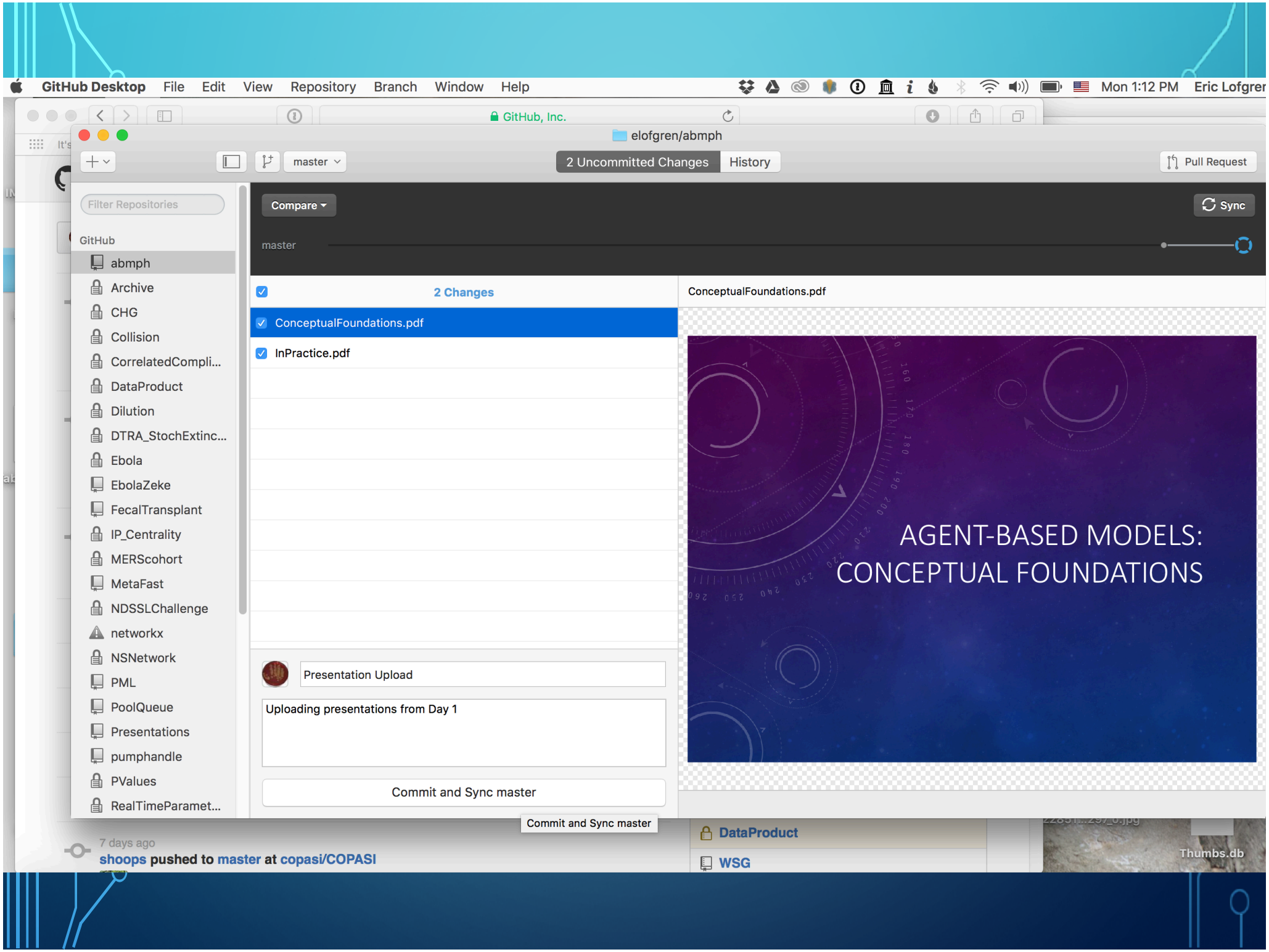
AGENT-BASED MODELING IN NETLOGO

NO EXPERIENCE NEEDED

- My background:
  - Started in biology
  - Ended up doing modeling by accident
  - No formal background in math or CS
  - This is where collaborators are really useful

GITHUB

- Distributed version control based of *git*
  - Your files live both in your desktop and on a server somewhere
  - Lots of useful features for version control, collaboration, filing bug reports, etc.
- GitHub is one site for hosting git repositories with a nice graphical interface
- Major place where open source development takes place
- DOIs can be had for repositories
- People can easily "fork" or "clone" your repository for their own use, download files, contribute, etc.
- *Lots* of tutorials online – agent based models or not, if you write code, you should probably be using some form of version control.


