

SIMULATION & VISUALIZATION OF EPIDEMIC SPREADING IN REAL-TIME

This project is all about social networking, In which we concern with epidemic properties like visualize the situation of infection, susceptible and recovery of the people on any kind of map in real time scenario.

First of all we have to choose the map for showing the visualization. There are kind of maps present e.g MapBox , CartoDB, Here, Google Map etc. We have taken the google map because of its accuracy and customization.

There is always Infection rate and recovery rate would be there , it will be defining the rate by which the disease is spreading and being recover with different rate on the different places.

Simulation of data on the map can be done either deterministic way or stochastic way. If we are talking about the deterministic approach , computation would be always constant there is no role of time and probability. famous deterministic model is SIR model.

ROLE OF MATHEMATICAL MODEL :

On the map , simulation of data should be in random manner therefore the probability comes in role, for making real-time software we have used the stochastic model, name of this stochastic model is markov's model , sometime it is called chain binomial distribution also . this distribution works independently. It is only depends on present event. We can understand with small example . suppose there are 100 persons and out of 25 are infected with some infection rate (R_t) , and probability of success ($p \leq 1$) is given. so $(100-25 = 75)$ are susceptible(S) persons and we want to check probability of infection on 10 persons(x) out of 75. We will compute in this way....

$$P(x=10) \sim \text{binom}(S,p)$$

For more detail one can check:

<http://math.unm.edu/~sulsky/mathcamp/SimpleStochModel.pdf>

PLATFORM REQUIRED

As we are making a kind of software which shows the epidemic scenarios in continuous time. There should be front -end and back-end as well.

FrameWork : Django (Version 1.9.0)

Front-End : HTML , CSS, JAVASCRIPT ,JQUERY, BOOTSTRAP

Back-End : python (python 3.6)

DataBase : SQLite
DataSet : .json file (with keys "Latitude" and "Longitude")

How to run the project?

- Go to the project folder in cmd prompt
- Type the command: **python manage.py flush**
- Type the command: **python manage.py runserver**

Here, we are giving the documentation for each and every file and script which related with our implementation. The source codes are also well-commented for the convenience of third person.

DOCUMENTATION

*Documentation for **models.py** :*

Following are the Methods written in this python script

1. Class UserProfileInfo(models.Model):

It contains the following field -

- 1 :- username
- 2 :- email
- 3 :- password
- 4 :- user website url link
- 5 :- user profile picture

2. class Parameters(models.Model):

===== Disease Parameters Model=====

It contains the following field -

- 1 :- infection rate of disease , between 0 and 1
- 2 :- recovery rate , between 0 and 1
- 3 :- user uploaded file in JSON format containing latitude and longitude information of the different locations where disease may spread

3. class SIR(models.Model):

===== SIR Like Model =====

It contains the following field -

- 1 :- latitude information of the location
- 2 :- longitude information of the location

3 :- counter, which can take value 0 and 1. Zero means person is infected , one means person is recovered.

4 :- Date , to represent one a particular day how many people are infected and recovered.Date information will be used for plotting data from database on the map.

*Documentation for **views.py** :*

1. `def register(request):`
It takes data as parameters from html page entered by user to register or Login to use the system.
It incorporates strong authentication steps.
2. `def userLogout():`
Logout the user and clears all his data from database.
3. `def userLogout():`
Logs In the user and allows the user to use the software.
4. `def remove(array1,array2):`
Parameters:
array1 →Infected Population
array1 →Susceptible Population
Logical Operation: This function removes infected fraction of population from the susceptible population once they get infected
5. `def include(array1,array2):`
Parameters:
array1 →Infected Population
array1 →Susceptible Population
Logical Operation:
This function adds infected fraction of population from the susceptible population once they get infected.
6. `def distance(Point1,Point2):`
Point1 and Point2 are co-ordinates on google map.(DataType: LatLng)

Logical Operation: This methods calculates and returns the distance between two points using Euclidian method .

7. `def incrementDate(DD,MM,YY):`

Parameter : Date in above DD/MM/YY format

Logical Operation: Updates and returns the current input date to next Date.

8. `def modelSimulation()`

Parameters: i.>Dataset of population in JSON format

ii.> Infection rate

iii.> Recovery rate

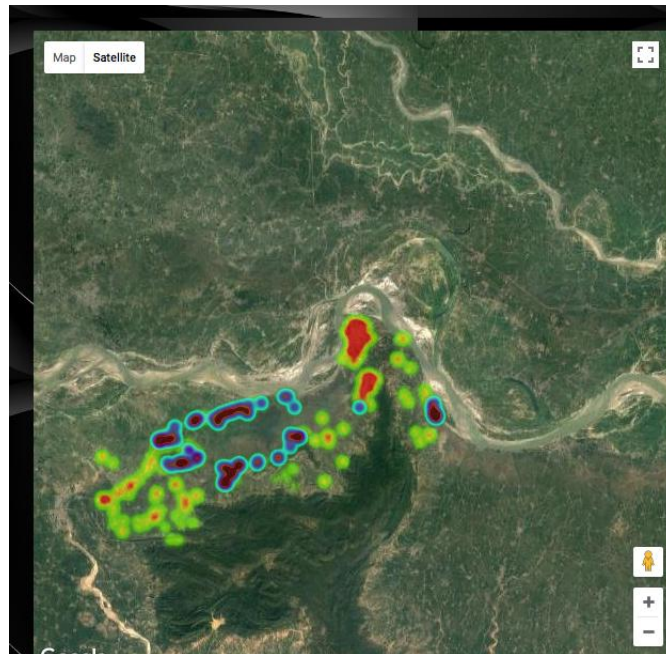
Logical Operation:

This is the Core function for the simulation model.It reads JSON file from the database given by user through html page and converts it into dictionary for the galvanizing the simulation.

Firstly, It removes all the redundant data from the total susceptible population.

Further, the function calculates the distance of all susceptible population from infected population and updates their status based on distance calculated,threshold distance,infection rate,recovery rate with respect to time.

Once the equilibrium point is reached or the total population is exhausted all the population statuses are written back to the database with the time stamp for visualization and simulation is terminated.



Documentation for eav.html :

In script section we have define the different function which are using for manipulation of HTML code.

<script>

-----JS code-----

</script>

```
1. /*header = document.querySelector("#heading");
start = document.querySelector("#start");
pie = document.querySelector("#pie");
result = document.querySelector("#result");
*/
```

This is concept of DOM(document object model) , here `querySelector()` is method which is access the id value (“#heading”) in the object form so that we can manipulate it further.

2. `function getRandomColor() :`

It generates the random color on the front - end with heading “*Epidemic Analysis and Visualization*” .

3. `function initMap() :`

This is initialize the google heatmap and customize the properties of map like ZOOM level and mode etc.

4. `function move()`

First of all it stores the all the datapoints those are infected in `mvcI[]` list and all recovered data into `mvcR[]` list.

5. `function drawChart()`

This function shows the pie chart on the web page.

