

HS19 Data Visualization Concepts

Exercise Session Multiple-view Data Visualization

Haiyan Yang

haiyan@ifi.uzh.ch

Visualization and MultiMedia Lab
Department of Informatics
University of Zürich



**University of
Zurich^{UZH}**

Exercise Sessions

Exercise Sessions

General Overview

- Fundamental concepts of data visualization
 - Digitization, Color and perception, Multivariate data analysis and visualization, Spatial and geospatial data visualization, Trees, Graphs and networks
- Programming exercises using Python
 - Python familiarity for this course will be needed
- Takes place on specific Thursdays throughout the semester
 - 5 exercise sessions are scheduled, with exercise point distribution: 2 - 3 - **2** - 5 - 3
 - A minimum points of 5 must be achieved out of exercise 1, 2 and 4
- Contact (for exercises): Kate Gadola <kate.gadola@uzh.ch>
 - Discussions and questions will be handled in OLAT forum (technical questions) and VisGuides (theoretical questions)
 - For meeting in person, arrange first an appointment
 - Please use the platforms as much as possible such that all the students can benefit from them

Exercise Sessions

Session Structure

- Introduction to new theoretical and technical aspects related to new assignment
 - Including examples, code structure, demos, sample results if necessary, etc.
- Announcement of new assignment (one in every session)
 - Discussion of requirements, solution hints, etc.
 - Clarification of point requirement.
- Discussion
 - Including comments on submissions, answering questions regarding the grading, etc.
 - Questions regarding the newly assigned exercise can be handled shortly after the lecture (15mins) or on the OLAT later on.
- Takes place in the second half of the lecture on Thursdays

Exercise Sessions

Assignment Guidelines

- Assignments related only to Data Visualization course.
- For every assignment there will be a .zip file in OLAT, including:
 - Exercise's announcement (**what to do** – *assignment requirements in details*)
 - Presentation of theoretical and technical aspects (**how to do** – *technical guidance*)
 - Data files and code skeleton (with needed libraries and hints) will be provided when necessary
 - **Attention!** Uploaded .zip file will **NOT** include additional material presented in lab session , such as demos, code snippets, solutions from previous sessions, etc.
- Grading will be ***incomplete, partial complete or complete***
 - Only a **complete** will result in the full awarded points
- Exercises **MUST** be submitted before each deadline, otherwise it will be a **FAIL**.

Exercise Sessions

Assignment Submission

- Project files must be zipped and the .zip archive has to be named:
dvc_exc4_MATRIKELNUMBER1_MATRIKELNUMBER2.zip
 - e.g. [dvc_exc4_01234567_01234568.zip](#)
- Follow exercise instructions and provide an answer sheet when necessary (e.g. a “readme.txt” file)
- Each group should submit the same zip file for every group member
- Use OLAT to submit files
 - [Deadlines are typically Wednesdays at 23:59](#)
- Use OLAT forum to ask questions about the technical questions from exercises

Instructions

Instructions

Dataset - eBird

GLOBAL UNIQUE IDENTIFIER	LAST EDITED DATE	TAXONOMIC ORDER	CATEGORY	COMMON NAME	SCIENTIFIC NAME	SUBSPECIES COMMON NAME	SUBSPECIES SCIENTIFIC NAME	OBSERVATION COUNT	E
URN:CornellLabOfOrnithology:EBIRD:OBS570779581	2018-01-24 14:41:34.0	19073	species	American Crow	Corvus brachyrhynchos			2	
URN:CornellLabOfOrnithology:EBIRD:OBS563756637	2018-01-03 22:54:39.0	19073	species	American Crow	Corvus brachyrhynchos			2	
URN:CornellLabOfOrnithology:EBIRD:OBS563333659	2018-01-03 22:54:39.0	19073	species	American Crow	Corvus brachyrhynchos			2	
URN:CornellLabOfOrnithology:EBIRD:OBS563148351	2018-01-09 21:46:14.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS566089279	2018-01-10 16:17:09.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS563757539	2018-01-09 21:46:14.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS573616617	2018-05-01 13:28:08.0	19073	species	American Crow	Corvus brachyrhynchos			3	
URN:CornellLabOfOrnithology:EBIRD:OBS570204089	2018-01-22 13:06:57.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS565036961	2018-01-07 13:31:06.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS565027324	2018-01-07 13:11:33.0	19073	species	American Crow	Corvus brachyrhynchos			3	
URN:CornellLabOfOrnithology:EBIRD:OBS563757396	2018-01-06 18:34:34.0	19073	species	American Crow	Corvus brachyrhynchos			3	
URN:CornellLabOfOrnithology:EBIRD:OBS563135906	2018-01-06 18:34:34.0	19073	species	American Crow	Corvus brachyrhynchos			3	
URN:CornellLabOfOrnithology:EBIRD:OBS570775035	2018-01-24 14:20:02.0	19073	species	American Crow	Corvus brachyrhynchos			4	
URN:CornellLabOfOrnithology:EBIRD:OBS570986312	2018-01-26 08:08:07.0	19073	species	American Crow	Corvus brachyrhynchos			4	
URN:CornellLabOfOrnithology:EBIRD:OBS566304678	2018-01-11 11:32:41.0	19073	species	American Crow	Corvus brachyrhynchos			2	
URN:CornellLabOfOrnithology:EBIRD:OBS571034544	2018-01-25 16:59:50.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS570975325	2018-01-25 16:59:50.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS563337268	2018-01-03 16:14:41.0	19073	species	American Crow	Corvus brachyrhynchos			4	
URN:CornellLabOfOrnithology:EBIRD:OBS566343995	2018-01-11 13:40:10.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS571610540	2018-01-27 15:19:02.0	19073	species	American Crow	Corvus brachyrhynchos			1	
URN:CornellLabOfOrnithology:EBIRD:OBS572716949	2018-01-30 11:29:50.0	31039	species	American Goldfinch	Spinus tristis			1	
URN:CornellLabOfOrnithology:EBIRD:OBS563085699	2018-01-02 09:30:05.0	31039	species	American Goldfinch	Spinus tristis			1	