GitHub Desktop File Edit View Repository Branch Window Help
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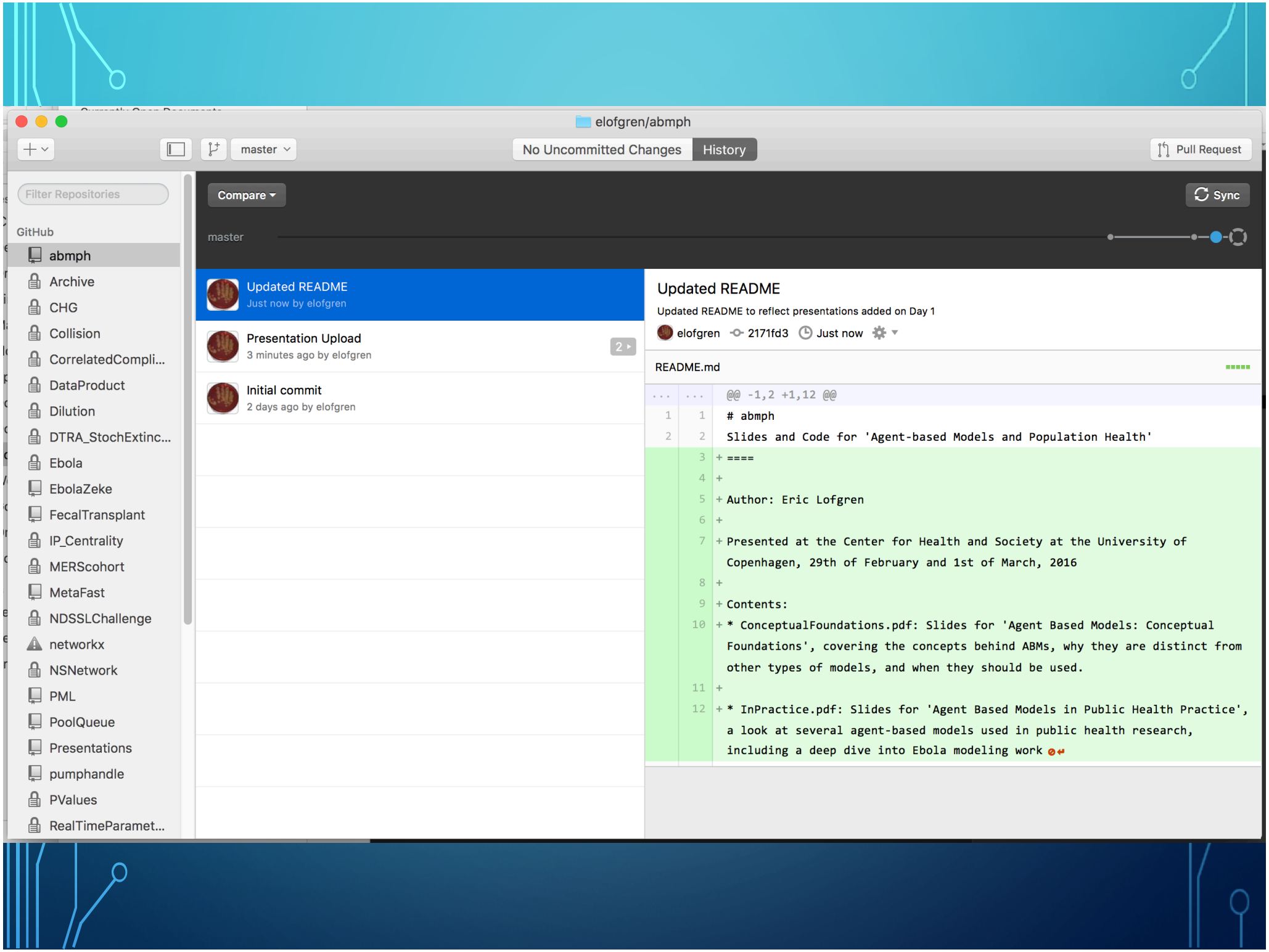
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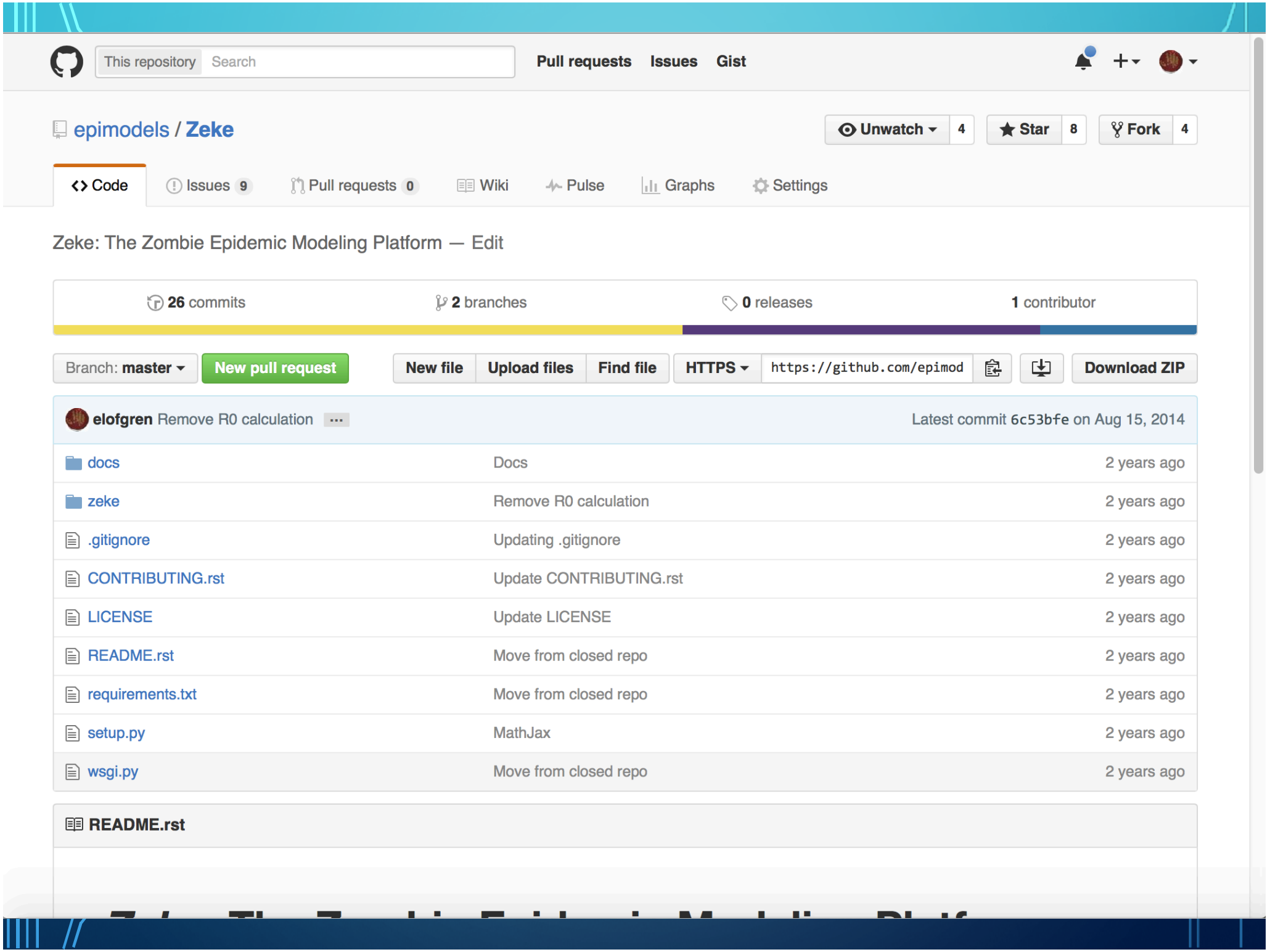
# abmph
Slides and Code for 'Agent-based Models and Population Health'
====
Author: Eric Lofgren
Presented at the Center for Health and Society at the University of Copenhagen, 29th of February and 1st of March, 2016
Contents:
* ConceptualFoundations.pdf: Slides for 'Agent Based Models: Conceptual Foundations', covering the concepts behind ABMs, why they are distinct from other types of models, and when they should be used.
* InPractice.pdf: Slides for 'Agent Based Models in Public Health Practice', a look at several agent-based models used in public health research, including a deep dive into Ebola modeling work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epimodels / Zeke
