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% ENGS 27; Final Project - Matlab
% November 18, 2020

%This script handles the collection of the data which we will use to
 inform
%our model in final_code.m (Note: some of the figures are best when
 viewed
%in full screen. Also note that distance between longitudes is not
 constant
%on a graph due to mercator projections.)
clear

% Note: distance between longitudes is not constant on a graph

protest_data = readtable('US_BLM_Protests.xlsx'); % Read protest data
 into table form

num_events = height(protest_data(:,1)); % Count rows in data table

% Turn select table columns into column arrays of cell type
type_column = protest_data.EVENT_TYPE;
date_column = protest_data.EVENT_DATE;
county_column = protest_data.ADMIN2;
state_column = protest_data.ADMIN1;
lat_column = protest_data.LATITUDE;
lon_column = protest_data.LONGITUDE;
actor_column = protest_data.ASSOC_ACTOR_1;

% Find duration of protest data in days
total_duration = days(date_column(num_events)-date_column(1));

% Turn dates into indexable integers
x = date_column(1);
y = 1;
for i=1:num_events
    if date_column(i)==x
        rel_date_column(i,1) = y;
    else
        x = x+1;
        y = y+1;
        rel_date_column(i,1) = y;
    end
end

% Count # of protests and # of BLM riots via for loop
num_protests = 0;
num_protests_blm = 0;
for i=1:num_events
    if type_column(i) == "Protests"
        num_protests = num_protests+1;
        if actor_column(i) == "BLM: Black Lives Matter"
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            num_protests_blm = num_protests_blm+1;
        end
    end
end

% Define how many regions and time steps we want
num_regions = 49; % Number of box regions
num_times = total_duration; % Number of time steps

% Creating mesh grid over the US excluding AL AND HI
max_lon = -66; % East coast
min_lon = -125; % West coast
max_lat = 49; % 49th parallel
min_lat = 24; % Southern tip of florida
num_region_rows = sqrt(num_regions);
num_region_cols = sqrt(num_regions);
region_row_lines = flip(linspace(min_lat,max_lat,num_region_rows+1));
region_row_lines_2 = linspace(min_lat,max_lat,num_region_rows+1);
region_col_lines = linspace(min_lon,max_lon,num_region_cols+1);

% Convert event type and actor data to cateegorical form
protest_data.EVENT_TYPE = categorical(protest_data.EVENT_TYPE);
protest_data.ASSOC_ACTOR_1 = categorical(protest_data.ASSOC_ACTOR_1);

% Extract BLM data and create a condensed table
BLM_table = protest_data(((protest_data.EVENT_TYPE == 'Protests')
 & ...
                          (protest_data.ASSOC_ACTOR_1 == 'BLM: Black
 Lives Matter')),:);
BLM_rel_date_column = rel_date_column(((protest_data.EVENT_TYPE
 == 'Protests') & ...
                                       (protest_data.ASSOC_ACTOR_1
 == 'BLM: Black Lives Matter')));

% Store geographic coordinates of BLM data
geo_coordinates = zeros(num_protests_blm,2); %Initialize
 geocoordinates matrix
geo_coordinates(:,1) = BLM_table.LATITUDE; %Store latitude in the
 first column
geo_coordinates(:,2) = BLM_table.LONGITUDE; %Store longitude in the
 second column

% Populate the 3D matrix protests_per_region
protests_per_region = zeros(num_region_rows, num_region_cols,
 num_times);
for i=1:num_times
   [protests_per_region(:,:,i),Xedges,Yedges] =
 histcounts2(geo_coordinates((BLM_rel_date_column == i),1),...

 geo_coordinates((BLM_rel_date_column == i),2),...

 region_row_lines_2,...

 region_col_lines);
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end

% For the histogram to work, the data had to be flipped
% We flip it back to get the actual matrix representation
for i = 1:num_times
    protests_per_region(:, :, i) = flipud(protests_per_region(:, :,
 i));
end

% Visualize the 3D matrix with a daily heat map by plotting the first
 21
% days, just to provide an example of temporal progression.
figure(1);
    x_labels = {'c1','c2', 'c3', 'c4', 'c5', 'c6', 'c7'};
    y_labels = {'r1','r2', 'r3', 'r4', 'r5', 'r6', 'r7'};
    for count = 3:23
        x = count - 2;
        subplot(5, 5, x);
        heatmap(x_labels, y_labels, protests_per_region(:, :, count));
        colormap autumn
        title('Day' + string(x));
    end
    sgtitle('Number of Protests in Each Region by Day')