■
■
■

Instructions

Task Overview

- Accomplish a multiple-view visualization
 - It is required to have **two views** for groups of two and **three views** for groups of three
 - each group member should complete one of the views by him/her-self
- Write a final report which includes but not limited to:
 - **specific question(s)** you want to address
 - **visual design rationale** regarding the question(s), i.e. how do you think this/these question(s) can be solved via which type of visual explanation
 - **explanation of the functions** of each view in detail, i.e. how each view helps for information exploration and/or data analysis
 - **findings/conclusion**
 - **task division**

Instructions

Grading Scheme

- Tasks

- **Task1: For each student**

- a. Implement one single-view visualization with necessary widgets (e.g. high-dimensional visualization, geo visualization, temporal visualization, network visualization, etc.) using eBird dataset;
 - b. Implement interaction via event handling (https://docs.bokeh.org/en/0.12.16/docs/user_guide/interaction/widgets.html).

- **Task2: For each group**

- c. Link all the two (or three) views together by linking and brushing:

You should be able to pick a point on the map, or brush an area on the map or a scatterplot, then the data should be filtered in all the views, and all the views should be updated.

- d. Write a group project report.

- Grading

- Points: {0, 3, 5}
 - 5: If both task1 and task2 are successfully completed.
 - 3: If only task1 is successfully completed.
 - 0: If you miss any required document/file.

Instructions

Do It Yourself

- Learn Python-Bokeh visualization techniques from online tutorials and documentation
- **Write proper comments for your code**
- **Report is required for each group**
- **Use forum to ask and/or answer questions**
- Make sure to produce desired results with Bug-Free code
- Submit it before deadline

Python-Bokeh Visualization

Python in Practice

Reading/Writing Files

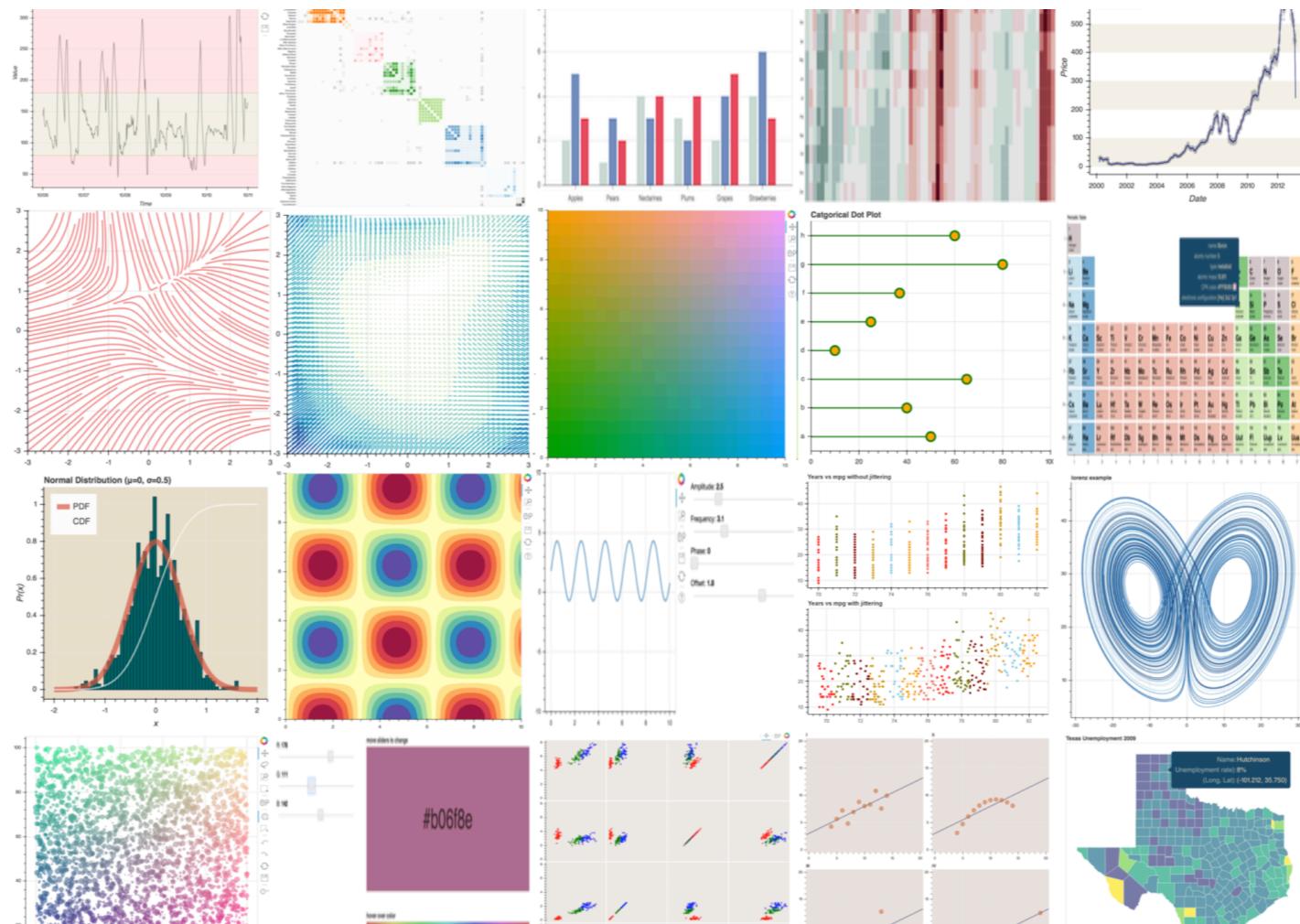
- In Python, basically you don't need to import any library to read and write files
- However, to handle dataset more efficiently, we recommend the IO Tools of Pandas, and use the absolute path for the input file(s)
 - In []:

```
import pandas as pd
__file__ = 'example.csv'
my_absolute_dirpath = os.path.abspath(os.path.dirname(__file__))
data = pd.read_csv(os.path.join(my_absolute_dirpath, __file__))
```
- `pandas.read_csv('filename', sep=',', lineterminator=',', error_bad_lines=False)`
 - return: a dataframe which represents the data as a structured table with labeled axes

