Isaac Blinder
Intro to Computer Sim Project 2 Writeup
4/5/18

Werewolf Simulation

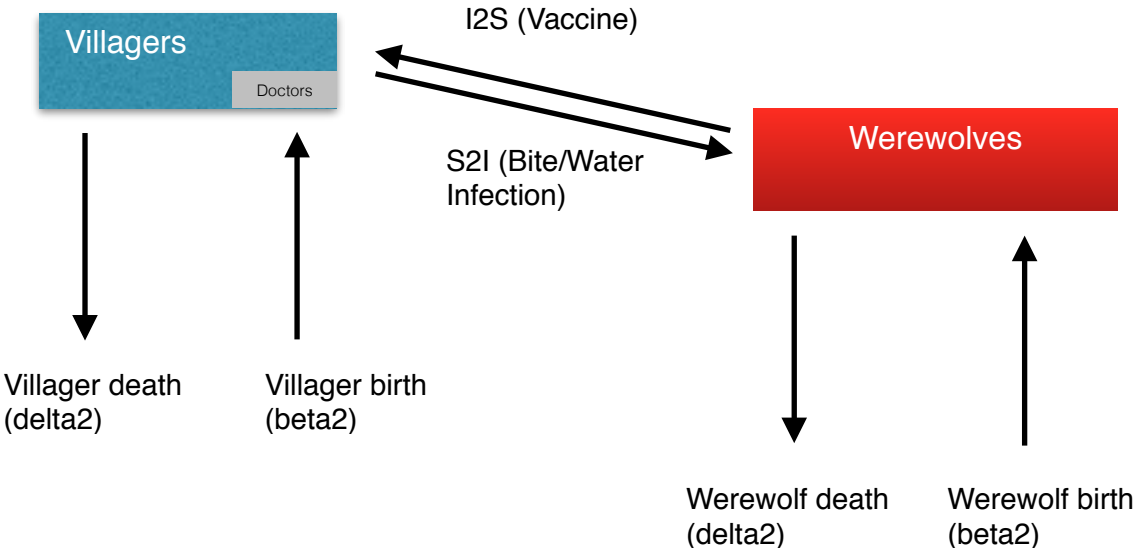
For this project I simulated a werewolf epidemic. Werewolves are in the town, and are spreading the werewolf virus to the villagers. Doctors have received a vaccine that has a 20% success rate, however there aren't enough doctors to administer the vaccine to everyone, and it takes time to train more doctors. To make things worse, there is no way of telling who has the werewolf gene unless there is a full moon, when a werewolf transforms into it's true self.

How to become a werewolf:
You can become a werewolf in a variety of ways. For this project, I chose these common beliefs:
- you can be bitten by another werewolf
- you can drink rainwater that a werewolf drank

How to be healed:
- you can be saved by a doctor
  - Each doctor can administer the vaccine to 20 people a day with a 20% success rate if the person happens to carry the virus. If the person does not have the virus nothing happens.
  - Another doctor is trained each week
  - doctors can also be killed/infected by werewolves

NOTE - It is important to know that for this project a person cannot be bitten by a werewolf unless there is a full moon, however there are other ways of becoming a werewolf (drinking werewolf water, child of a werewolf) that are possible at any time.

MODELS


Villagers
Doctors
I2S (Vaccine)
S2I (Bite/Water Infection)
Werewolves
Villager death (delta2)
Villager birth (beta2)
Werewolf death (delta2)
Werewolf birth (beta2)

