VAST Challenge 2018 Reviewer Guide: Mini-Challenge 1

This document provides information to support peer review of submissions to VAST Challenge 2018, 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+2018.

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@ieeevis.org for assistance.

Scenario

We have oriented the VAST Challenge 2018 around an invented environmental scenario. This year's scenario extends the one we created in 2017, and if you would like additional information about that work, please see the 2017 Challenge material at http://www.vacommunity.org/VAST+Challenge+2017 . The 2018 participants did not have to participate in the 2017 Challenge, nor would they have needed to extensively review that material to submit this year. The storyline may make a little more sense if some of the 2017 narrative was reviewed, however.

Overview

Mistford is a mid-size city located to the southwest of the Boonsong Lekagul Wildlife Preserve. The city has a small industrial area with four light-manufacturing endeavors. Mistford and the wildlife preserve are struggling with the possible endangerment of the Rose-Crested Blue Pipit, a locally loved bird. The bird's nesting pairs seem to have decreased alarmingly, prompting an investigation last year implicating Kasios Office Furniture, a Mistford manufacturing firm. Since the initial investigation, the situation has evolved: Kasios insists that they have done nothing wrong! They assert that grad student Mitch Vogel and his professors are mere media-seekers trying to draw attention away from their lackadaisical research. Kasios presents itself as an extremely eco-friendly organization. They have launched their own very public investigation into the issues raised last year and are reporting very different results! It's time to apply your visual analytics expertise to help illuminate the path to good science.

Mini-Challenge 1, "Cheep Shots?"

In 2017, the VAST Challenge results suggested that the Kasios Furniture manufacturing company (one of the firms located in Mistford) may have been a primary contributor to the apparent reduction of the number of nesting pairs of the Rose-Crested Blue Pipit, a favorite bird of Mistford residents and Boonsong Lekagul Nature Preserve visitors. Kasios supposedly used the banned substance

Methylosmolene in their manufacturing process. They surreptitiously dumped process waste in the northeast region of the Preserve (mini-challenge 1 from 2017) and Methylosmolene was detected in their smokestack emissions (mini-challenge 2 from 2017).

Kasios now claims that the analysis was flawed and biased. To combat these conclusions, Kasios has launched their own "investigation" into the Pipit situation, and they are now reporting that there are plenty of Rose-crested Blue Pipits happily living and nesting in the Preserve. To back up this claim, they have provided a set of Pipit bird calls, recently recorded across the Preserve, with locations of where they were recorded. Clearly, they claim, the Pipits are a thriving population, and Kasios will provide even more supporting evidence as their investigation proceeds.

In last year's Challenge, an ornithology grad student from Mistford College named Mitch Vogel discovered the plight of the Pipit and carried out an investigation. Normally, we would call on Mitch again to help validate Kasios' claim. Unfortunately, Mitch is working far from Mistford in a remote area without internet access for an extended time and cannot be easily reached!

The Pangera Ornithology Conservation Society, who sponsored Mitch last year, is at their wit's end at what to do about this turn of events. The townsfolk and Preserve rangers seem satisfied that the recordings back up Kasios' claims. Mistford College does not have another Pipit expert they can call upon for help. But, they do have a collection of bird calls from the Preserve that has been vetted by various ornithology groups as having accurate identifications. They have heard that new techniques from machine learning and visual analytics can be applied to situations like this. Perhaps, the calls could be classified and analyzed using these technologies, and reviewed when Mitch returns.

Ground Truth

Of primary interest is that the bird calls provided by Kasios are not all Pipits. There are some Pipit calls, but there are also bird calls from other birds known to be in the region and also some not found in the Preserve at all (at least from the data provided to the contestants). The geolocation analysis of the various birds in the Preserve show some mixed results. It does appear that the Pipits move away from the contamination area from last year, but it would be difficult to argue for a catastrophic reduction in Pipit numbers just from detected calls from this data. Other species also move locations over time, but researchers need to take care in identifying trends as definitive or not.

Contestants that do report trends in movements or in bird populations should be careful not to claim anything that might be the result of sampling practices or yearly variations.

Data

Four datasets were provided to the contestants. The first is a dataset containing the birdcalls collected by Mistford College. There is also metadata about the bird calls as to their type and quality. There is a simple bitmap of the Preserve that can be used when considering geolocations, and finally, there are the calls claimed by Kasios to be all Pipits from across the Preserve.

