

Assignment 2 - CS 458

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1 INTRODUCTION

1.1 Problem

Within the last decade, numerous works have surfaced that suggest climate change has detrimental effects on many aspects of the environment. One indicator of climate change in a geographic region is air quality, which is measured in parts per million of particulate matter. Generally, any particulate less than 2.5 microns in diameter meets the standards for dangerous particulates. An area that has a high concentration of dangerous particulates - a high number on the air quality index, which corresponds to bad air quality - can be both a symptom of or a catalyst for climate change. Identifying areas in which the air quality is markedly bad or decreasing over time can provide a way to focus climate change studies and environmental science efforts.

1.2 Motivation

Though there is much data available on the topic of air quality, very little of it is not simply presented in a table or list. Of the visualizations that do exist, many are simply colored maps that make darker or more saturated colors correspond to worse air qualities. Thus, it can be hard to see just which areas present a problem over time (signified by either a continual or sudden, severe decrease in air quality). A visualization that could clearly show both the magnitude of the air quality index and give an indication of how the quality was increasing or decreasing over time would be very useful to researchers in the field.

1.3 Potential Users

Our potential users include researchers and climate change/air quality scientists who study geographic regions in the western US. (We will focus our visualization on this region in order to make the scope appropriate for this project.) This visualization will ideally give scientists a quick overview of air quality trends in an area, which could indicate that the region requires more study or analysis in future work.

In addition, we should not forget that the general population might benefit from a good visualization of this data as well. For instance, perhaps a person who has asthma might view the data as part of a decision on whether or not to relocate to a certain state. A citizen activist might also be interested in this data in order to raise awareness in their region about the dangers of poor air quality. Multiple cases such as these exist and might be well served by this visualization.

1.4 General Approach

We will pull data from the American Health Rankings site by the United Health Foundation. We will use this to aggregate data from the air quality measures of 13 western region states over the past 10 years. We then intend to make a series of tree maps that visualize two dimensions of the data: the magnitude of the air pollution levels (represented by the size of the block; larger = worse) and the rate of change in air quality levels (represented by the color of the block;

green = decreasing/getting better, red = increasing/getting worse, more saturated = changing faster).

2 VISUALIZATION TASKS

- Our visualization aims to address the following questions:
 - How fast is the air quality increasing and decreasing in each state?
 - What states on the west coast are most at risk of bad air quality?
 - What trends in air quality can we identify in air quality on the west coast over the past 10 years?
 - Which states can be identified as danger zones for further research (air pollution that is quickly increasing)?

3 RELATED WORK

***** FILL IN WITH PREVIOUS WORK IN THE FIELD OF AIR POLLUTION RESEARCH AND VISUALIZATIONS *****

4 BACKGROUND

***** FILL IN WITH QUESTIONS WE'RE TRYING TO ANSWER *****

5 METHODS

5.1 Data Sources

**note: should probably just move all these links to citations and just summarize here **double note: also need to add eastern region states

We will be pulling data from the United Health Foundations website that catalogues data about each state by year. We will be studying 11 different states in the western US. We chose the western United States as the data set was relevant to our team's interest and to keep the project within a manageable scope.

- Washington: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/WA>
- Oregon: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/OR>
- California: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/CA>
- Alaska: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/AK>
- Hawaii: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/HI>
- Montana: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/MT>
- Wyoming: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/WY>
- Colorado: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/CO>
- New Mexico: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/NM>

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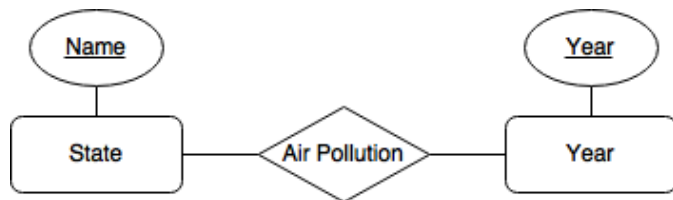


Fig. 1. An ER diagram showing the relationship between our 3 tables: the State table has a primary key "name" and the Year table has a primary key "year", both of which are used to query on the Air Pollution table

Sort by key: None

			Name
<input type="checkbox"/>			Alaska
<input type="checkbox"/>			Arizona
<input type="checkbox"/>			California
<input type="checkbox"/>			Colorado
<input type="checkbox"/>			Hawaii
<input type="checkbox"/>			Idaho
<input type="checkbox"/>			Montana
<input type="checkbox"/>			Nevada
<input type="checkbox"/>			New Mexico
<input type="checkbox"/>			Oregon
<input type="checkbox"/>			Utah
<input type="checkbox"/>			Washington
<input type="checkbox"/>			Wyoming

Fig. 2. A visualization of the contents of the "state" table, with the "name" column serving as the primary key and key to index the "air pollution" table.