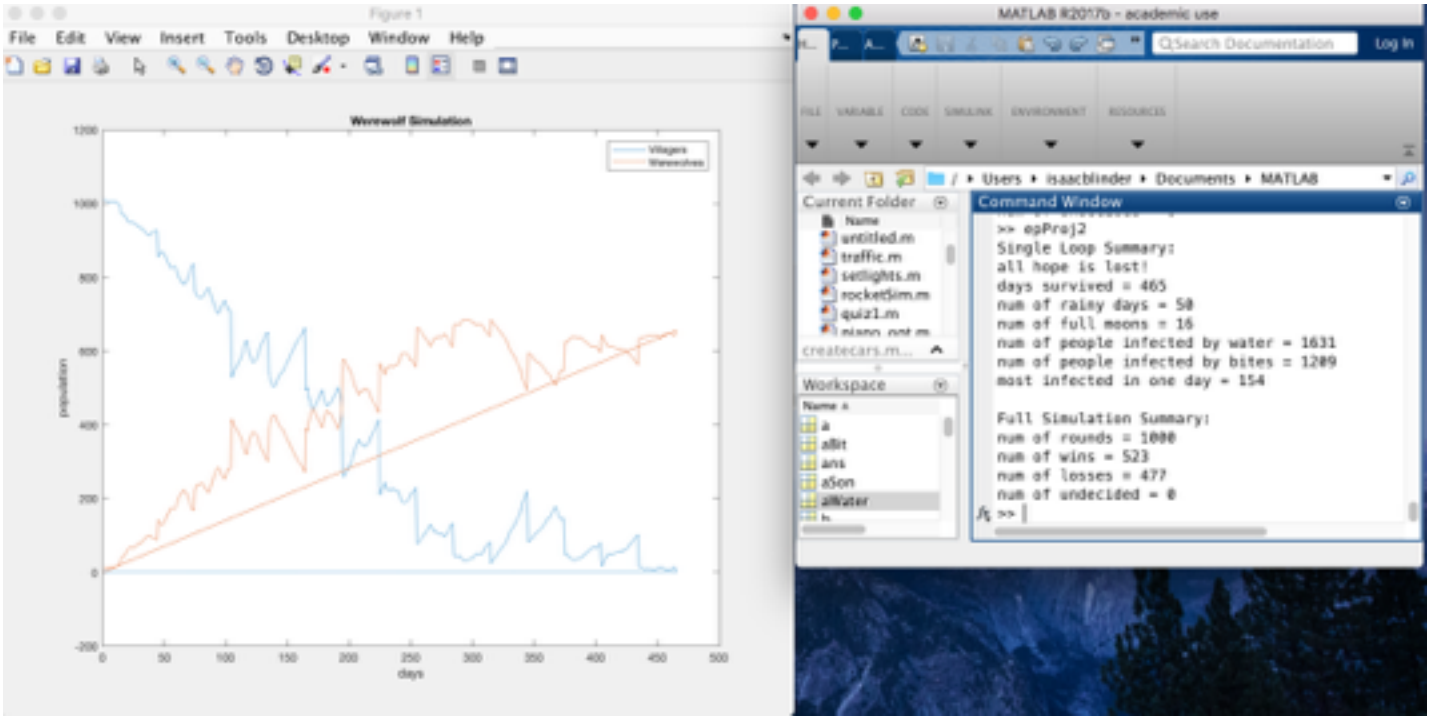


Figure 1
File Edit View Insert Tools Desktop Window Help
Werewolf Simulation
Villagers
Werewolves
population
days
MATLAB R2017b - academic use
Search Documentation
Log In
Users isaacblinder Documents MATLAB
Current Folder
Name
untitled.m
traffic.m
setlights.m
rocketSim.m
quiz1.m
createcars.m...
Workspace
Command Window
>> epProj2
Single Loop Summary:
all hope is lost!
days survived = 465
num of rainy days = 58
num of full moons = 16
num of people infected by water = 1631
num of people infected by bites = 1209
most infected in one day = 154
Full Simulation Summary:
num of rounds = 1000
num of wins = 523
num of losses = 477
num of undecided = 0
>>

Parameters / Chance of infection:

	Raining	Full moon
Getting bitten	decreases chance	must be true
Drinking bad water	improves chance	neutral

S = number of susceptible people (regular population)
I = number of werewolves
docs = number of doctors

Water:
- everyone drinks water
- if raining chance of infection = 10%
- not raining = chance goes down by 1% each day without rain
- a full moon doubles the chance of infection

rainy season (1/4 of the year) = 20% chance of rain each day
dry season (1/4 of the year) = 4% chance of rain each day
other 1/2 of the year = 8% chance of rain each day

Bitten:
- each werewolf has a chance of biting a regular person when there is a full moon
  - the more people there are to bite, the higher the chances of catching someone
  - a werewolf can catch a max of 1 person in a night
  - if it is raining, the chance of biting a person is cut in half
- When a werewolf bites a person
  - 65% chance of becoming a werewolf.
  - 25% chance of death
  - 10% chance of escape

FORMULAS

$$S2I = -aBit \cdot \frac{S(t)}{N(t)} - \left(aWater \cdot \frac{I(t)}{N(t)}\right)$$

$$I2S = \frac{10 \cdot I(t)}{N(t)} \cdot 0.2 = \frac{2I(t)}{N(t)}$$

$$\frac{I(t+\Delta t)-I(t)}{I\Delta t} = I + S2I - I2S + D2I - Idie + Iborn$$

$$\frac{S(t+\Delta t)-S(t)}{S\Delta t} = S - S2I + I2S - D2I - Sdie + Sborn$$

Variables:

- unit of time is days

S = number of villagers + docs
I = number of werewolves;
docs = number of doctors
—> doctors can administer a werewolf vaccination to 10 random villagers each day in the hopes of administering it to someone with the infection (except for when there is a full moon, because then Werewolves are out). A person that that gets the vaccine has a 20% chance of being healed if he/she has the werewolf infection. The vaccine is safe.

S2I = villagers that become infected
D2I = doctors that become infected
I2S = infected that are healed

aWater = chance of infection by drinking contaminated water
aBit = chance of infection from a werewolf bite
oddsOfCatch = chance of werewolf catching someone (on full moon) = (S-S2I-D2I)/N;
—> odds of catch are reduced when there are less villagers left to hunt

beta1 = 0.0002*S —>birth rate for villagers
beta2 = 0.0004*I —>birth rate for werewolves
delta1 = 0.00015*S —>death rate for villagers
delta2 = 0.00015*I —>death rate for werewolves