Python-Bokeh Visualization

More Bokeh Examples

- More Bokeh visualization examples can be found in:
 - <https://docs.bokeh.org/en/latest/docs/gallery.html>



Python-Bokeh Visualization

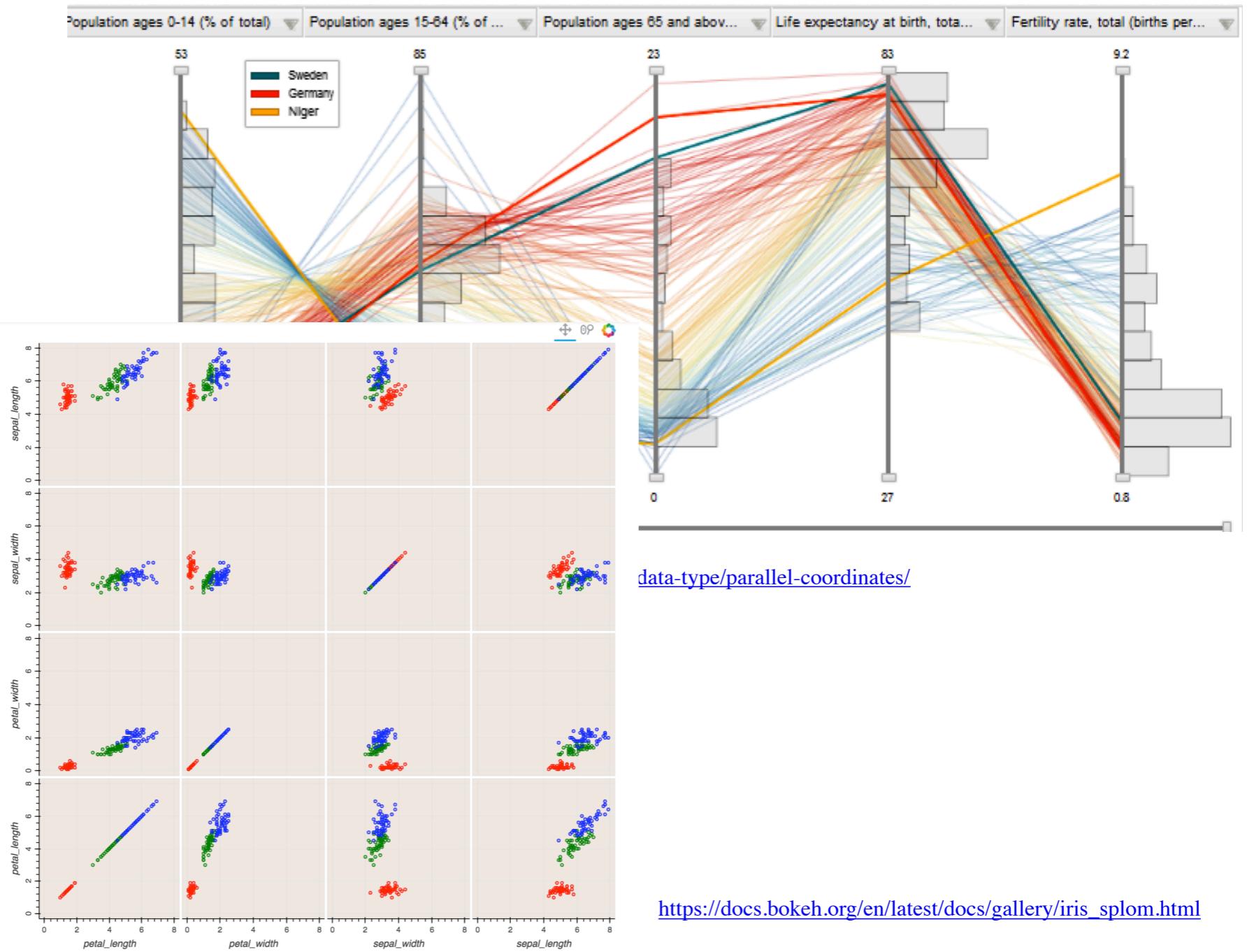
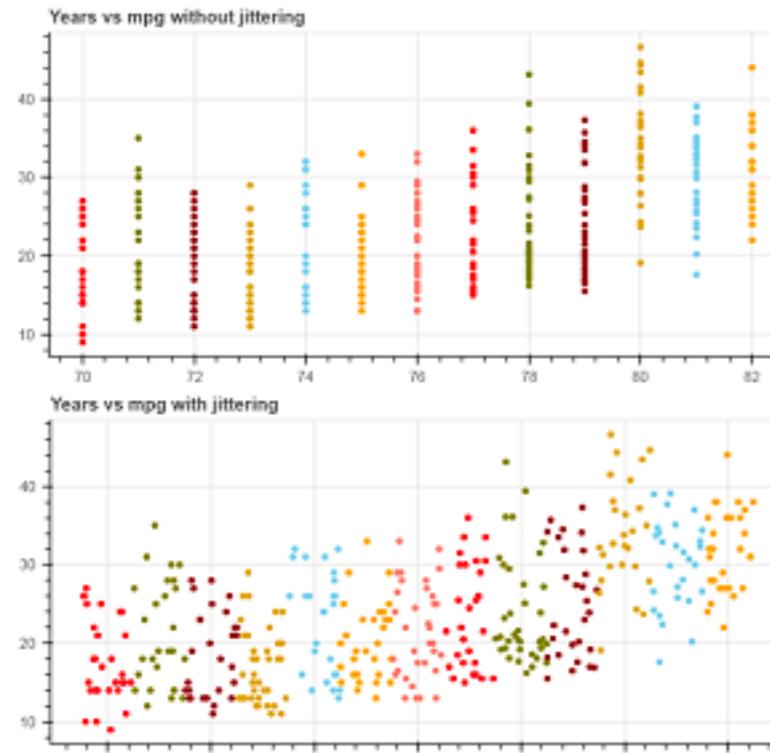
More Tutorials