- Idaho: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/ID>
- Utah: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/UT>
- Arizona: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/AZ>
- Nevada: <http://www.americashealthrankings.org/explore/2015-annual-report/measure/air/state/NV>

5.2 Data Organization

We set up our data in the form of 3 tables, 1 for the states, one for the years, and one for the air pollution. The entity-relationship diagram for these tables can be seen in Figure 1. The state name and year are used as keys to index the values stored within the air pollution table. This data was retrieved from the United Health Foundation's report on air pollution across the United States.

Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/> Air_Pollution	varchar(3)	latin1_swedish_ci		No			
<input type="checkbox"/> name	varchar(20)	latin1_swedish_ci		No			
<input type="checkbox"/> year	varchar(4)	latin1_swedish_ci		No			

Check All / Uncheck All With selected:

Fig. 3. The "air pollution" table's columns include "air pollution", "name", and "year" with "air pollution" containing all the values of the air pollution for each state and year, and "name" and "year" serving as keys.

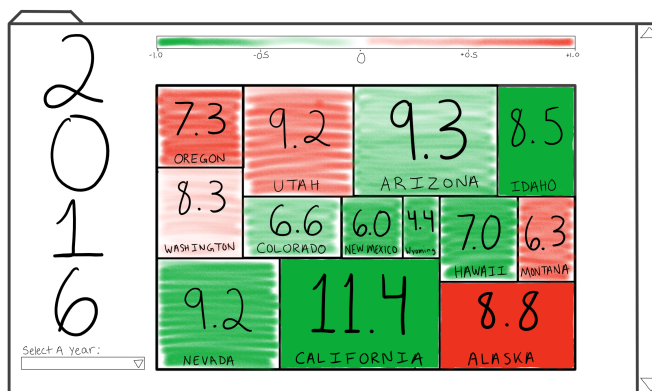


Fig. 4. A visualization using a tree map describing the levels of air pollution in the western region by block size.

5.3 Design of the Interface

We represent our data using an interactive tree map on a webpage. On the left hand side, users can select what year they want to view from 2007 to 2016, giving them the ability to see the changes in air pollution over the years. The size of the boxes on the tree map represent how much or how little air pollution there is in a state. The larger the box, the more air pollution exists. The color of the boxes represent the change in air pollution from the previous year to the one selected. The range is from -1 to +1, with -1 representing the highest positive change and the +1 representing the highest negative change in air pollution. The visualization is represented in Figure 4 .

5.4 Enhancement Over Existing Models

** Fill in with why our design is better/more helpful than other already existing models - should tie back to Related Works **
 ** Idea - whoever writes this section should also be in charge of related work **

6 IMPLEMENTATION

6.1 Data Organization

We created a relational database with 3 tables to store our data. The "state" table and "year" database are used to index values stored within the "air pollution" database, as seen in the ER diagram in Figure 1. We implemented the database on the ONID Database Server provided by Oregon State University. The contents of the "state" diagram can be seen in Figure 2 and the "air pollution" configuration can be found in Figure 3.

6.2 Website

** fill in with how we created website - might need Kat's help here **

6.3 Issues Encountered

** fill in with any issues encountered probably while creating visualization/website - again might need Kat's help here **

7 RESULTS

** intro to what we found **

7.1 Insights

** ??? I don't really know what kinds of insights we'd find but we will see I guess **

7.2 Data Set

** Yeah we already said this up in Methods so we could just reference that again I guess??? **

7.3 Dimensions Used

** Our visualization is both spatial (size of block) and temporal (can show change over time) so I guess talk about that/why we chose that visualization/if it worked or not **

7.4 Performance

** no idea here since we're not running any sort of tests on it or doing any user studies lmao **

7.5 Supplementary Materials

** alannah said: link to source code - so I guess here we could link to our github or something **

8 CONCLUSION AND FUTURE WORK

** some longform paragraph here about our model, why it's awesome, etc. how we would want to change it in the future **

9 ACKNOWLEDGEMENTS

** TO AMBER FROM AMBER: i think the original tex doc he supplied had some special thing for acknowledgements so copy paste** ** Here we just acknowledge the website we got data from (?) and Eugene and the TAs???? **