Visualization of data

- What is it good for?
- What is its function?

helps understand the significance of data by placing it in a visual context
allows us visual access to huge amounts of data in easily digestible visuals
So that we can do something with the data (predict, apply, fix, change, enhance, identify, clarify, etc.)
Charles Minard. Napoleon’s March in Russia 1812
Charles Minard. 
Napoleon's March in Russia 1812
Charles Minard. Napoleon’s March in Russia 1812
Charles Minard. Napoleon’s March in Russia 1812
Charles Minard. Napoleon’s March in Russia 1812
Charles Minard. Napoleon’s March in Russia 1812

1. Captures multivariate complexity (size of army, location, direction, temperature, and time).
2. Forces visual comparisons where the upper lighter band showing the large French army marching to Moscow vs. the narrow dark band showing the much smaller French army retreating.
3. Shows partial causality (the temperature line chart above). However, there are more reasons than temperature why Napoleon lost the battle.
4. Illustrates high quality content comprised of complete and accurate data, presented to support Minard’s argument against war.
5. Integrates text and graphic into a coherent whole.
6. Use the smallest effective difference. Avoid bold colors, heavy lines, distracting labels and scales.
7. Place comparisons adjacent to each other versus sequentially. Viewers of the map often forget data values if they have to switch from page to page.
Data visualization. U.S. Gun Murders 2010-2013

U.S. GUN MURDERS IN 2010

9,595
PEOPLE KILLED

410,919
STOLEN YEARS

1,083 | 11%
CHILDREN

8,512 | 89%
ADULTS

What This Data Reveals

69% OF ALL MURDERS WERE WITH A HANDGUN
According to the FBI’s Unified Crimes
Reports (UCR) data, 69% of all
homicides were committed with a handgun.

58% OF THOSE KILLED ARE 30 OR YOUNGER
According to the FBI’s UCR data, 5,597
of the 9,595 killed were 30 years old or
younger, which is 58% of those killed.
Data visualization. Shanghai Metro Flow by Till Nagel
Data visualization. Wind map by

Nov. 19, 2017
10:37 pm EST
(time of forecast download)

top speed: 53.9 mph
average: 9.7 mph

1 mph
3 mph
5 mph
10 mph
15 mph
30 mph
Data visualization. US Thanksgiving on Google Flights 2015
Computer Science

Data visualization.

A Stranger to words by Meng Chiang
Data visualization. Englewood Social Service
Data visualization. Gun deaths in U.S.
Data-Driven Documents (D3)

A JavaScript library

Web visualizations

Version 4 modular – 2016

DOM

HTML5, JavaScript, CSS

SVG - Scalable Vector Graphics
Document Object Model (DOM)
Web browser renders a web page by rendering the DOM
Components of a web program:
• HTML – structure of the DOM
• CSS – styling the DOM
• JS – interacting with + dynamically updating the DOM
• JSON – loading in data used by JS to update the DOM

Special DOM/ HTML5 elements:
SVG  - Scalable Vector Graphics / Canvas
```javascript
var sel = svg.selectAll("rect")
  .data(dataArray)
  .enter().append("rect")
  .attr("height", function(d){
    return d*15;
  })
  .attr("width", 50)
  .attr("fill", "pink")
  .attr("x", function(d,i){
    return i*60;
  });
  .attr("y", function (d,i) {
    return 300 - (d*15);
  });
```

**SVG shape library**

dataArray
d 5 1 1 1 8
i 0 1 2

**Inputs**

**Outputs**
data point [5, 11, 18]

var dataArray = [5, 11, 18];

index 0, 1, 2...

SVG elements – circle, line, polyline, rectangle, ellipse, polygon, paths
How to work

Atom text editor

How to debug:
- Firefox Developer Edition (former Firebug) / browser’s console
- Using JSBin (http://jsbin.com/cogagi/1/edit?html,js,console)
D3 built-in data handlers

D3 data handlers allow to pull data in from a database or file.

- **HTML**: hyper text markup language
- **CSV**: comma-separated values
- **TSV**: tab-separated values
- **DSV**: data source view
- **XML**: eXtensible markup language
- **JSON**: JavaScript object notation