- Interactive Data Visualization in Python With Bokeh (<https://realpython.com/python-data-visualization-bokeh/>)
 - An online advanced tutorial
- Bokeh server (https://bokeh.pydata.org/en/latest/docs/user_guide/server.html)
 - The Bokeh server usage with some examples
- Bokeh documentation (https://bokeh.pydata.org/en/latest/docs/user_guide.html#userguide)
 - The official Bokeh documentation
 - With nice examples

Visualization Examples

Visualization Examples

High-dimensional Visualization

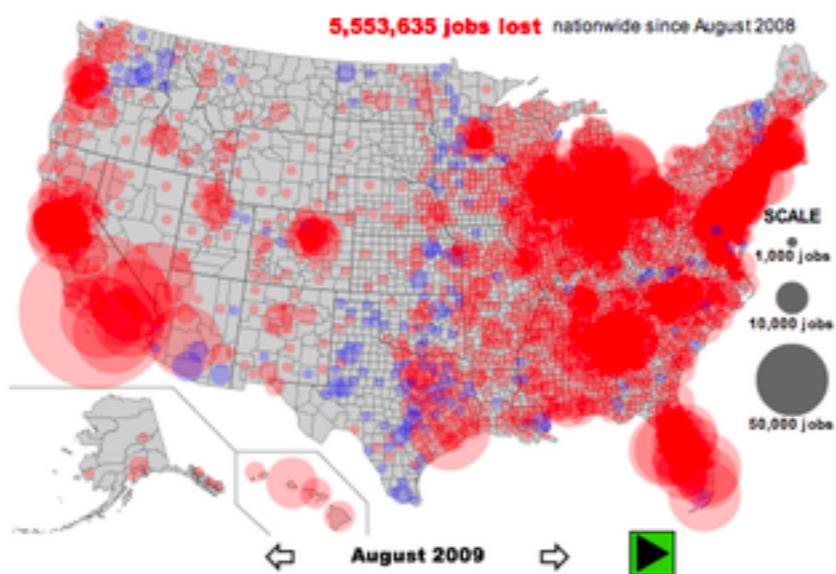


[data-type/parallel-coordinates/](#)

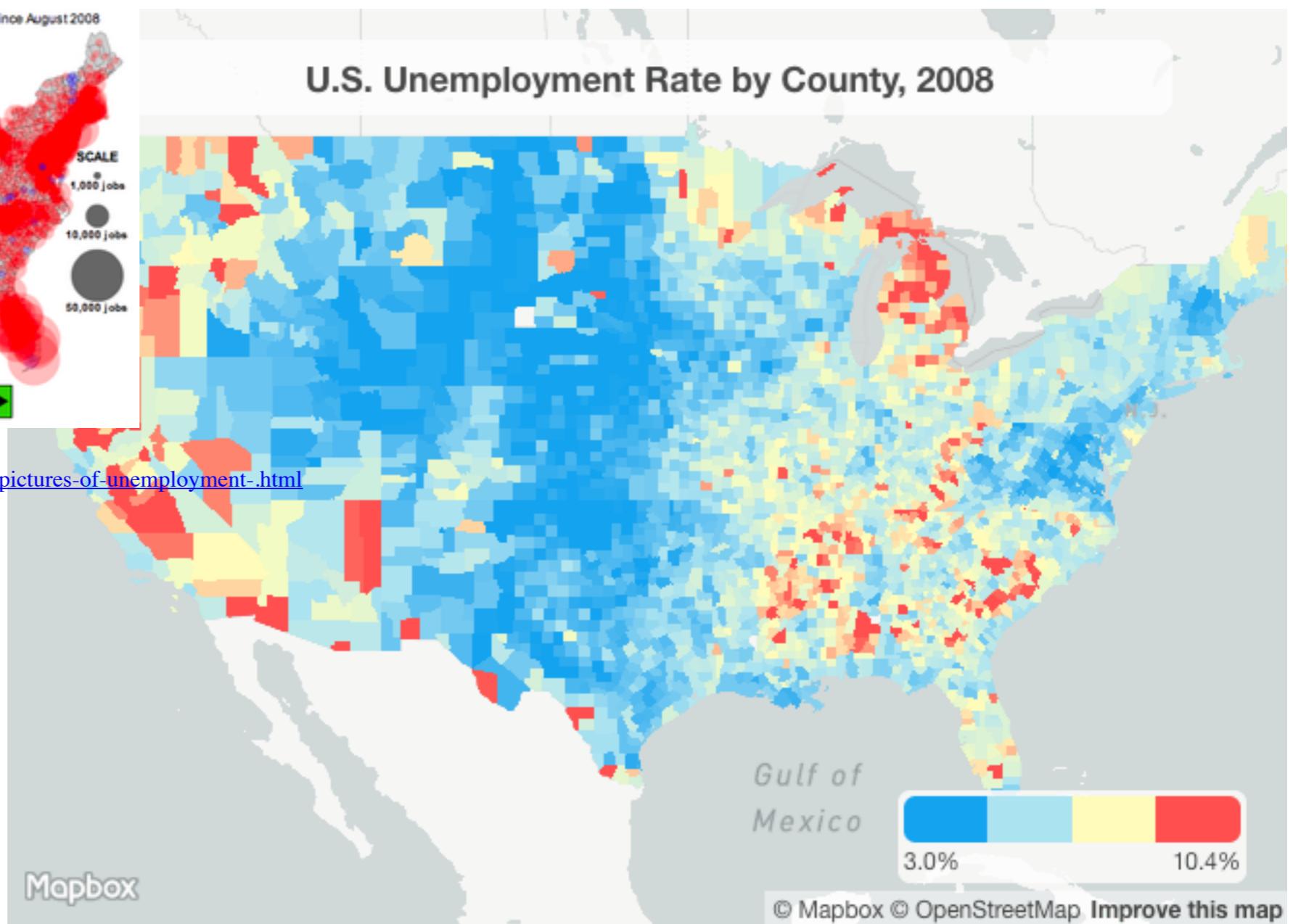
https://docs.bokeh.org/en/latest/docs/gallery/iris_splom.html

