VAST Challenge 2017 Reviewer Guide: Mini-Challenge 1

This document provides information to support peer review of submissions to VAST Challenge 2017, Mini-Challenge 1. It covers background about the submission structure, the challenge problem, tasks and questions presented to participants, potential answers, and evidence found in the Challenge data supporting these answers. For a full description of the challenge problems and to access the data provided to the participants, please visit http://vacommunity.org/VAST+Challenge+2017.

Submissions

Participants are required to submit their entries on a standard answer form, along with a video explaining how visual analytics were used to help solve the challenges. Please consider both parts of the submission in your review. If you have difficulty reading the answer form or playing the video, please contact us at vast-challenge@ieee.org for assistance.

Scenario

Overview

Mistford is a mid-size city 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.

Mini-Challenge 1

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 the 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 Preserve 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, it may assist him in his investigations.

Ground Truth

There is a truck that visits a Ranger Station in a fairly remote part of the Preserve periodically throughout the dataset timeline that is illicitly dumping factory waste. It is registering in the data as a non-Ranger vehicle, visiting a Ranger-Stop. The dumping has a slight effect on the visits to the campground nearby.

Data

Contestants are provided with a description of how traffic through the Preserve appears and how traffic is measured through the sensors. They are given background information about the Preserve. They are given bitmapped files describing the gridded map against which the data is provided. Finally, the data is given in a .csv file.

The .csv data contains: a timestamp of when the vehicle passed a sensor location, a car-id, a car type (as described in the background information), and a sensor identification (also described in the background. The sensors are identified on the labeled bitmap).

Contestant Questions

1. *"Patterns of Life" analyses depend on recognizing repeating patterns of activities by individuals or groups. Describe up to six daily patterns of life by vehicles traveling through and within the park. Characterize the patterns by describing the kinds of vehicles participating, 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"). Please limit your answer to six images and 500 words.*

   There are several potentially interesting patterns contestants could identify. Here are some that they may include in their submissions:

   - "Pass-through" –vehicle drives through the Preserve without stopping at campsites or anywhere else along the way.
   - "Day-Campers" –vehicle enters, tours around, and exits the same day. Vehicle occupants may spend time at a campground but they are most likely picnicking.
   - Overnight Campers – vehicle spends one or more nights in the Preserve.
   - "Grand Tour" visitors – vehicle drives to many locations within the Preserve to look at as many of the interesting locations as possible.
   - Park Rangers – vehicles that leave from the Preserve Headquarters and perform checks at the ranger stops and at the campgrounds, where rangers have maintenance and security tasks to perform.

2. *Patterns of Life analyses may also depend on understanding what patterns appear over longer periods of time (in this case, over multiple days). Describe up to six patterns of life that occur over multiple days (including across the entire data set) by vehicles traveling through and within the park. Characterize the patterns by describing the kinds of vehicles participating, 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, many vehicles showing up at*

the same location each Saturday at the same time may suggest some activity occurring there each Saturday). Please limit your answer to six images and 500 words.

Again, there are several potentially interesting patterns contestants could identify. Here are some that they may include in their submissions.

