

CSC/SDS 235: Visual Analytics

Fall 2024

HW 03: Spatiotemporal Data

This is a group assignment (3-4 students) – I recommend choosing collaborators with complementary skillsets to yours!

Goals:

- Explore realistic data via visual analytics
- Work with data that has spatial and temporal attributes

Instructions

Overview

Scenario

The year is 2017, and we find ourselves in the idyllic-seeming Mistford, a mid-size city is located to the southwest of a large nature preserve. The city has a small industrial area with four light-manufacturing endeavors. Mitch Vogel is a post-doc student studying ornithology at Mistford College and has been discovering signs that the number of nesting pairs of the Rose-Crested



Blue Pipit, a popular local bird due to its attractive plumage and pleasant songs, is decreasing! The decrease is sufficiently significant that the Pangera Ornithology Conservation Society is sponsoring Mitch to undertake additional studies to identify the possible reasons. Mitch is gaining access to several datasets that may help him in his work, and he has asked you (and your colleagues) as experts in visual analytics to help him analyze these datasets.

The Boonsong Lekagul Nature Preserve is used by local residents and tourists for day-trips, overnight camping or sometimes just passing through to access main thoroughfares on the opposite sides of the preserve. The entrance booths of the preserve are monitored in order to generate revenue as well as monitor usage. Vehicles entering and exiting the preserve must pay a fee based on their number of axles (personal auto, recreational trailer, semi-trailer, etc.). This generates a data stream with entry/exit timestamps and vehicle type. There are also other locations in the part that register traffic passing through. While hiking through the various parts of the preserve, Mitch has noticed some odd behaviors of vehicles that he doesn't think are consistent with the kinds of park visitors he would expect. If there were some way that Mitch could analyze the behaviors of vehicles through the park over time, this may assist him in his investigations.



The four factories in the industrial area are subjected to higher-than-usual environmental assessment, due to their proximity to both the city and the preserve. Gaseous effluent data from several sampling stations has been collected over several months, along with meteorological data (wind speed and direction), that could help Mitch understand what impact these factories may be having on the Rose-Crested Blue Pipit. These factories are supposed to be quite compliant with recent years' environmental regulations, but Mitch has his doubts that the actual data has been closely reviewed. Could visual analytics help him understand the real situation?

After working through all of the data concerning traffic patterns and smokestack plumes, Mitch now needs to bring the data and discoveries together to tell a coherent and comprehensive story about what he believes is affecting the Rose-crested Blue Pipit. Mitch sees some relationships among all of the data and the analytics you and he have worked on, but he has

run across some additional information that he believes could strengthen his hypotheses about the conditions for the Pipit. Once again, he turns to you, his visual analytics expert, to help him out in sorting through what is important and relevant to creating the story that is taking shape.

The Data

To support your analysis, you have been granted access to several datasets documenting activity in the preserve and the greater city of Mistford:

- Movement data recorded from sensors around the Boonsong Lekagul Nature Preserve
- A map containing the locations of roadways and sensors throughout the Preserve
- Sensor readings from a set of air-sampling sensors distributed around Mistford's manufacturing district
- Meteorological data from a weather station in proximity to the factories and sensors
- Editions of the "Mistford Industrial Park Newsletter", published semiannually covering the years 2013-2016

The [data](#) available via Moodle. You may use as much or as little of the data in your analysis as you like. Some is useful, other parts might be less so... but you won't know what's what until you explore!

Your Objective

We've recently started to explore the complexities of data that vary over both time and space. This challenge will require you to think carefully about how to model (and visualize!) these complex phenomena. You're the Pipit's only hope!