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Code
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Settings
Zeke: The Zombie Epidemic Modeling Platform — Edit
26 commits
2 branches
0 releases
1 contributor
Branch: master
New pull request
New file
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HTTPS
https://github.com/epimod
Download ZIP
elofgren Remove R0 calculation
Latest commit 6c53bfe on Aug 15, 2014
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.gitignore Updating .gitignore 2 years ago
CONTRIBUTING.rst Update CONTRIBUTING.rst 2 years ago
LICENSE Update LICENSE 2 years ago
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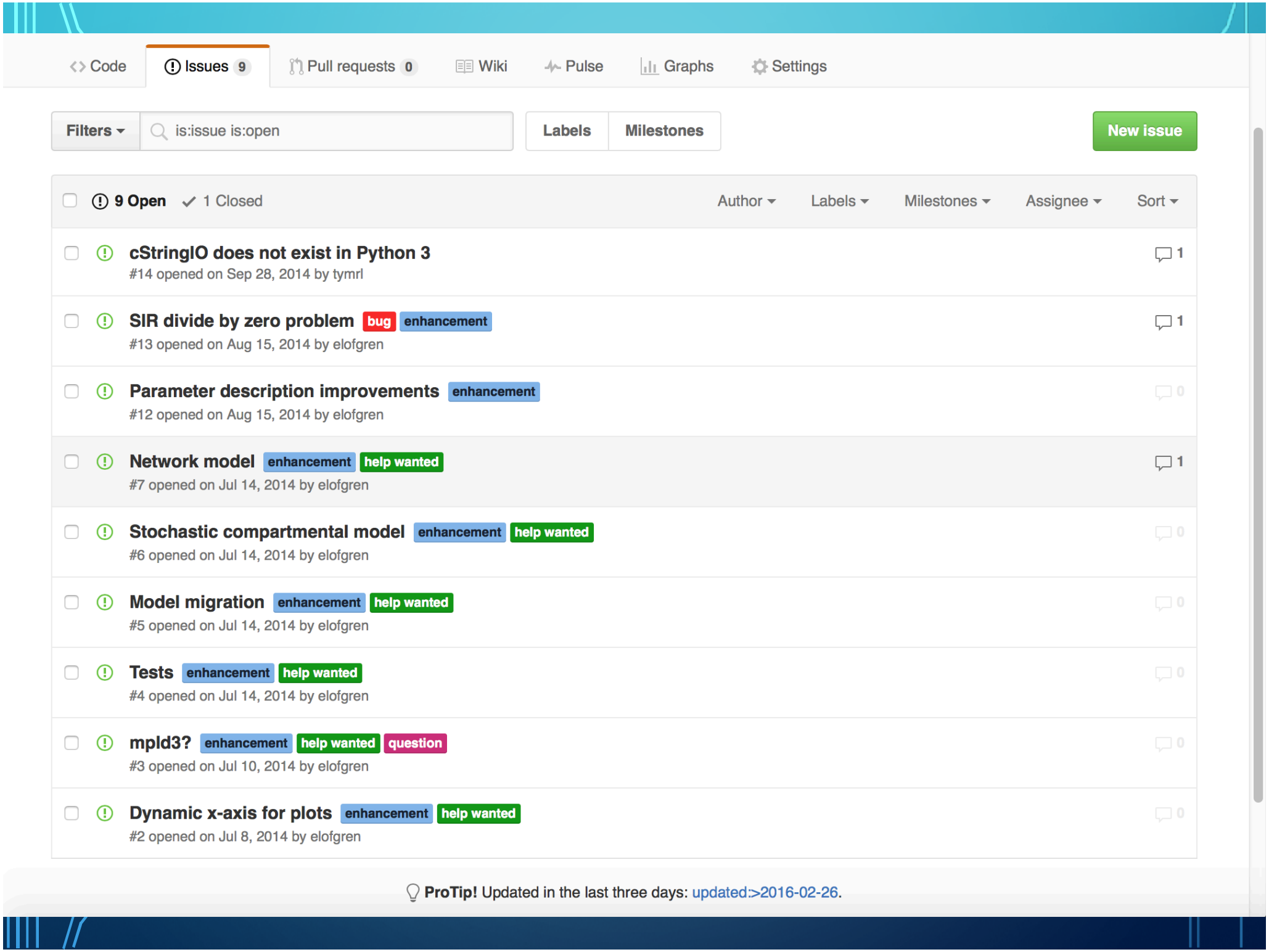
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cStringIO does not exist in Python 3
#14 opened on Sep 28, 2014 by tymrl
1
SIR divide by zero problem
bug
enhancement
#13 opened on Aug 15, 2014 by elofgren
1
Parameter description improvements
enhancement
#12 opened on Aug 15, 2014 by elofgren
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Network model
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#7 opened on Jul 14, 2014 by elofgren
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Stochastic compartmental model
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#6 opened on Jul 14, 2014 by elofgren
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Model migration
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#3 opened on Jul 10, 2014 by elofgren
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Dynamic x-axis for plots
enhancement
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#2 opened on Jul 8, 2014 by elofgren
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ProTip! Updated in the last three days: updated:>2016-02-26.

