Title(Social Distancing App)

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Abstract

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)...

1 Introduction

Artificial intelligence (AI) has the potential to help us tackle the pressing issues raised by the COVID-19 pandemic...

2 Problem definition

The goal of this project is to build a ...

3 User Stories

- Persona 1: (User experiencing symptoms of COVID-19)[can go from SECONDARY USER to PRIMARY USER] As a citizen experiencing symptoms of COVID-19, I'd like to help the people around me with social distancing. Identify as positive: I would like to login, go to a page and flag myself as a COVID-19 positive case and enter a date and status e.g. tested positive Jan 29 2020, in self isolation week 2, not hospitalized.I understand that my age, sex and location will be shared with the app, but that my data will be anonymized such that the data can not be tied to me, my name, my phone number/ phone id.I would like the provision to unflag myself once I have recovered and am out of self isolation.I would like to be able to share my experience with COVID-19, where I got treated and how long did it take for me to recover along with the symptoms I experienced - if I choose to do so.
- Persona 2: (User without any symptoms of COVID-19) [PRIMARY USER] As a citizen practicing social distancing, I would like to get an alert any time I am within 100 meters of a person who has tested positive for COVID-19. I would also like to get a heatmap of the city where I live to identify which areas contain high concentrations of COVID-19 patients and recommendations on when should I leave home for essential chores such as a visit to the grocery store/ gas station.
- Persona 3: (Medical professional treating COVID-19 cases) As a medical professional, I would like to report the ground truth about protective gear shortages and hospital capacity. I would like to get a daily report of new cases identified as well as cases discharged near me.

4 Related Work

At the beginning of March, South Korea was the country with the highest number of confirmed cases of Coronavirus, COVID-19, after China, with more than 3000 cases. In response to the virus, some developers have created apps that track known information about COVID-19 and outbreak locations. [1]

The 'Corona 100m' (Co100) app, was launched on February 11 and, using government data, alerts users with a push notification when they come within 100 metres(328 ft) of a location visited by an infected person. It had a million downloads in its first ten days after launch, according to South Korean government website Korea.net, which said the app "allows users to conveniently avoid potentially dangerous locations without checking the travel histories of those infected". The approach has sparked some concerns about information overload and privacy/surveillance. According to reports, the communications don't identify patients individually but give their gender and age range and assign them a case number. [2]
Another app called 'Corona Map' was released in South Korea. The app functionalities are similar to the one of 'Corona 100m' app. The app plots the locations where people known to have had COVID-19 have been, to make avoiding these areas easier. The app differently from the previous one, it is more for visualization and it simply shows the locations where people have been, without giving any alerts. [1]

In Singapore on March 20, an app called 'TraceTogether' was released to the public. It is described as an additional tool to help track the virus, relying on infected individuals' recall and memory of where they were while moving around. When installed, the app allows short-distance Bluetooth signals to connect with one another, with detailed records then stored on a user's phone for 21 days at a time. Location data is not connected. If a user is diagnosed with COVID-19, the disease caused by the coronavirus, they can let Singaporean health authorities access their app data and see who else might have been infected. Singapore's rules mandate that when a person is contacted in the above instances, they are required by law to help map out their whereabouts to trace the pattern of infection. All of this has led to some privacy concerns. Singapore has tried to offset those concerns,

saying the app doesn't collect personal details like a person's name, doesn't record location data and doesn't access anyone's phone contact list or other private data.[3]

5 Alert within a specific radius

5.1 Concept

The general concept...

5.2 Implementation Details

Details of about how the app will work and how it is implemented, text, images ...

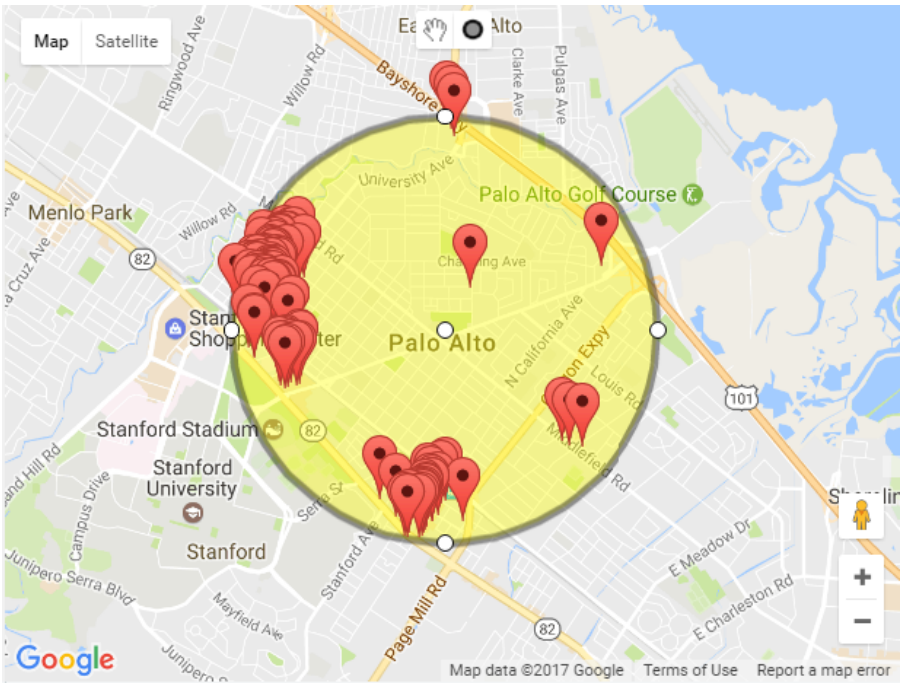

Figure 1: Radius Example

5.3 Experiments

Experiments done ...

