

Lab 5: Event

Objectives

Through this lab, you will gain a deeper understanding of the concept of an event in geographic space by experimenting with event data in the application area of sensor networks.

Tasks

Provide a technical report (as a single pdf uploaded in Gauchospace) with precise answers to the following questions. Purple asterisks (*) indicate that the question requires a screenshot! (Lab total is 22 points)

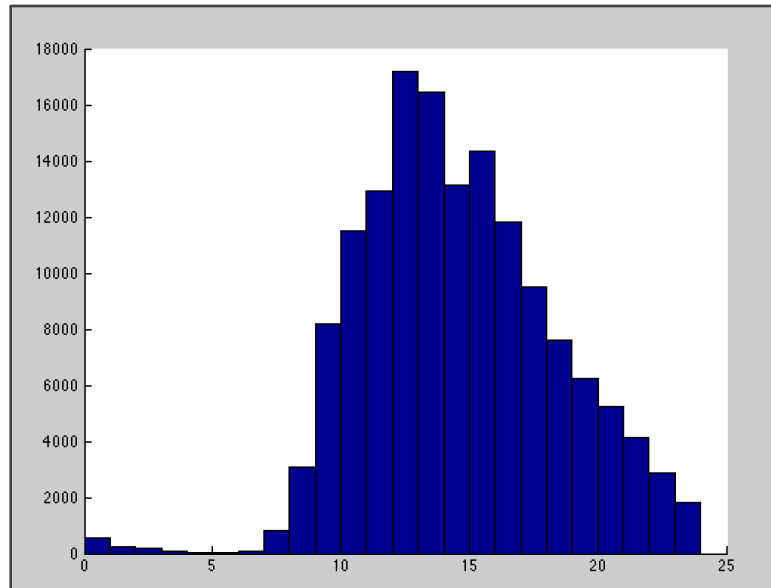
Preparations (no response needed):

We access the internet all the time, but in order to do so, we must have a device that connects to an access point. There are hundreds of these access points located across campus inside of buildings. When you travel across campus, your device will switch its connection to the closest access point.

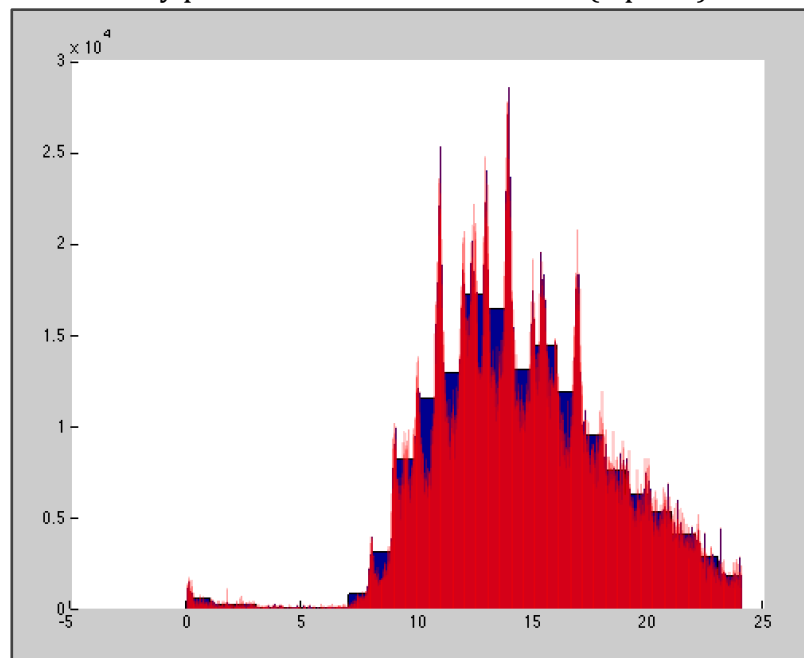
1. **Visualize** connections made to the campus wireless access points using [this web application](#). You can see connections on different days of the week by changing the *Start_at_percentage* parameter. These data are records of the times and positions of all wireless connections on campus from a seven day period in early 2012 (e.g., a laptop or cell phone connecting to a access point). Each of these **connection events** implies the presence of a person connecting a device at a certain place and time to a wireless access point located in a building.
 - a. Change the days of the week by changing the *start_at_percentage* value. What do the flashing dots represent? What spatial and temporal trends can you observe from the simulation? *Note*: The times are reported in GMT. The animation also “speeds up” in the absence of data. (2 points)
 - b. *Take a screenshot at a particular moment and discuss what you observe, spatially and temporally. (1 point)
2. **Plot** the event data by importing *events_by_day.csv* file into Excel or Google Sheets. Generate a bar graph so that each X value represents each row of the data. *Note*: Excel calls this kind of graph “Clustered Column.”