SIR divide by zero problem #13

Edit | New issue

Open **elofgren** opened this issue on Aug 15, 2014 · 1 comment

elofgren commented on Aug 15, 2014 — Computing for Epidemiology member

In the SIR model, a gamma of 0.0, which implies infinitely durable zombies, is hanging the server version. This is because of a divide by zero error in calculating R0. There should be some checking (no negative numbers for beta or gamma, gamma > 0, etc.) in all models, but the R0 calculation should probably be outright removed for now, as it's not being used.

elofgren added the bug label on Aug 15, 2014

elofgren commented on Aug 15, 2014 — Computing for Epidemiology member

See `6c53bfe`

Immediate bug fix, but no input checking/sanitization.

elofgren added the enhancement label on Aug 15, 2014

Write | Preview

Leave a comment

Labels

bug

enhancement

Milestone

No milestone

Assignee

No one—assign yourself

Notifications

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1 participant

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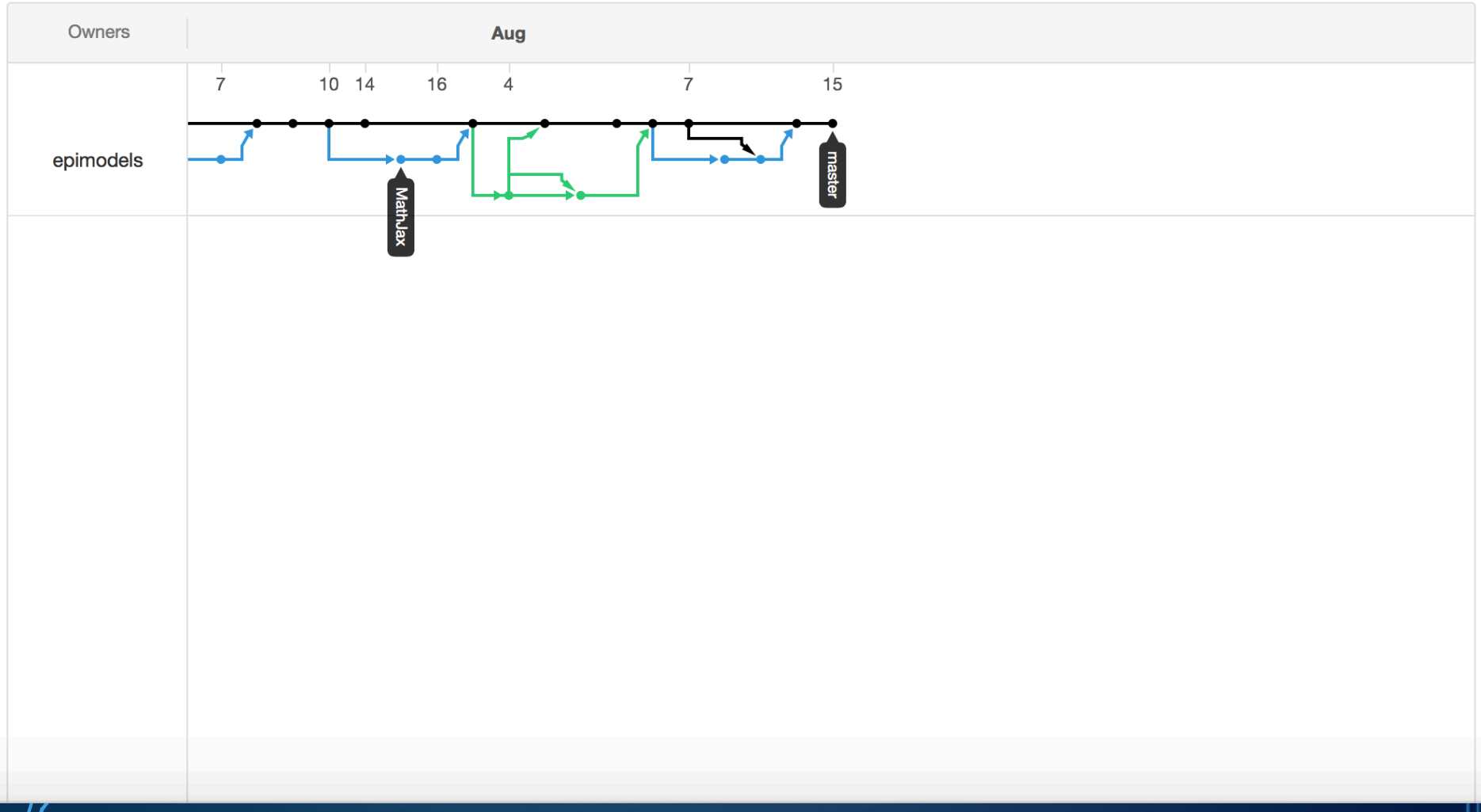
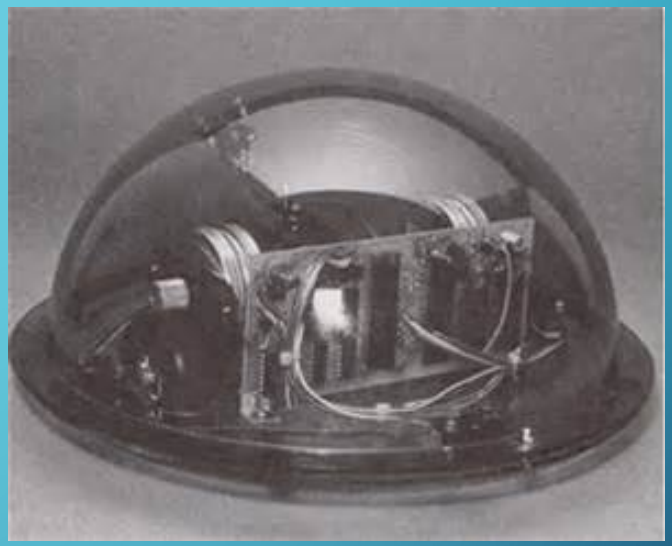
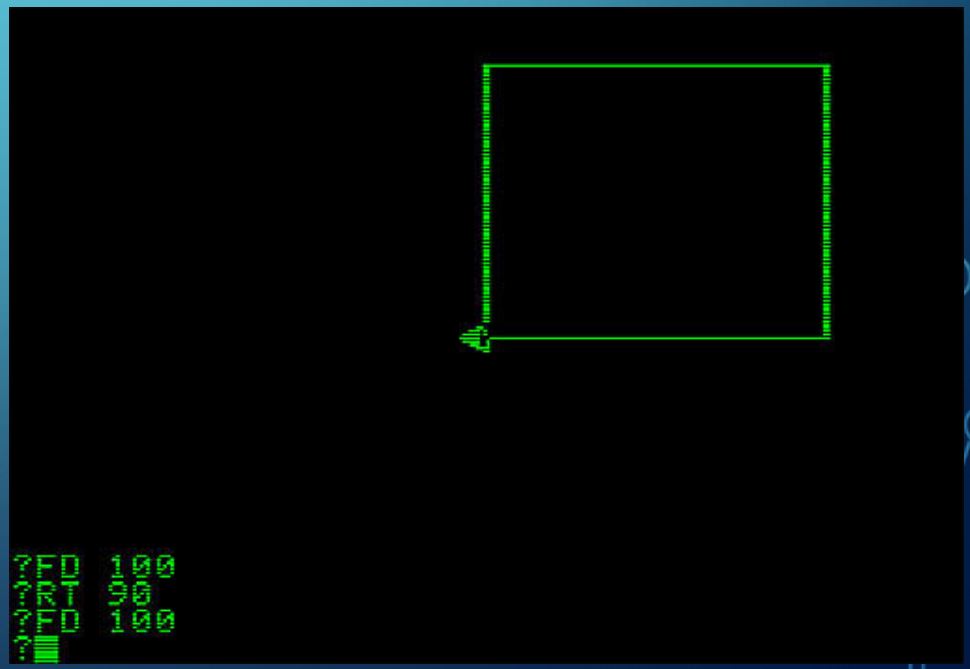
Contributors | Traffic | Commits | Code frequency | Punch card | Network | Members