% Visualize the geospatial density of proteests with a scatter plot
figure(2)

 geoscatter(geo_coordinates(:,1),geo_coordinates(:,2),'filled','MarkerFaceColor',
[0.6350, 0.0780, 0.1840]);
     hold on
     for n = 1:(num_region_cols+1)
         geoplot([min_lat max_lat], [region_col_lines(n)
 region_col_lines(n)],'-k','LineWidth',1)
         geoplot([region_row_lines_2(n) region_row_lines_2(n)],
 [min_lon max_lon],'-k','LineWidth',1)
     end
     title('All Protests over a Span of 164 Days');
     geolimits([min_lat max_lat],[min_lon max_lon])
     geobasemap streets-dark
     hold off
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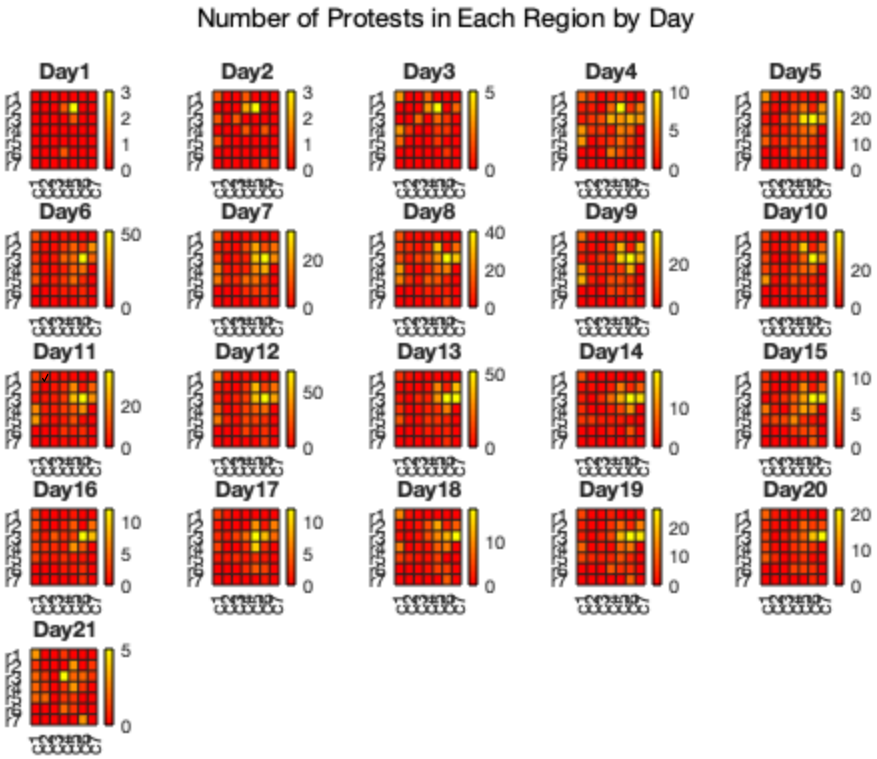
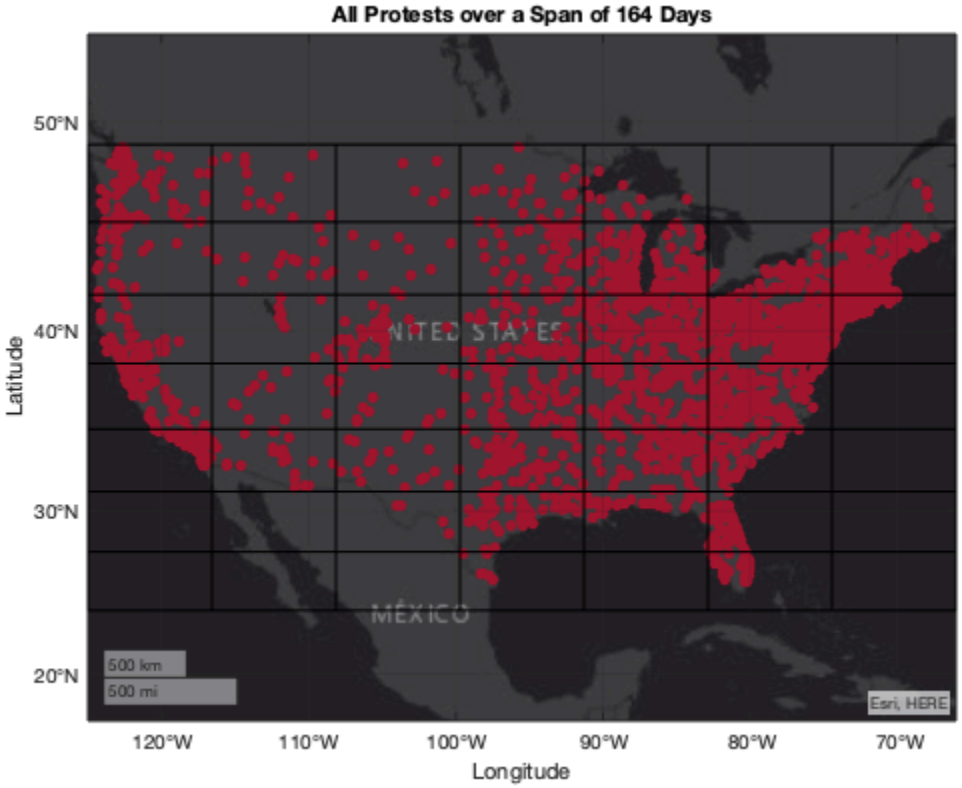
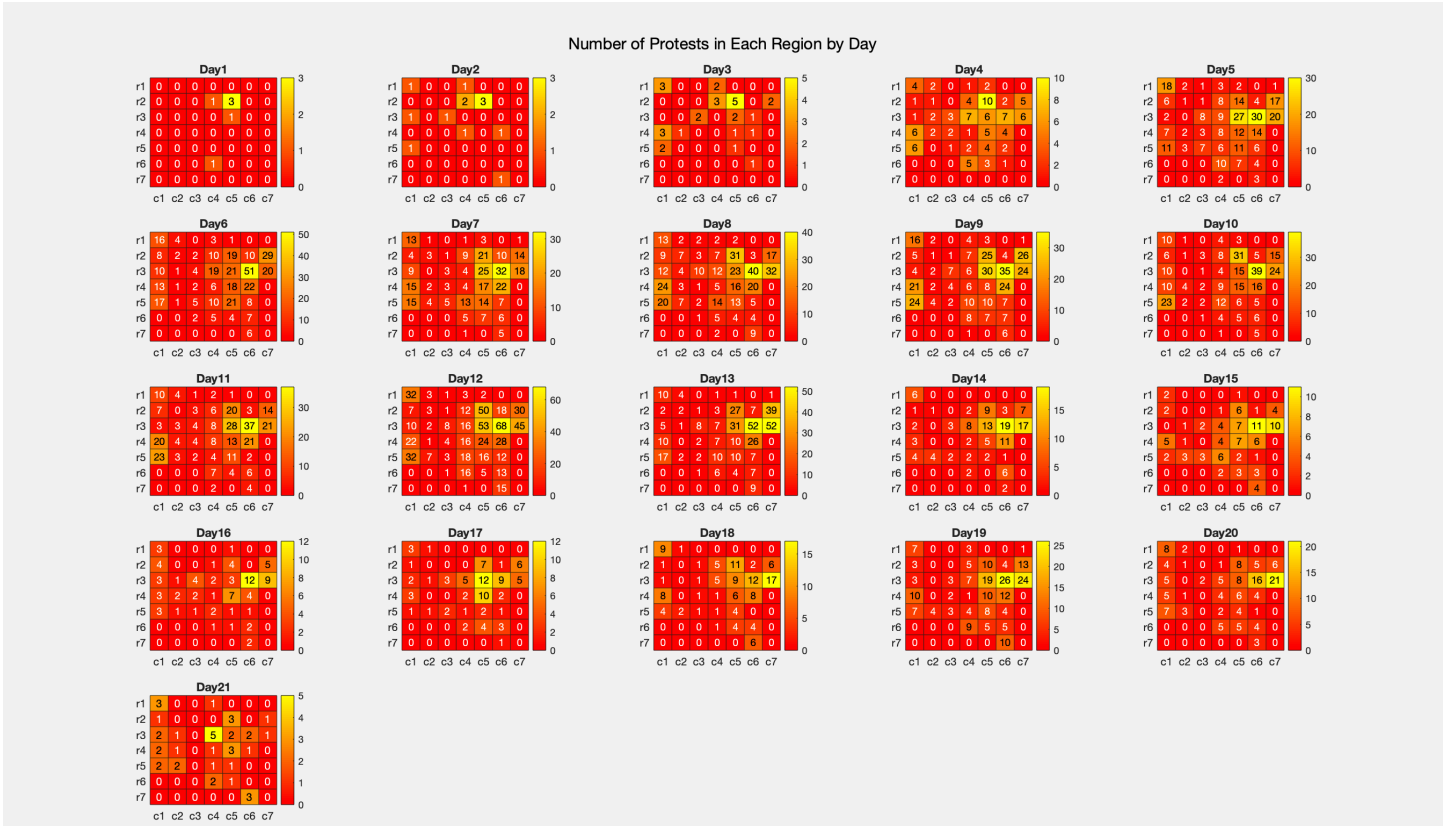
Because this figure is best viewed in full screen, we have appended this document with a screenshot of this heat map in an optimzed view. Note: this map only proved a visual example for 21 of 164 days.






