Smallpox Outbreak Modeling in Python

Joe Fetsch
Computer Systems Lab 2009-2010

Abstract

This project is intended to determine the effects of quarantine officers and immunization on the death rate of a given population of agents in which an outbreak of Variola occurs in a closed world scenario where agents are allowed to move randomly.

The agent movement will be affected by the quarantine officers who would direct them to safety or to an immunization site, determined by the officer as whichever has the greater value and practicality based on the location of the agents at the time.

This can be used to help realize the maximum benefit of quarantine officers and vaccination on a closed population in order to reduce the death rate of the population in which the outbreak takes place.

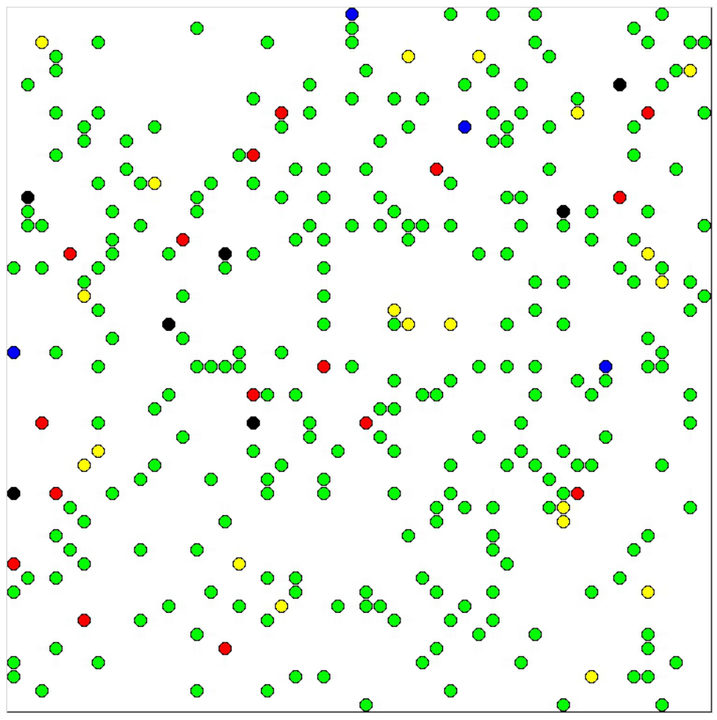

Figure 1: A typical display of the world where green agents are healthy, red are infected, black are quarantine officers, blue are immune, and yellow agents are carriers, meaning infected without symptoms or infectiousness

Background and Introduction

An understanding of the disease of smallpox in order to better represent the effects of the virus on infected agents, with
examination of other projects with respect to quarantine regarding a generic illness, vaccination regarding a generic illness, and the modeling of virus transmissions between agents. These reports are
to be used to better represent the effects of the quarantine officers on the population, ideal immunization rates, and the spread of the disease among agents.

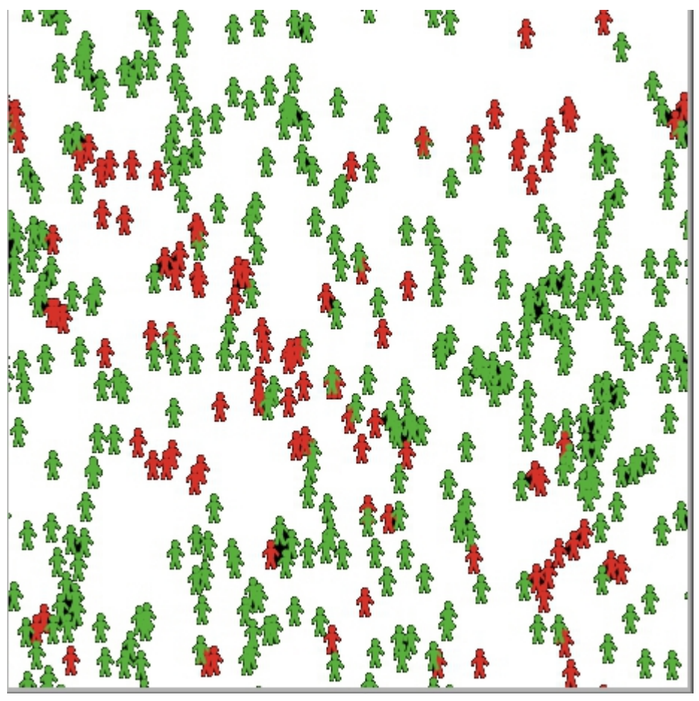

Figure 2:a NetLogo representation of a simpler world with a generic virus where red = infected and green = healthy

Discussion

Python will be used in the final project where NetLogo was used to obtain a basic understanding of the intended result of the project. Testing will be done with regard to statistics for previous outbreaks of smallpox and recorded death rates with regard to variables in these outbreaks. Immunization will also be implemented with similar tests.

Results and Conclusions

This project can be expected to provide an understanding of the use of quarantine if an outbreak of smallpox were to occur in a real-world scenario and provide examples for the greatest efficiency by determining the ideal quarantine officer/general population ratios in different situations, spreading out the manpower of the officers over a higher range to save the greatest number of lives.
\par These statistics could be explained in a chart comparing the number of quarantine officers with vaccination rates with the number of fatalities or other statistics.