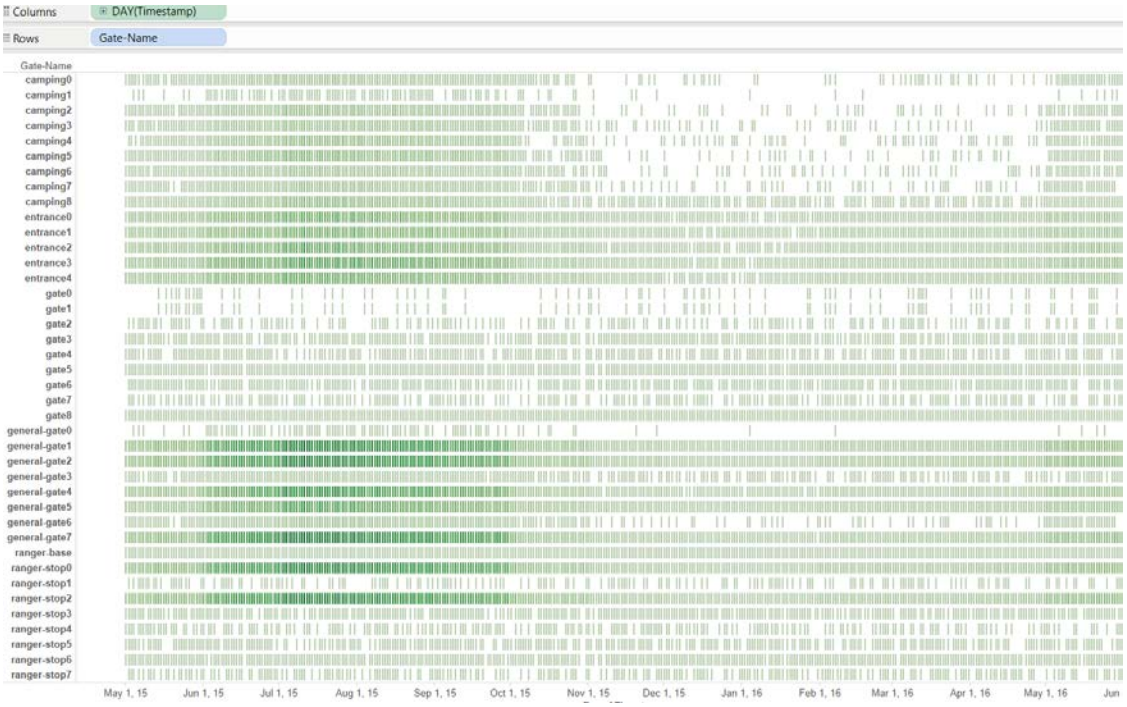

Figure 1

Figure 1 illustrates the overall use of the gates, camping areas, and so on for all of the vehicles entering and traveling through the Preserve across the dates of the dataset. Each tick mark represents a sensor reading. This view shows the seasonal increase during the summer months and the camping decrease over the winter months, among other trends.

Some vehicles repeatedly visit the Preserve over time (Figure 2).

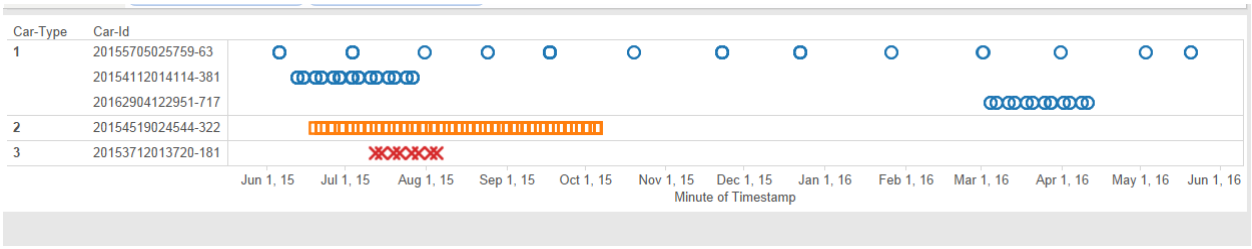

Figure 2

This data shows some rare case of vehicles retaining an ID across multiple days, as a special pass for the Preserve. On the first line, Vehicle -63 appears to never leave the Preserve, although it tends to move around quite a bit inside the area. Its pattern is as follows.

- 2015-06-05 5:44:00.000 – Camping6
- 28 days later – At Camping2
- 56 days later – At Camping3
- 80 days later – At Camping5
- 104 days later – At Camping1 but then moves to Camping5 same day
- 136 days later – At Camping2
- 170 days later – At Camping6
- 200 days later – At Camping3
- 235 days later – At Camping4
- 270 days later – At Camping0
- 300 days later – At Camping4
- 333 days later – At Camping2
- 350 days later – At Camping5

There are some other vehicles that have numerous camping stays over the years, as shown in Figure 3.

- Vehicle -381 has 14 encounters with Entrance 0 over the 2015 summertime.
- Vehicle -717 shows a similar pattern with 12 encounters with Entrance 3 in 2016.
- Vehicle -322 shows encounters entrances 32 times in 2015.
- Vehicle -181 encounters entrances 6 times in 2015.