Number of Protests in Each Region by Day
Day1
r1 0 0 0 0 0 0 0
r2 0 0 0 1 3 0 0
r3 0 0 0 0 1 0 0
r4 0 0 0 0 0 0 0
r5 0 0 0 0 0 0 0
r6 0 0 0 1 0 0 0
r7 0 0 0 0 0 0 0
c1 c2 c3 c4 c5 c6 c7
3 2 1 0
Day2
r1 1 0 0 1 0 0 0
r2 0 0 0 2 3 0 0
r3 1 0 1 0 0 0 0
r4 0 0 0 1 0 1 0
r5 1 0 0 0 0 0 0
r6 0 0 0 0 0 0 0
r7 0 0 0 0 0 1 0
c1 c2 c3 c4 c5 c6 c7
3 2 1 0
Day3
r1 3 0 0 2 0 0 0
r2 0 0 0 3 5 0 2
r3 0 0 2 0 2 1 0
r4 3 1 0 0 1 1 0
r5 2 0 0 0 1 0 0
r6 0 0 0 0 0 1 0
r7 0 0 0 0 0 0 0
c1 c2 c3 c4 c5 c6 c7
5 4 3 2 1 0
Day4
r1 4 2 0 1 2 0 0
r2 1 1 0 4 10 2 5
r3 1 2 3 7 6 7 6
r4 6 2 2 1 5 4 0
r5 6 0 1 2 4 2 0
r6 0 0 0 5 3 1 0
r7 0 0 0 0 0 0 0
c1 c2 c3 c4 c5 c6 c7
10 8 6 4 2 0
Day5
r1 18 2 1 3 2 0 1
r2 6 1 1 8 14 4 17
r3 2 0 8 9 27 30 20
r4 7 2 3 8 12 14 0
r5 11 3 7 6 11 6 0
r6 0 0 0 10 7 4 0
r7 0 0 0 2 0 3 0
c1 c2 c3 c4 c5 c6 c7
30 20 10 0
Day6
r1 16 4 0 3 1 0 0
r2 8 2 2 10 19 10 29
r3 10 1 4 19 21 51 20
r4 13 1 2 6 18 22 0
r5 17 1 5 10 21 8 0
r6 0 0 2 5 4 7 0
r7 0 0 0 0 0 6 0
c1 c2 c3 c4 c5 c6 c7
50 40 30 20 10 0
Day7
r1 13 1 0 1 3 0 1
r2 4 3 1 9 21 10 14
r3 9 0 3 4 25 32 18
r4 15 2 3 4 17 22 0
r5 15 4 5 13 14 7 0
r6 0 0 0 5 7 6 0
r7 0 0 0 1 0 5 0
c1 c2 c3 c4 c5 c6 c7
30 20 10 0
Day8
r1 13 2 2 2 2 0 0
r2 9 7 3 7 31 3 17
r3 12 4 10 12 23 40 32
r4 24 3 1 5 16 20 0
r5 20 7 2 14 13 5 0
r6 0 0 1 5 4 4 0
r7 0 0 0 2 0 9 0
c1 c2 c3 c4 c5 c6 c7
40 30 20 10 0
Day9
r1 16 2 0 4 3 0 1
r2 5 1 1 7 25 4 26
r3 4 2 7 6 30 35 24
r4 21 2 4 6 8 24 0
r5 24 4 2 10 10 7 0
r6 0 0 0 8 7 7 0
r7 0 0 0 1 0 6 0
c1 c2 c3 c4 c5 c6 c7
30 20 10 0
Day10
r1 10 1 0 4 3 0 0
r2 6 1 3 8 31 5 15
r3 10 0 1 4 15 39 24
r4 10 4 2 9 15 16 0
r5 23 2 2 12 6 5 0
r6 0 0 1 4 5 6 0
r7 0 0 0 1 0 5 0
c1 c2 c3 c4 c5 c6 c7
30 20 10 0
Day11
r1 10 4 1 2 1 0 0
r2 7 0 3 6 20 3 14
r3 3 3 4 8 28 37 21