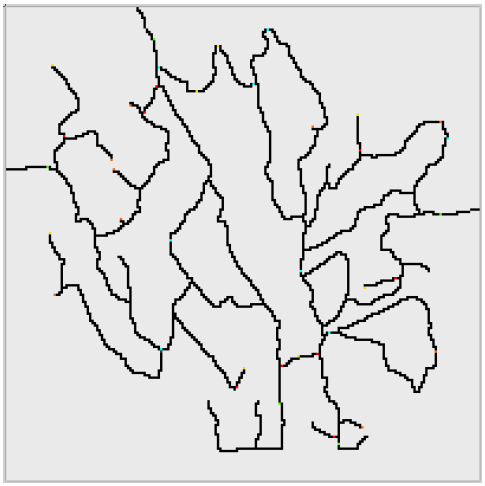
File "ALL BIRDS.zip" contain calls and songs from the known birds in the Boonsong Lekagul Wildlife Preserve. These files are MP3 format and are of varying lengths. The name contains an integer that refers to the metadata about the particular bird and audio file in file "AllBirdsv4.csv".

"AllBirdsv4.csv" is the metadata file for the bird sounds files. The File ID field is the index to the file names in the ALL BIRDS file collection. The English_name is the common English name for the particular

bird. The Vocalization_type is the kind of bird sound it is: a call, a song, or some other particular sound. The researchers did not provide additional descriptions of the differences between the vocalizations, so contestants had to manage this data as best they could. Quality is a score A, B, C, D, or E. These provide a qualitative measure of the quality of the bird sound, e.g., purity, lack of background noise, and so on. Again, the researchers did not provide additional descriptions of this field. Time and Date are for the capture of the sound. Finally, X and Y are the coordinates on the enclosed map of where the sound was recorded (see the map information below).

Example:
File ID,English_name,Vocalization_type,Quality,Time,Date,X,Y
402254,Rose-crested Blue Pipit,call,no score,13:30,2/8/2018,49,63
406171,Rose-crested Blue Pipit,call,A,7:48,6/7/2017,125,133
405901,Rose-crested Blue Pipit,call,A,12:00,2/8/2018,58,76

"Lekagul Roadways 2018" is a 200 x 200 pixel map of the Preserve, with general indications of roadways through the site. The coordinates from AllBirdsv4 should be considered from bottom left to top right, (0,0) to (199,199). The alleged dumping site for the Kasios waste products was centered around coordinates (148,159). Its extent has not been thoroughly studied.

 (The Map)

"Test Birds for Challenge" are the bird sounds Kasios claims as Pipits from across the Preserve. All of these recording were taken over the past couple of months. "Test Bird Locations" indicate where in the pixel map the bird sounds were recorded.

ID, X, Y
1,140,119
2,63,153

Contestant Questions

1. *Using the bird call collection and the included map of the Wildlife Preserve, characterize the patterns of all of the bird species in the Preserve over the time of the collection. Please assume we have a reasonable distribution of sensors and human collectors providing the recordings, so that the patterns are reasonably representative of the bird locations across the area. Do you detect any trends or anomalies in the patterns? Please limit your answer to 10 images and 1000 words.*

The birds seem to cluster in different locations around the Preserve.

- Riffraff – Scattered across the west
- Zipper – Cluster in the SW region
- Bombadil – Clustered in the northwest regions
- Jojo – Mostly in SW region
- Cootamum – Mostly in NW region
- Carries – Clustered in SE region
- Darkwing – Cluster in the NW and SW regions
- Skeet – Very few, but clustered in the North Central region
- Scarlet Pipit – Scattered
- Birchbeere – Mostly SW region, although some to the east
- Plover – Central and Southwest regions
- Snape – Clustered around the contaminated region (to the south). Apparently not affected by it.
- Pinkfinch – Scattered
- Tout – Scattered
- Qax – Clustered in W region
- Queenscoat – Western region
- The Pipit – Northeast, then moved south starting in 2015
- Jay – Northwest and Southwest clusters
- Trillian – North Central region

2. *Turn your attention to the set of bird calls supplied by Kasios. Does this set support the claim of Pipits being found across the Preserve? A machine learning approach using the bird call library may help your investigation. What is the role of visualization in your analysis of the Kasios bird calls? Please limit your answer to 10 images and 1000 words.*

The identification of the bird calls provided by Kasios is as follows:

Number	MC2 Bird Type
1	Rose-crested Blue Pipit
2	Bent-beak Riffraff
3	Bombadil
4	Bombadil
5	Undefined
6	Rose-crested Blue Pipit
7	Undefined
8	Lesser Birchbeere
9	Bent-beak Riffraff
10	Orange Pine Plover
11	Rose-crested Blue Pipit
12	Orange Pine Plover
13	Bent-beak Riffraff

14 Undefined
15 Rose-crested Blue Pipit

So clearly, Kasios is playing fast and loose with its claims about the poor Pipit.

3. Formulate a hypotheses concerning the state of the Rose Crested Blue Pipit. What are your primary pieces of evidence to support your assertion? What next steps should be taken in the investigation to either support or refute the Kasios claim that the Pipits are actually thriving across the Boonsong Lekagul Wildlife Preserve? Please limit your answer to 500 words.

   The Pipit was affected by something during recent years, but these studies do not do much to support the claims of contamination losses.

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?