Visualization Examples

Geo Visualization



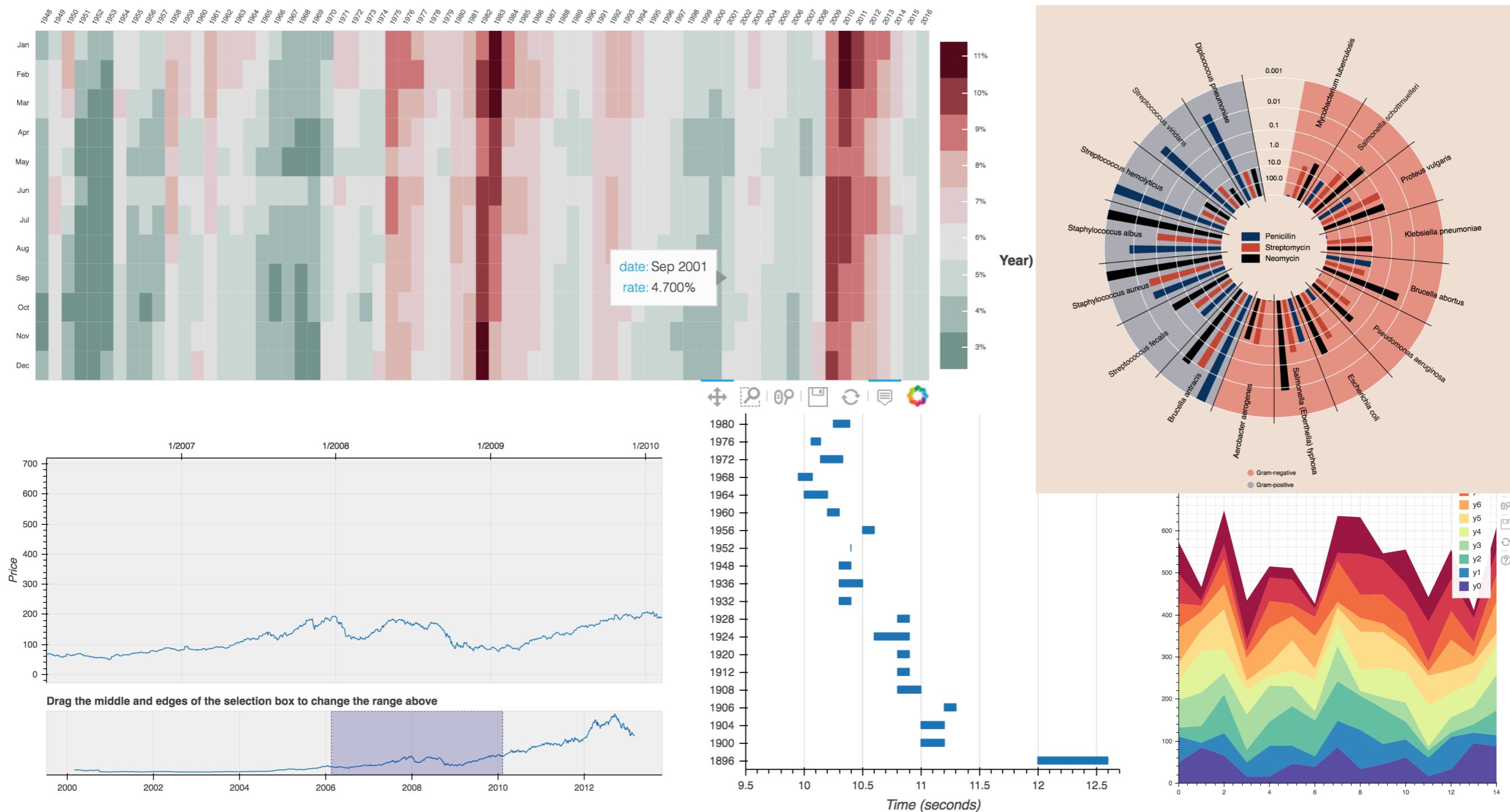
https://junkcharts.typepad.com/junk_charts/2010/08/different-pictures-of-unemployment-.html



<https://blog.mapbox.com/7-data-visualizations-techniques-for-location-544c558cc960>