WHAT IS LOGO?

- Logo language developed in the late 1960's
- From the Greek *logos* or 'word'
- Intended primarily as an educational tool to teach children programming concepts using something close to natural language
- Most famous for it's "turtle", either on screen or a robot, who can be commanded via code





SO WHAT'S NETLOGO?

- NetLogo is an implementation of a Logo-like language maintained by the Center for Connected Learning and Computer-based Modeling at Northwestern University
- Allows for many simultaneously acting agents – still called "turtles"
- Turtles occupy space in a grid, known as a "patch"

WHY NETLOGO?

- It's free
- Meant to have a "low threshold and no ceiling"
  - Good for learning
  - Not immediately useless once you've gotten the basics down
- Visual, rapid prototyping
  - Easier to start actually *working* with models instead of thinking about them
  - Fast feedback
- Approachable language
  - It's fairly easy, made for beginners, etc.

EXPLORING NETLOGO

- Not going to be able to cover everything today
- NetLogo was also chosen because it has some great resources
  - Several textbooks on agent-based modeling with NetLogo
  - Lots of models online and easily findable
  - A extensive model library built into NetLogo, where you can view code, modify models and extend them, etc.
    - This is a good way to get started

LANGUAGE BASICS

- Indentation doesn't matter
- **Spacing does**
  - This-is-a-hyphen
  - This - is - subtraction
- Most functions are set up as follows:

```
to action
    things here
end
```

VERY SIMPLE MODEL – A RANDOM WANDERER

- Lets set up a couple things:
  - A colored grid for someone to wander along
  - An agent ("turtle") to do the wandering
  - A basic interface to run this simulation
- Recall modular code and testing suggestions from yesterday – this is a good way to do that
- Create a setup button
- Create a go button
- Actually do things
- Disclaimer: Live coding demos are the most perilous part of any talk

```
to setup
      clear-all
      create-turtles 1
      ask turtles [setxy random-xcor random-ycor]
      reset-ticks
end
to go
      move-turtles
      tick
end
to go
      move-turtles
      tick
end
to move-turtles
      ask turtles [ right random 360 forward 1]
end
```

COLORING PATCHES

- Add:
  - setup-patches to setup
  - Create setup-turtles

```
to setup-patches
      ask patches [set pcolor grey ]
end
to setup-turtles
      create-turtles 1
      ask turtles [setxy random-xcor random-ycor]
end
```

We have an agent-based model!

ADDING SOME SOPHISTICATION

- Turtles should interact with the environment
- Can we have different types of turtles, fast and slow?
- How about some visualization?
- "Turtle Tron"

```
to claim-patch
   ask turtles [
      if pcolor = grey [
            set pcolor blue
      ]
   ]
end
to move-turtles
      ask turtles [ right random 360 forward 1]
      claim-patch
end
```

```
breed [runners runner]
breed [walkers walker]
to setup
        clear-all
        setup-patches
        setup-runners
        setup-walkers
        reset-ticks
end
to go
        move-runners
        move-walkers
        tick
end
To setup-walkers  create-walkers 1  ask walkers [setxy random-xcor random-
ycor]end
to setup-runners  create-runners 1  ask runners [setxy random-xcor random-
ycor]end
to move-walkers  ask walkers [ right random 360 forward 1]  claim-walkerpatch
end
to move-runners  ask runners [ right random 360 forward 3]  claim-runnerpatch
end
to claim-walkerpatch  ask walkers [set pcolor blue] end
to claim-runnerpatch  ask runners [set pcolor yellow] end
```