To help focus your analysis, you may want to consider (some of!) the following questions:

- “Patterns of Life” analyses depend on recognizing repeating patterns of activities by individuals or groups. Describe some of the daily patterns of life you observe in the vehicles traveling through and within the park. Characterize the patterns by describing:
 - the kinds of vehicles
 - their spatial activities (where do they go?)
 - their temporal activities (when does the pattern happen?)
 - and provide a hypothesis of what the pattern represents (for example, if I drove to a coffee house every morning, but did not stay for long, you might hypothesize I’m getting coffee “to-go”).
- Some patterns may appear over longer periods of time (in this case, over multiple days). Describe a few patterns of life that occur over longer time periods by vehicles traveling through and within the park. You may want to use the same what-where-when breakdown described above to frame your description.

- Some activities may deviate from an established pattern, or are just difficult to explain from what you know of a situation. Describe any unusual patterns (either single day or multiple days) and highlight why you find them unusual.
- What are the top 3 patterns you discovered that you suspect could be most impactful to bird life in the preserve?
- Turning your attention to the sensor data, characterize the sensors' performance and operation. - Are they all working properly?
 - Can you detect any unexpected behaviors of the sensors through analyzing the readings they capture?
- What about the chemicals themselves?
 - Which chemicals are being detected by the sensor group?
 - What patterns of chemical releases do you see?
 - Which factories are responsible for which chemical releases?
 - For the factories you identified, describe any observed patterns of operation revealed in the data.

Again, as always: don't worry too much about getting the "right answer" - instead, focus on making sure that the evidence your present should support your hypotheses of what the roles and relationships are and the motivations of the person(s) involved.

Good luck!

Acknowledgements

This dataset was prepared by Pacific Northwest National Laboratory as part of the VAST Challenge 2017.

Deliverables

****Your visualization must include interaction and multiple views.**

You will submit **four** deliverables for this assignment:

1. Sketches of the visualization(s) you intended to create.
2. The write up you would present to your supervisor based on your analysis.
3. Code (and a README.txt with instructions for running the code) that generates the visualization(s) in your write up.
4. A reflection (the entire group can write a reflection together, or group members may write individual reflections) that includes:
 - How each group member contributed to the final submission
 - One obstacle you encountered and how you overcame it
 - If you were to do this assignment again, what you would do differently.

Submission

Submit your deliverable(s) in a .zip on Gradescope. If you worked on the reflection as a group, submit as a group (<https://guides.gradescope.com/hc/en-us/articles/21863861823373-Adding-Group-Members-to-a-Submission>), otherwise submit (all pieces) individually.

Rubric

The following matches the rubric you will see on Gradescope. **Note your sketches and reflection weight most heavily into your grade.**

	Missing / Not Complete (0)	Approaching (3)	Meets (5)	Exceeds (6)
Sketches	Not submitted or not readable.	Sketches are difficult to read and/or need more detail. They do not demonstrate appropriate visual mappings (as discussed in lecture), or clearly support the analysis objectives.	Sketches are difficult to read and/or need more detail. They include some appropriate visual mappings (as discussed in lecture), but not all visual mappings are appropriate. Some visualizations do not support the analysis objectives.	Sketches are detailed, clear, and easy to read. They demonstrate appropriate visual mappings (as discussed in lecture), and clearly support the analysis objectives.
Reflection	Not submitted or not readable.	Reflection does not fully address all three points listed above. And/or needs improvement in one or more of the following areas: formatting, grammar and spelling, clear, concise writing.	Reflection addresses all three points listed above, but answers are not thoughtful. It is well formatted, contains good grammar and spelling, and clear, concise writing.	Reflection thoughtfully addresses all three points listed above. It is well formatted, contains good grammar and spelling, and clear, concise writing.

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	Missing / Not Complete (0)	Approaching (1)	Meets (2)
Code	Not submitted.	Code does not run.	Code runs.
Write-up	Not submitted or not readable.	Write up addresses some but not all the objective(s) of the assignment. It could use improvement in one or more of the following areas: formatting, grammar and spelling, clear, concise writing. Hypotheses are unclear and/or not supported by visualizations shown.	Write up clearly addresses the objective(s) of the assignment. It is well formatted, contains good grammar and spelling, and clear, concise writing. Hypotheses are present and well supported by visualizations shown.