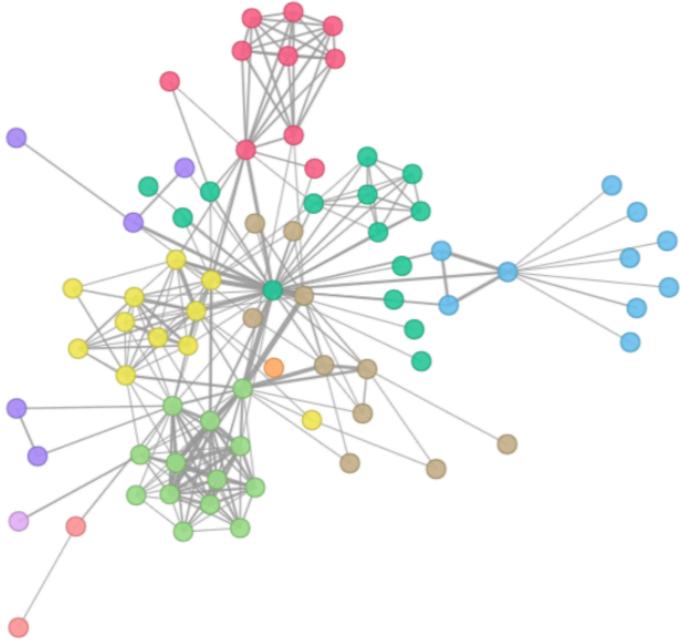
Visualization Examples

Temporal Visualization

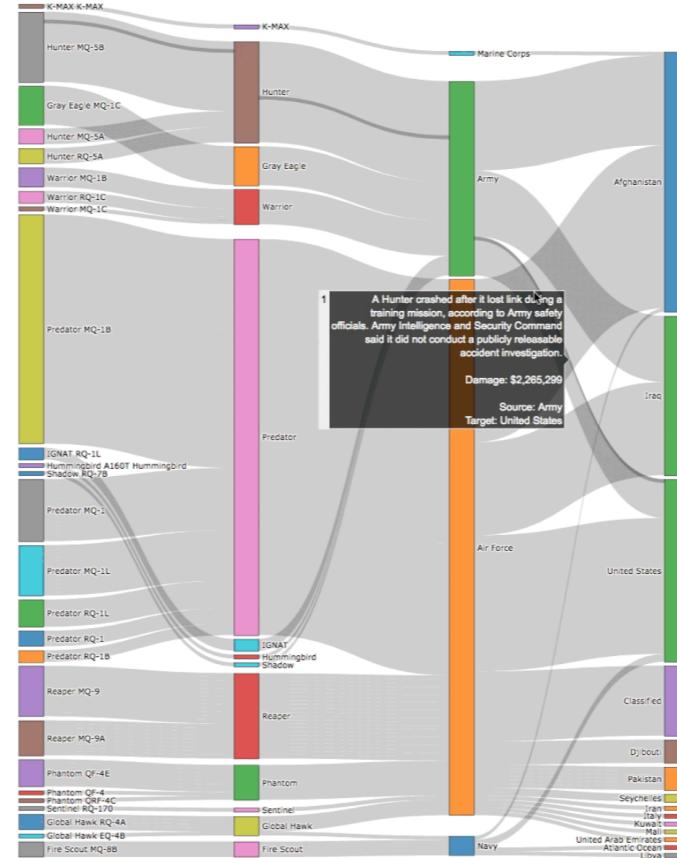


Visualization Examples

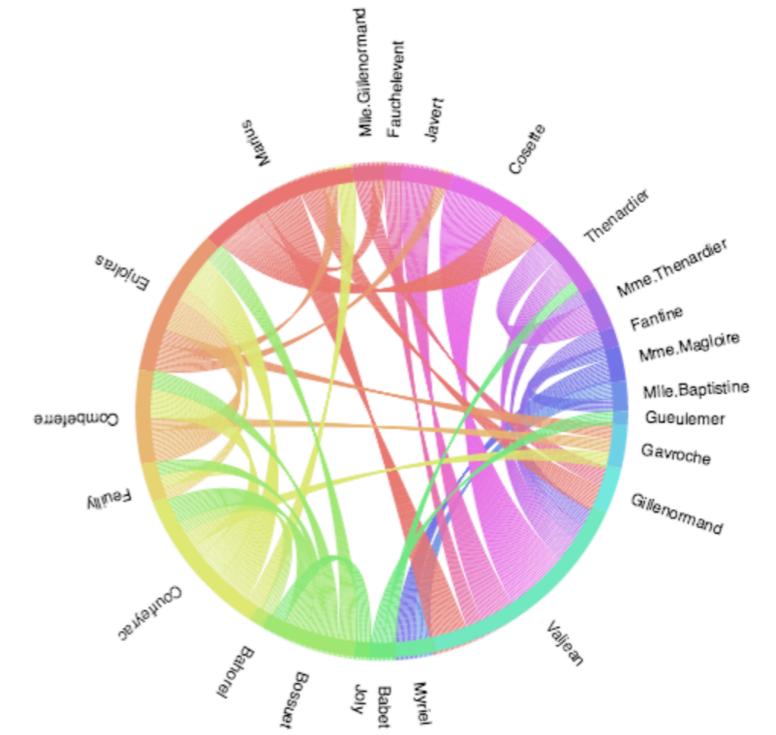
Network Visualization



<https://mesostars.wordpress.com/2017/03/15/visualization-in-zeppelin-with-lightr/>



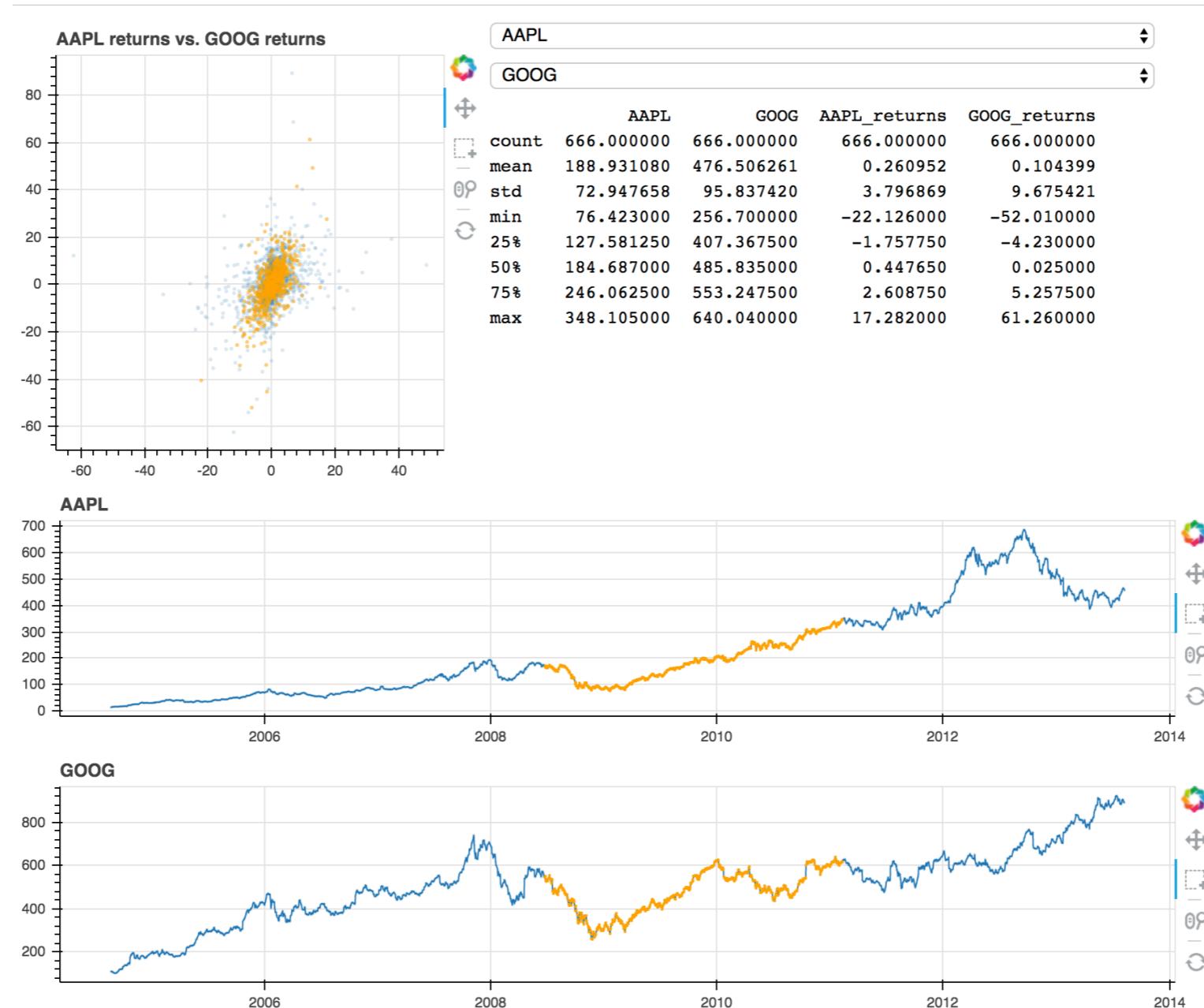
<https://medium.com/plotly/4-interactive-sankey-diagram-made-in-python-3057b9ee8616>



