Math 4MB3 Project Notebook 2018

Daniel Presta (The Infective Collective)

March 28, 2018 @ 9:43

Friday 9 March 2018

Group Meeting (in class)
Approximate Duration: 0.5 Hours

- We discussed project topics, and settled on “Spatial Epidemic Dynamics: Synchronization" as our topic
- We sent an email to Dr. Earn, confirming our topic choice.

Wednesday 14 March 2018

Group Meeting (in class)
Approximate Duration: 1 Hour

- Updated “README.md" in the GitHub repository; added papers that should be read for the next meeting.
- Discuss step (b) (construction of spatial SIR model) next meeting, will hopefully have model approved by Dr. Earn by the end of the next meeting.
- Read suggested papers.

Friday 16 March 2018

Group Meeting (in class)
Approximate Duration: 1 Hour

- Tried to construct spatial SIR model after reading suggested papers.
- We approached Dr. Earn about a possible idea for a model.

Group Meeting
Approximate Duration: 1 Hour

- Split up work
- Aurora and Michael are to work on numerical/computational simulations.
- DPark and DPresta will try to connect this model to existing theorems
- DPark and DPresta will try to use existing theorems to analytically determine/prove a set of criteria for coherence in our model.

Tuesday 20 March 2018

Solo Work
Approximate Duration: 2 Hours

- Read (Earn & Levin 2006) and (McCluskey & Earn 2011) to better understand analytical approaches
- Using their approaches, attempted to derive a set of criteria for coherence in our model.
- Messed around with possible reproductive functions, before stopping and realizing that the dispersal matrix in the exponent cannot be simplified.

Wednesday 21 March 2018

Solo Work
Approximate Duration: 2 Hours

- Took different approach to finding analytical condition.
- Like DPark, I analyzed a two patch SIS model and tried to derive a coherence criterion.
- Difference is that I did not assume equal coupling.
- Algebra did not simplify, ran into a wall.

Group meeting
Approximate Duration: 1 Hour

- Aurora, Michael, and DPark all troubleshooted code and fixed their error in the Rcpp file.
- I worked on simplifying the algebra required to derive a coherence criterion for a two patch SIS system (where dispersal matrix does not have equal coupling).

Thursday 22 March 2018

Solo work
Approximate Duration: 1.5 Hours

- Attempted to find coherence criterion for continuous time version of our SIR model (first examined the continuous time version of the SIS model).
- Once again assumed that dispersal matrix did not have equal coupling.
- Algebra became impossible to simplify; looking like analysis may not be as easy we thought. Only results obtained so far come from basic two patch SIS models.

Friday 23 March 2018

Group Meeting (in class)
Approximate Duration: 1 Hour

- Split up work for draft.
- Decided that DPark and I will be doing numerical work now, while Aurora and Michael will be doing analytical work.

Sunday 25 March 2018

Solo work
Approximate Duration: 1.5 Hours

- Learned basics of Rcpp so that I can write a source file in Rcpp for a stochastic SIR model.
- Began to tinker with Rcpp source file for our simple SIR model (no alterations); will write code tomorrow

Monday 26 March 2018

Group Meeting (in class)
Approximate Duration: 1 Hour

- Discussed direction for the paper and further split up work.
- Analytical work will be shelved, for now; only focusing on numerical simulations.
- I will be working on the investigation of effects of seasonal forcing and the changes in seasonal amplitude.

Solo Work
Approximate Duration: 2.5 Hours

- Wrote a function in Rcpp that simulates changes for a stochastic version of our SIR model.
- This file was then used by DPark and he copied the important bits into the "SIRmodelnpatch.cpp" file, in order to keep repository clean and code easy to work with.
- Began to analyze different functions for $\beta(t)$. Will use sinusoidally-forced transmission rate, will also use a term-time transmission rate similar to one seen in (He et al. 2009).

Group Meeting (evening)
Approximate Duration: 1 Hour

- Discussed plan for the draft.

Tuesday 27 March 2018

Solo work
Apprxomiate Duration: 3.5 Hours

- Wrote a function for term-time forced transmission rate and added it to the general source file ("SIRmodelnpatch.cpp").
- Encountered several errors; prevalence vs. time graph looked extremely incorrect.
- Also simulated various runs of sinusoidally-forced transmission rate when seasonal amplitude is changed, observed trends.
- Wrote a paragraph in introduction.

Group meeting
Approximate Duration: 1 Hour

- DPark and Michael helped fix the bug in my code, turned out it was a simple int/float conflict error in Rcpp.
- Agreed that everyone will have things done by 9 AM tomorrow.

Solo work
Apprxomiate Duration: 3 Hours

- Adapted the code previously used by Aurora and Michael to account for changes in seasonal amplitude (and ignore changes in $\mathcal{R}_0$ and connectivity matrices).
- Ran simulations for different seasonal amplitude values for both forced transmission rates. Coherence trends are difficult to detect right now. A bifurcation diagram will be necessary to better understand the effects of seasonal amplitude.
- Wrote up my findings in the project document, while also explaining a bit about time-dependent transmission rates in general.

Total time spent on this project

Group work: 8.5 hours

Solo work: 16 hours