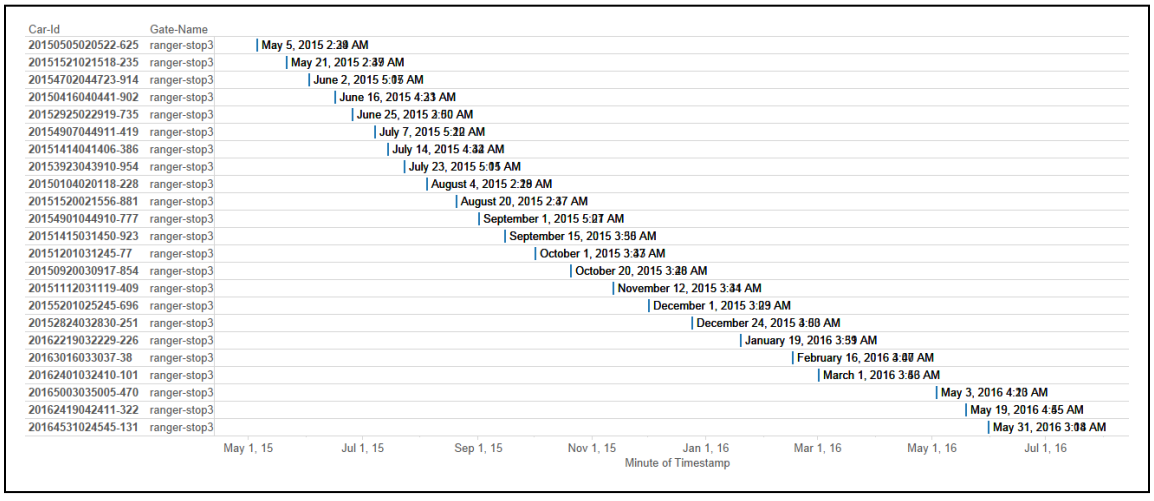

Figure 3

A truck (or perhaps a series of trucks) makes a regular visit to a ranger-stop multiple times throughout the data. Trucks are not allowed to visit ranger-stops, so this is also odd. The times of these visits are between 2AM and 5AM. This is a key pattern for the Grand Challenge, so it is something to note, if the team has a Grand Challenge entry.

3. *Unusual patterns may be patterns of activity that changes from an established pattern, or are just difficult to explain from what you know of a situation. Describe up to six unusual patterns (either single day or multiple days) and highlight why you find them unusual. Please limit your answer to six images and 500 words.*

   Many of the patterns listed in answer 2 could also be considered difficult to explain or differentiate from more normal patterns.

Car-Id	Car-Type	Gate-Name
20152810102803-808	1	ranger-stop1
20152810102819-458	1	ranger-stop1
20152810102828-459	1	ranger-stop1
20152910102928-970	1	ranger-stop1
20152910102959-782	1	ranger-stop1
20153010103017-871	1	ranger-stop1

   These vehicles should not be visiting ranger stop 1, but all were there at the same day and time (July 10, 2015). One could imagine a set of motorcyclists traveling around the protective gate to this ranger-stop.

   On certain days, some 4-axle trucks enter the Preserve, park somewhere along the streets but not in a campground, and then leave the next morning. This happens on Jun 27, 2015; Jul 4, 2015; Sep 1, 2015; Oct 22, 2015; Mar 23, 2016; and May 8, 2016.

   Two car exhibit faster than expected speeds in the preserve: vehicle Ids 20151320031302-558 and 20151320031302-782. Could there be drag racing in the Preserve?

4. *What are the top 3 patterns you discovered that you suspect could be most impactful to bird life in the nature preserve? (Provide a short text answer.)*

   This answer should be based in logical reasoning and provide a sound explanation. Please watch for mere repeats of patterns mentioned above without a supporting rationale.

   A key pattern to mention for this question would be the truck making multiple visits to the Ranger Stop.

Additional Reviewer Considerations

MC1 Questions and Approach:

- Was the submission able to sort out suspicious patterns (relevant to the scenario) from the false leads (which would not present a feasible threat to wildlife)? Were multiple variations in patterns identified?
- If there were hypotheses that remained unresolved, did the submission specify actions to be taken to resolve them?

MC1 Application of visual analytics:

- Did the team develop an innovative visual analytic tool? Alternatively, did they use an existing tool in an innovative way?
- Did visualizations enable the analysis process? Or did they merely illustrate conclusions? Did the submission rely more heavily on non-visual analytic approaches?
- Did their tool allow useful interactions?
- Did they use all the available data?
- Was the submission clear?