5.4 Results

The results obtained ...

6 Reinforcement Learning algorithm to generate heatmap of the city

6.1 Concept

We plan on using reinforcement learning(q-learning), a machine learning technique that try find the best possible behavior or path that should be taken in a specific situation. To accomplish this task, an agent will take suitable action to maximize the reward. In this use case, Reinforcement Learning(RL) will be used to build a live heatmap of the city around a user's location.

6.2 Implementation Details

In this section we will define some key concepts and parameters to better understand the RL algorithm that will be used to generate the heatmap:

Cell: it is a unit of abstraction of the size of a city block. For the purposes of this application, you can assume that the U.S. will be divided into a mozaic of cells - each cell covering a geographical area equivalent of a city block.

Here are some details on the parameters for RL:

State	cellId, set {app users present in this cell}
Action	move up, down, left, right to adjacent cells
Policy	given a cellId, pick the action with the max reward value
Reward	Each state has a reward value associated with it. A huge positive reward for the presence of essential services e.g. gas station/ grocery store. A huge negative reward for each COVID-19 positive user identified in the given cell. A Small negative reward for each COVID-19 negative user to encourage social distancing.

Table 1: RL Training Parameters

Training: Exploration of state space begins with a user wanting to go to an essential service.

Algorithm 1: Training

for *a given random user in the set of users,* { *u* } **do**
  for *an intended destination,*{ *d* } **do**
    Let A define the adjacency matrix defining the state's spatial relationship with each other:
    a) identify the current cell id;
    b) for each adjacent cell for states given by A;
    c) compute the inherent reward r for each state in step b;
    d) pick the recommended action a -¿ up,down,left,right ;
    e) update the q-value for the state using observed reward and max possible;
    reward for the next state;
    f) move to the next state;
    e) repeat process in line 3;
  end
end

Result: The resulting map of q-values for the states in geographical area will come to represent a live heat map of COVID-19 cases near you.

Goal: The main goal of the RL algorithm are:

1. Compute a path from current state to the final destination using the safest path possible.
2. Try to co-relate positive and negative hot zones with times of day to recommend for users. [4]

This figure show the heatmap of the city ...:

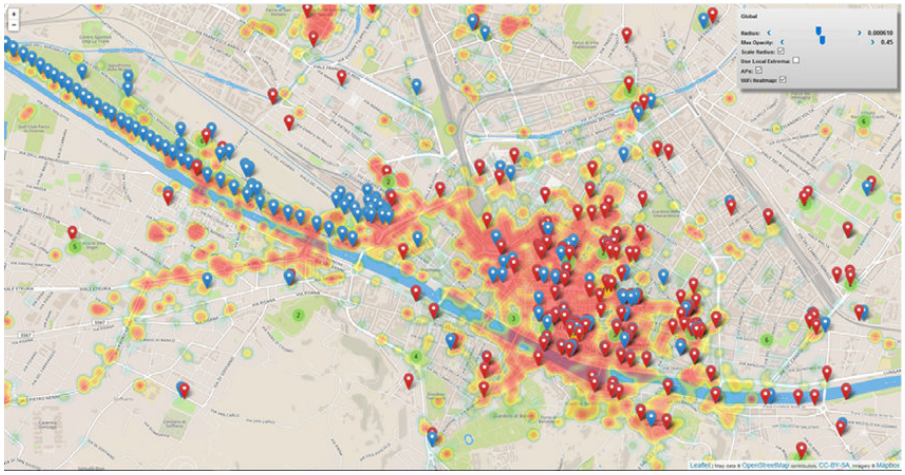

Figure 2: City Heatmap

7 Conclusion

Conclusion ...

For future work...

Another interesting direction that can be taken ...

References

[1] Take a look at these Korean apps helping people avoid areas infected by the coronavirus. Available at https://www.businessinsider.com/coronavirus-south-korea-photos-apps-location-outbreak-where-2020-3 (March 2, 2020).

[2] South Korea to step-up online coronavirus tracking. Available at https://www.smartcitiesworld.net/news/news/south-korea-to-step-up-online-coronavirus-tracking-5109 (March 12, 2020).

[3] App Lets Singapore Track Virus Patients' Movements. Available at https://www.pymnts.com/coronavirus/2020/app-lets-singapore-track-virus-patients-movements/ (March 25, 2020).

[4] Reinforcement Learning. Available at https://www.cse.unsw.edu.au/~cs9417ml/RL1/algorithms.html.