- a. *Take a screenshot of your bar graph and explain what the X value intervals (also called *bins*) represent. (1 point)
- b. Judging by the shape of your graph, on which day of the week do most connection events occur? *Note*: Day 0 is Saturday. (1 points)

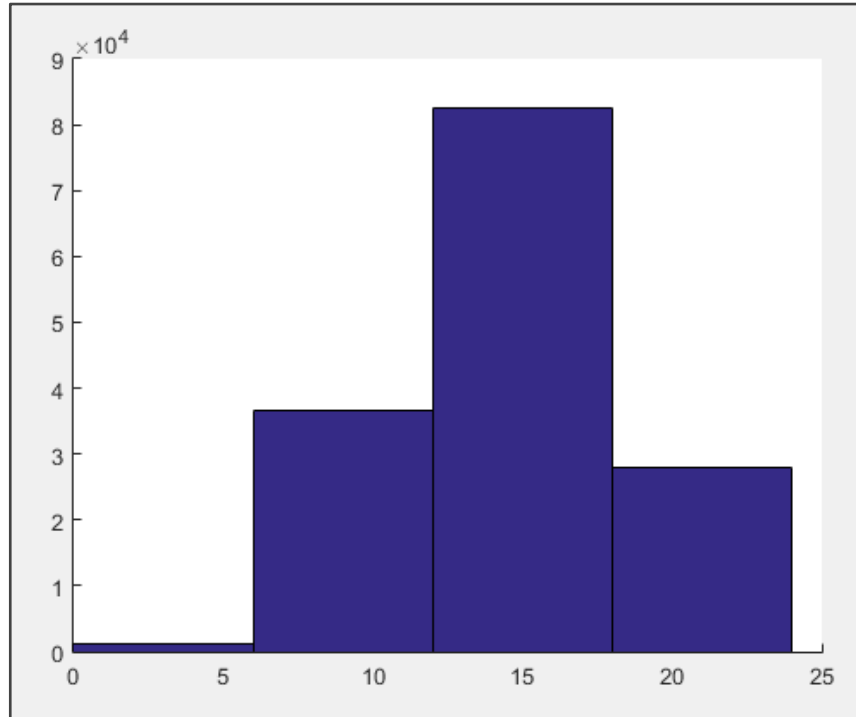
3. **Assess** the following event data plots.



- a. In the plot above, the x-axis shows hour of the day and the y-axis shows number of connection events. The bin width of the blue graph is one hour. Describe the daily pattern of connection events. (1 point)



- b. Next, in the plot above, we overlay the blue histogram with the higher temporal resolution red plot, which has a bin width of one minute. Looking at the higher resolution histogram, connections fluctuate and peak at different times within the hour. In what single time slot do you see the most activity now? What do you think is happening on campus at this time? (2 points)




- c. If we set the number of blue hourly bins to 4, as in the plot above, what is the graph failing to convey about the event data at this low temporal resolution? What is this new bin width? Does it still convey any significant trend(s)? (1 point)
4. The table below shows the raw data that was used to generate the plots in question 3. The columns from left to right are: time-stamp; router ID; and user's device ID.

