

Math 4MB3 Project Notebook 2018

Daniel Presta (The Infective Collective)

April 9, 2018 @ 11:29

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***Approximate 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*Approximate 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.

Sunday 1 April 2018

Solo work

Approximate Duration: 1 Hour

- Read papers on coherence, specifically Earn et. al (2000) to determine next steps that should be taken for stochastic results.
- Tried to make a diagram similar to that displayed in stochasticfig for only two mixing rates (but for more values of basic reproductive number), but stopped once I realized that the simulation would take an extremely long time.

Monday 2 April 2018

Group work

Approximate Duration: 1 Hour

- We met to discuss Dr. Earn's feedback and to settle on a definitive path for the remainder of the project.
- Dr. Earn gave us feedback on how we should approach the remainder of the paper.
- Split up work for the next couple days; I will be running sample trajectories and exploring the behaviour of stochastic trajectories near cycle endpoints of the bifurcation diagram.

Solo work

Approximate Duration: 1 Hour

- Played around with sample trajectories for a bit (for the stochastic model).
- Specifically tried to examine the correspondence between sharp increases and decreases in local/global extinction and the beginning of new cycles (or end of old cycles) in the bifurcation diagram.

Tuesday 3 April 2018

Solo work

Approximate Duration: 3 Hours

- Continued to examine various sample trajectories; continued work from previous night.
- Using a few of these samples, I made figures that displayed local/global extinction and rescue effect, as well as synchronous vs. asynchronous behaviour.
- Still need to learn `ggplot` so I can make my graphs look consistent with other figures in the project.

Group work*Approximate Duration: 1 Hour*

- We met to talk about our progress on our individual parts and to plan the presentation.
- Set up a `beamer` file and formed a general idea of what should be on each slide.
- Split up work for presentation and decided which plots we must have done for Friday (presentation day).

Wednesday 4 April 2018

Group work*Approximate Duration: 1 Hour*

- Changed our incoherence measure; it is no longer an absolute threshold, it is instead relative to epidemic size.
- Discussed themes for our plots and how to go about making our individual slides look consistent.

Group work*Approximate Duration: 1 Hour*

- Changed our incoherence measure again; changed it back to an absolute threshold, but instead raised the threshold.
- Finished planning out presentation, I will work on the introductory slides with Aurora and stochastic results slides with DPark.

Solo work*Approximate Duration: 2 Hours*

- Learned basics from `ggplot` from DPark so I could make my graphs look nicer.
- DPark and I worked on slideshow presentation, we made our graphs look consistent and decided which figures to include in presentation, as well as what to write.
- Began introductory slide of presentation.

Thursday 5 April 2018

Solo work*Approximate Duration: 1 Hour*

- Made some edits to stochastic section of presentation.
- Finished introductory slides with Aurora.

Group work*Approximate Duration: 3.5 hours*

- Made final changes to the `beamer` file and finalized the presentation for tomorrow.
- Discussed changing coherence measure again but decided against it.
- Changed research questions and introduction a bit, also talked about how to transition from section to section to maintain good flow during the presentation.
- Ran through the presentation a few times; each time we practiced, we gave each other feedback on what we could do to shorten our speaking time and have better flow.

Solo work*Approximate Duration: 0.5 Hours*

- Practiced my parts of presentation, I will be doing the introduction, summary, and conclusion/future questions.

Friday 6 April 2018

Group work*Approximate Duration: 1 hour*

- Practiced the presentation a few times before presenting in class.
- Discussed how to present next questions/future directions, and how to try our best to stay under time.

Solo work*Approximate Duration: 0.5 Hours*

- Practiced my parts of presentation in between our group meeting and our presentation in class.

Saturday 7 April 2018

Solo work*Approximate Duration: 3.5 Hours*

- Wrote up the first bit (paragraph and Figure 2) of the stochastic results section.
- Later, I added more to the stochastic results section and edited the rest of the section.
- I fixed Figure 2 so that its axis titles would be the same size as those in other figures.
- I began to read other papers to get an idea of what to write for the introduction.

Sunday 8 April 2018

Solo work

Approximate Duration: 7.5 Hours

- Finished up edits for stochastic section and discussion.
- Wrote introduction and abstract.
- Contributed to the supplementary file by writing the section of time-dependent transmission rate and the section on observed synchrony and asynchrony in stochastic models.
- Read through final document a couple times to make a few small edits, also helped organize word count.

Group work

Approximate Duration: 5 hours

- Met over Google Hangout chat twice; first meeting was for two hours, second meeting was for three hours.
- During the first meeting, we went through our document together, and made edits together as a group.
- We split up any edits and final work and decided to meet again the evening.
- In the evening, we edited the entire document again, specifically going over parts that were added since the afternoon.
- By the end of the second meeting, we were more or less ready to submit.

Total time spent on this project

Group work: 22 hours

Solo work: 36 hours