r4 20 4 4 8 13 21 0
r5 23 3 2 4 11 2 0
r6 0 0 0 7 4 6 0
r7 0 0 0 2 0 4 0
c1 c2 c3 c4 c5 c6 c7
30 20 10 0
Day12
r1 32 3 1 3 2 0 0
r2 7 3 1 12 50 18 30
r3 10 2 8 16 53 68 45
r4 22 1 4 16 24 28 0
r5 32 7 3 18 16 12 0
r6 0 0 1 16 5 13 0
r7 0 0 0 1 0 15 0
c1 c2 c3 c4 c5 c6 c7
60 40 20 0
Day13
r1 10 4 0 1 1 0 1
r2 2 2 1 3 27 7 39
r3 5 1 8 7 31 52 52
r4 10 0 2 7 10 26 0
r5 17 2 2 10 10 7 0
r6 0 0 1 6 4 7 0
r7 0 0 0 0 0 9 0
c1 c2 c3 c4 c5 c6 c7
50 40 30 20 10 0
Day14
r1 6 0 0 0 0 0 0
r2 1 1 0 2 9 3 7
r3 2 0 3 8 13 19 17
r4 3 0 0 2 5 11 0
r5 4 4 2 2 2 1 0
r6 0 0 0 2 0 6 0
r7 0 0 0 0 0 2 0
c1 c2 c3 c4 c5 c6 c7
15 10 5 0
Day15
r1 2 0 0 0 1 0 0
r2 2 0 0 1 6 1 4
r3 0 1 2 4 7 11 10
r4 5 1 0 4 7 6 0
r5 2 3 3 6 2 1 0
r6 0 0 0 2 3 3 0
r7 0 0 0 0 0 4 0
c1 c2 c3 c4 c5 c6 c7
10 8 6 4 2 0
Day16
r1 3 0 0 0 1 0 0
r2 4 0 0 1 4 0 5
r3 3 1 4 2 3 12 9
r4 3 2 2 1 7 4 0
r5 3 1 1 2 1 1 0
r6 0 0 0 1 1 2 0
r7 0 0 0 0 0 2 0
c1 c2 c3 c4 c5 c6 c7
12 10 8 6 4 2 0
Day17
r1 3 1 0 0 0 0 0
r2 1 0 0 0 7 1 6
r3 2 1 3 5 12 9 5
r4 3 0 0 2 10 2 0
r5 1 1 2 1 2 1 0
r6 0 0 0 2 4 3 0
r7 0 0 0 0 0 1 0
c1 c2 c3 c4 c5 c6 c7
12 10 8 6 4 2 0
Day18
r1 9 1 0 0 0 0 0
r2 1 0 1 5 11 2 6
r3 1 0 1 5 9 12 17
r4 8 0 1 1 6 8 0
r5 4 2 1 1 4 0 0
r6 0 0 0 1 4 4 0
r7 0 0 0 0 0 6 0
c1 c2 c3 c4 c5 c6 c7
15 10 5 0
Day19
r1 7 0 0 3 0 0 1
r2 3 0 0 5 10 4 13
r3 3 0 3 7 19 26 24
r4 10 0 2 1 10 12 0
r5 7 4 3 4 8 4 0
r6 0 0 0 9 5 5 0
r7 0 0 0 0 0 10 0
c1 c2 c3 c4 c5 c6 c7
25 20 15 10 5 0
Day20
r1 8 2 0 0 1 0 0
r2 4 1 0 1 8 5 6
r3 5 0 2 5 8 16 21
r4 5 1 0 4 6 4 0
r5 7 3 0 2 4 1 0
r6 0 0 0 5 5 4 0
r7 0 0 0 0 0 3 0
c1 c2 c3 c4 c5 c6 c7
20 15 10 5 0
Day21
r1 3 0 0 1 0 0 0
r2 1 0 0 0 3 0 1
r3 2 1 0 5 2 2 1
r4 2 1 0 1 3 1 0
r5 2 2 0 1 1 0 0
r6 0 0 0 2 1 0 0
r7 0 0 0 0 0 3 0
c1 c2 c3 c4 c5 c6 c7
5 4 3 2 1 0