Make sure you understand the nature of this data and look for trends.

```
1 "2012-01-28 00:09:36", "528-6400-ap1", "02e23ad13a"
2 "2012-01-28 00:10:44", "503-3228-ap1", "d924d983ce"
3 "2012-01-28 00:11:03", "503-3165-ap1", "d924d983ce"
4 "2012-01-28 00:11:48", "615-1000-ap1", "d6afb88008"
5 "2012-01-28 00:12:37", "558-1523-ap1", "b393cad05"
6 "2012-01-28 00:14:01", "503-3309-ap1", "d6afb88008"
7 "2012-01-28 00:15:42", "525-1530-ap2", "8aa2969cbd"
8 "2012-01-28 00:27:25", "528-6400-ap1", "facda2b686"
9 "2012-01-28 00:28:03", "515-2200a-ap1", "facda2b686"
10 "2012-01-28 00:28:13", "525-1530-ap2", "b5b305806a"
11 "2012-01-28 00:48:08", "528-3605-ap1", "a979b18a41"
12 "2012-01-28 00:51:33", "558-1300-ap1", "e68b3493b5"
13 "2012-01-28 00:57:44", "531-1145-ap1", "3a83f6642b"
14 "2012-01-28 00:57:47", "558-2400-ap2", "3a83f6642b"
15 "2012-01-28 00:57:52", "558-2502-ap1", "3a83f6642b"
```

- a. Interpret each of the three columns as an attribute of an instance of a core concept. For a different example, consider a table showing student perm numbers and names. Both of these attributes could be interpreted as identifiers of “objects” (students). (2 points)
 - b. Which properties and relations of the connection events recorded in this data set are temporal? Which are thematic? Why? (1 point)
 - c. Suggest how you would estimate the moment in time that a device *disconnects* from a router using only the data from the table above (that is, the data that lists the *connections* between devices and routers). (1 point)
5. **Produce trajectories** of devices over a certain time period using [this web application](#). (It is slightly different than the last web application). This tool will display the trajectories over your specified time interval on a predetermined day in 2012. First plot two devices over a 60 minute time interval by setting the *traveled_in_minutes* to 60 and *sample_size* to 2. Next, increase the interval to 360 minutes and update the emulation. What differences do you notice in the trajectories? Do you think that the trajectories are affected by the campus road network? How so? (2 points)
6. **Import** *Time_Animation.lpk* (layer package) into ArcMap from the catalog pane. This data set contains a pre-symbolized time layer, which aggregates the number of events into [Thiessen](#) polygons. Each polygon represents the coverage area of an access point. Add the OpenStreetMap basemap beneath your package layers. Adjust the Thiessen polygons layer transparency so you can see the buildings below (under the *layer properties > display* tab). Zoom your extent to the building that you identify as Davidson Library.

- Open the [Time Slider](#) panel  on the *tools* toolbar. This tool is accessible only when handling layers that have temporal information. In this case, you are referencing time-enabled data. In options under Time Display, ensure that the time step interval is set to 0.5 hours. Also ensure that the Start Time is 1/28/2012 at 8:00 AM and that the End Time is 2/4/2012 at 7:30 AM. You can change these presets to animate a single day of the week by adjusting Time Extent options. *Take a screenshot of the Time Slider options window. (1 point)
- Close the Options window and play your animation, either by pressing Play or by clicking through the time series frame by frame. *Identify a time that illustrates a significant event, explain what you're observing, and take a screenshot. (3 points)
- Compare your observation with the Thiessen polygons' attribute table. Note that the attribute table changes as you slide the time. Explain when and where the greatest number of events occurred. Speculate as to what may have occurred at this time and place. *Take a screenshot of the corresponding Thiessen polygon and its attributes in the attribute table. *Note:* depending on the time slice you are viewing, the attributes shown correspond to what is displayed on the map; to disable time and see all attributes, in the Time section of layer Properties uncheck "Enable time on this layer" (3 points)

