Slowing the Spread of Malaria

New Mexico Supercomputing Challenge

Final Report

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Team 1021

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In this project we made a computational model to display how malaria can spread through a population over a certain period of time. Malaria kills about 500,000 people each year and a model of the spread could help doctors and scientists find a cure. Our goal has been to use Salesforce, an online database, to show how the plasmodium organism spreads from mosquitoes to humans to other mosquitos to eventually take over an entire population. Multiple real life factors were added to the mosquitoes and humans in our model. For example, mosquitos can die off and some humans can have a natural immunity, like real humans with sickle cell anemia. In this project we tried to display how the plasmodium organism can spread from person to person via mosquito bite.

Malaria is a lethal disease that takes many treasured lives, mostly in warm climates near the equator. Attempts at creating a vaccine for malaria have been received with a small budget and a parasite that evades the immune system. The plasmodium parasite is transmitted through the bites of infected mosquitos. The plasmodium organism makes it way to the liver of humans when a person is bitten by a female mosquito. From there, the plasmodium reproduces and makes its way through the bloodstream and damages red blood cells. If not treated, malaria becomes life-threatening by harming vital organs. Both of our team members have had someone close to us struck with malaria. Luckily, all of them have survived this deadly disease. Our goal with this project has been to display how malaria spreads through a population; in order to find a way to slow the distribution of the disease.

To display the spread of malaria we used a website called salesforce.com. This method of computing worked best for us since it stored all of our code in the cloud, so we could access it in multiple places. Keeping our code in the cloud is an efficient way to store our data since we attend different schools. The salesforce database consists of an IDE which stands for Integrated Development Environment that has certain aspects needed to start the coding process built into the platform. Instead of focusing on a particular region where malaria is most common, we modeled the disease as a pandemic that would spread throughout the world. Our model is composed of three elements: sick humans, mosquitoes that are carriers of malaria and healthy humans and mosquitoes. The code will determine whether or not the mosquito is female. This is of critical importance since the disease is transmitted from person to person through the bite of the female mosquito, which needs blood for her eggs. When the elements interact in the code they are programmed to result in one of the following outcomes: a sick human, a carrier mosquito or a neutral human or mosquito. Other features we added into the model were common genetic factors like natural immunity and sickle cell anemia, and the gender of mosquitos since only female mosquitoes bite humans. The gene pool of the mosquitos is also changed due to the periodic birth of new generations. By modeling how fast the disease spreads we will then be able to bring about a treatment for the disease.

Our result from the data is that it takes a small percentage of people infected for an uninfected mosquito population to become carriers and spread Plasmodium throughout the rest of the human population. To further improve our findings we need to ensure the humans and

mosquitoes have a certain lifespan within the program so the disease is not portrayed as being prevalent over the world.

In future modifications of this project, we could add more human factors to make our simulation as realistic as possible. By inquiring into the certain factors that affect the treatment of malaria for example: the wealthier regions with medicine, we could reduce the chances of catching malaria. In addition to that people with better immune systems will be ill for a shorter period of time than others. Once we display the way malaria spreads through a community, we can also show the fastest way for a cure to be delivered. If we set up multiple versions of our same project, we could create an even more accurate simulation of a population that has been struck with malaria. By adding more qualifiers to our program like age, birth and death rates, and traveling people we take our simulation to the highest accuracy possible.

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"Malaria Facts." Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, 04 Mar. 2015. Web. 10 Mar. 2015.

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