<https://python-graph-gallery.com/231-chord-diagram-with-bokeh/>

Visualization Examples

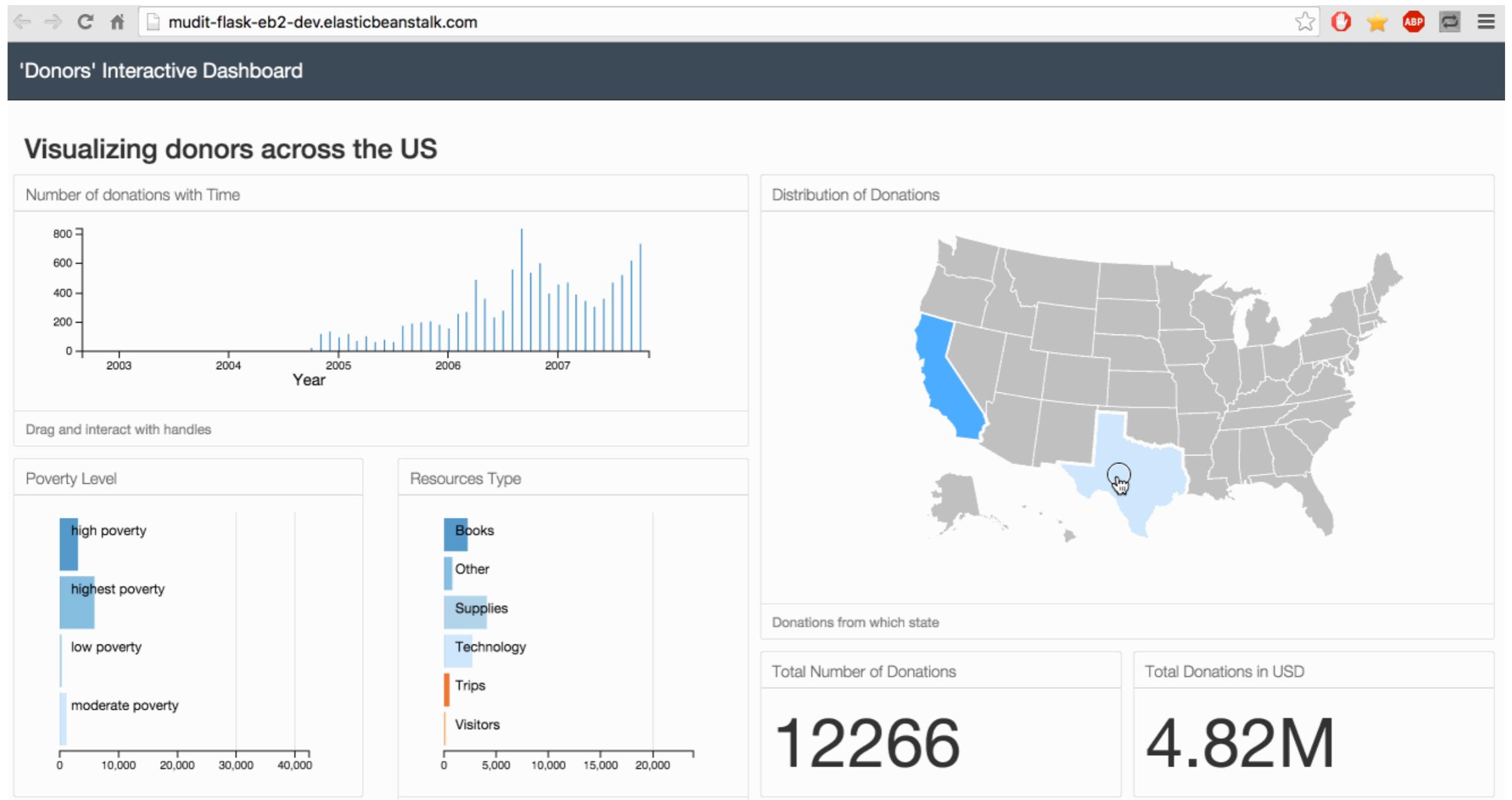
Multiple-view Visualization



<https://demo.bokeh.org/stocks>

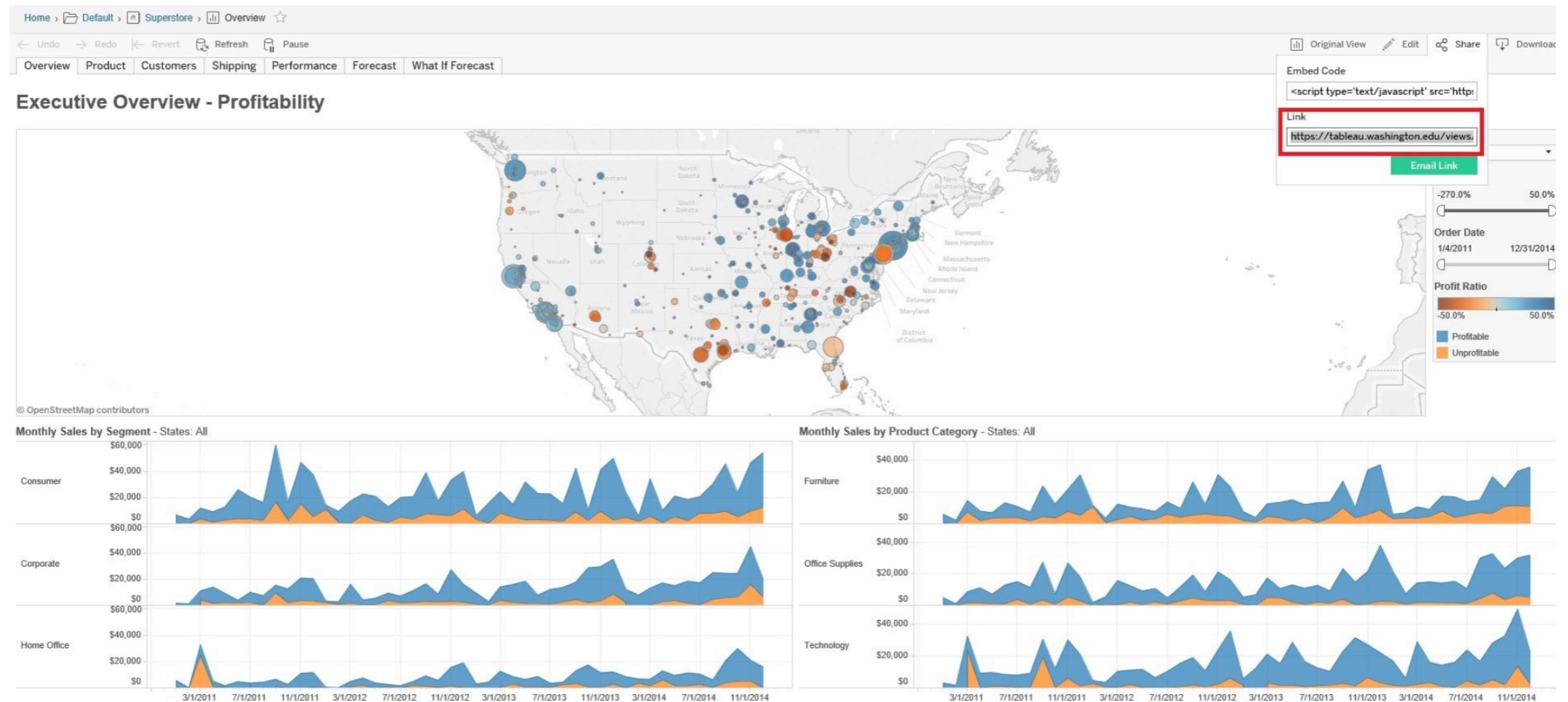
Visualization Examples

Multiple-view Visualization



Visualization Examples

Multiple-view Visualization



<http://itconnect.uw.edu/work/data/use-data/visualization-menu/publish-visualizations/embedding-tableau-in-websites/>

Instructions

Task Overview

- Accomplish a multiple-view visualization
 - It is required to have **two views** for groups of two and **three views** for groups of three
 - each group member should complete one of the views by him/her-self
 - It's possible that each group member gets different grades, and the evaluation will base on the overall degree of completion as well as each single view's functionality.
- Write a final report which includes but not limited to:
 - **specific question(s)** you want to address
 - **visual design rationale** regarding the question(s), i.e. how do you think this/these question(s) can be solved via which type of visual explanation
 - **explanation of the functions** of each view in detail, i.e. how each view helps for information exploration and/or data analysis
 - **findings/conclusion**
 - **task division**

Instructions

Grading Scheme

- Tasks
 - **Task1: For each student**
 - a. Implement one single-view visualization with necessary widgets (e.g. high-dimensional visualization, geo visualization, temporal visualization, network visualization, etc.) using eBird dataset;
 - b. Implement interaction via event handling (https://docs.bokeh.org/en/0.12.16/docs/user_guide/interaction/widgets.html).
 - **Task2: For each group**
 - c. Link all the two (or three) views together by linking and brushing:
You should be able to pick a point on the map, or brush an area on the map or a scatterplot, then the data should be filtered in all the views, and all the views should be updated.
 - d. Write a group project report.
- Grading
 - Points: {0, 3, 5}
 - 5: If both task1 and task2 are successfully completed.
 - 3: If only task1 is successfully completed.
 - 0: If you miss any required document/file.

Instructions

Grading Exceptions

- What if you can't join a group or just want to work alone?
 - Finish a single-view visualization (with widgets) + report -> 3 points
 - Finish a two-view visualization + linking and bushing + report -> 5 points
- What if one of the group members fail to complete his/her single view?
 - She/he can only get **2 points** if the whole project is still somehow completed.
- What if all the group members fail to complete their own view?
 - it means a FAIL of your project -> 0 points for every member

Instructions

Suggested Role Division

- For groups of three
 - **visual designer:** responsible for leading the general visual design for the whole project and finding the best solution to make all the views work coordinately.
 - **coder:** responsible for the final implementation of linking views (**attention:** each group member should still be able to finish one of the views by him/her-self).
 - **writer:** responsible for the writing of the final report (one-page report)
- For groups of two
 - **visual designer and writer:** responsible for leading the general visual design for the whole project and finding the best solution to make all the views work coordinately, as well as the writing of the final report
 - **coder:** responsible for the final implementation of linking views (**attention:** each group member should still be able to finish one of the views by him/her-self).

Thank you