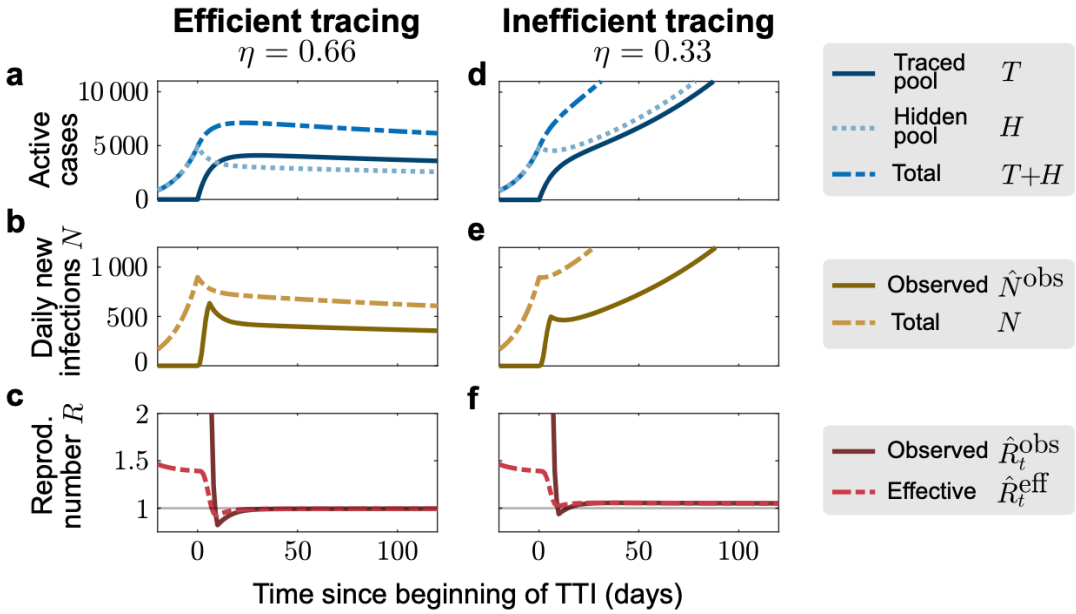
1. Read the paper about compartmental models
   - Read the details of the compartmental models by referring to code implementation
   - Understand the workflow of compartmental models
   - Compare the compartmental model and the Agent-based model
2. Do experiment with MATLAB
   - Integrate MATLAB code into Jupiter notebook
   - Understand how to use classes to manage code in MATLAB

Understanding of Compartmental Model

This paper introduced a compartmental model. This is an SEIR model and it incorporates test-trace-and-isolate(TTI) as it is a common strategy to contain COVID19. From the perspective of spreading dynamics, differential equation models are used together with numerical methods to study the stable and unstable states of the system. Details include the trends of Reproduction Numbers, Daily New Infections and Total Active Cases in different scenarios with different parameters.

The model divides the number of infected people into two categories: Hidden pool and Traced pool. The reproduction number R of Trace Pool is less than 1, and the R of Hidden is greater than 1. Through efficient TTI, Trace Pool will continuously deplete the number of infections from Hidden Pool, and eventually eradicate the virus.

This paper analyzes many different scenarios. The following example is one of them. It shows two states of the model, stable (left figures a, b, c) and unstable (right figures d, e, f), under different Tracing Efficiency.



Comparation with Agent-based Models

	Pros	Cons
Compartmental models	• Simple • Faster • Robust • Explanatory	• Poor adaptation to change • Cannot answer questions about special details
Agent-based models	• High adaptation to change • Can answer questions with special details	• Complex • Computationally expensive • Parameters are uncertainty • Depends on high quality data

The Covasim implements TTI simulation.

Covasim and this model are both SEIR models. The Covasim includes individual variability, while this compartment model does not include.

Difficulties and solutions

1. Confusion in understanding the details of the compartmental model.
   - There are related contents in the book, and I plan to read it next week.
2. How to combine the two models to predict the trend of the pandemic?
   - By comparing the performance of the two models?

Possible Future topic

1. Study how to use the compartmental model to fit data.
2. Compare the performance of the two models considering the TTI strategy.

Plan for next week

1. Working on the writing task of DATA7901
2. Understanding the theory behind the compartmental model.
   a. Reading chapter 2 Introduction to Simple Epidemic Models of the book: *Keeling, M. J., & Rohani, P. (2011). Modeling Infectious Diseases in Humans and Animals. Princeton University Press.*

Appendix

More work please refer to the Github: https://github.com/john210808/covasim_delta.git