Text files
Custom
## D3 data vis

- **D3.html**
- **prices.js**
- **prices.csv**

### CSV Data

<table>
<thead>
<tr>
<th>month</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/03</td>
<td>$54</td>
</tr>
<tr>
<td>2/1/03</td>
<td>$54</td>
</tr>
<tr>
<td>3/1/03</td>
<td>$50</td>
</tr>
<tr>
<td>4/1/03</td>
<td>$52</td>
</tr>
<tr>
<td>5/1/03</td>
<td>$53</td>
</tr>
<tr>
<td>6/1/03</td>
<td>$49</td>
</tr>
<tr>
<td>7/1/03</td>
<td>$51</td>
</tr>
<tr>
<td>8/1/03</td>
<td>$52</td>
</tr>
<tr>
<td>9/1/03</td>
<td>$50</td>
</tr>
<tr>
<td>10/1/03</td>
<td>$52</td>
</tr>
<tr>
<td>11/1/03</td>
<td>$50</td>
</tr>
<tr>
<td>12/1/03</td>
<td>$52</td>
</tr>
<tr>
<td>1/1/04</td>
<td>$59</td>
</tr>
<tr>
<td>2/1/04</td>
<td>$60</td>
</tr>
<tr>
<td>3/1/04</td>
<td>$61</td>
</tr>
<tr>
<td>4/1/04</td>
<td>$59</td>
</tr>
<tr>
<td>5/1/04</td>
<td>$60</td>
</tr>
<tr>
<td>6/1/04</td>
<td>$64</td>
</tr>
<tr>
<td>7/1/04</td>
<td>$58</td>
</tr>
</tbody>
</table>
d3.csv("prices.csv")
    .get(function(error, data){
        console.log(data);
    })
var parseDate = d3.timeParse("%m/%d/%Y");

d3.csv("prices.csv")
  .row(function(d) { return {month: parseDate(d.month), price: Number(d.price.trim().slice(1))}; })
  .get(function(error, data) {
    console.log(data);
  });

console.log(data);
```javascript
var parseDate = d3.timeParse("%m/%d/%Y");

d3.csv("prices.csv")
  .row(function(d){ return {month: parseDate(d.month), price:Number(d.price.trim().slice(1))}; })
  .get(function(error, data){

  var height= 300;
  var width = 500;
```

var max = d3.max(data, function(d) {return d.price; });
var minDate = d3.min (data, function(d) {return d.month;});
var maxDate = d3.max (data, function(d) {return d.month;});

var y = d3.scaleLinear()
    .domain([0, max])
    .range([height, 0]);

var x = d3.scaleTime()
    .domain([minDate, maxDate])
    .range([0, width]);
```javascript
var yAxis = d3.axisLeft(y);
var xAxis = d3.axisBottom(x);

var svg = d3.select("body").append("svg").attr("height", "100%").attr("width", "100%")

var margin = {left:50,right:50,top:40,bottom:0};
var chartGroup = svg.append("g")
    .attr("transform", "translate(\"+margin.left+\", \"+margin.top+\")");
```
```javascript
var line = d3.line()
  .x(function(d){ return x(d.month); })
  .y(function(d){ return y(d.price); });

chartGroup.append("path").attr("d", line(data));
chartGroup.append("g").attr("class", "x axis")
  .attr("transform", "translate(0, "+height+")").call(xAxis);
chartGroup.append("g").attr("class", "y axis").call(yAxis);
```
```javascript
var line = d3.line()
    .x(function(d) { return x(d.month); })
    .y(function(d) { return y(d.price); });
chartGroup.append("path").attr("d", line(data));
chartGroup.append("g").attr("class", "x axis")
    .attr("transform", "translate(0, \"\+height\")")
    .call(xAxis);
chartGroup.append("g").attr("class", "y axis")
    .call(yAxis);
```

prices.js
Datasets

Welcome!

Where are TV shows and movies being filmed? How clean is my favorite restaurant? City of Chicago’s Open Data Portal provide information about your community. Browse and search for information about your neighborhood and the city. A bit confused? Take a look at a brief video about how to use the portal.
Welcome to Reddit, the front page of the internet.

and subscribe to one of thousands of communities.

META  Monthly discussion thread | November, 2017

Submitted 17 days ago by AutoModerator - announcement
4 comments share save hide report

question  Anyone pull news related tweets from the twitter streaming api?? What kind of volume can I expect?

Submitted an hour ago by ebolanurse

comment share save hide report

dataset  [Dataset] Cryptocurrency Historical Data (Top 50)

Submitted an hour ago by incoherent
## Datasets

### UCI Machine Learning Repository

**Center for Machine Learning and Intelligent Systems**

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Types</th>
<th>Default Task</th>
<th>Attribute Types</th>
<th># Instances</th>
<th># Attributes</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abalone</td>
<td>Multivariate</td>
<td>Classification</td>
<td>Categorical, Integer, Real</td>
<td>4177</td>
<td>8</td>
<td>1995</td>
</tr>
<tr>
<td>Adult</td>
<td>Multivariate</td>
<td>Classification</td>
<td>Categorical, Integer</td>
<td>48842</td>
<td>14</td>
<td>1996</td>
</tr>
<tr>
<td>Annealing</td>
<td>Multivariate</td>
<td>Classification</td>
<td>Categorical, Integer, Real</td>
<td>798</td>
<td>38</td>
<td>1996</td>
</tr>
<tr>
<td>Anonymous Microsoft Web Data</td>
<td></td>
<td>Recommender-Systems</td>
<td>Categorical</td>
<td>37711</td>
<td>294</td>
<td>1998</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Multivariate</td>
<td>Classification</td>
<td>Categorical, Integer, Real</td>
<td>452</td>
<td>279</td>
<td>1998</td>
</tr>
<tr>
<td>Artificial Characters</td>
<td>Multivariate</td>
<td>Classification</td>
<td>Categorical</td>
<td>6000</td>
<td>7</td>
<td>1992</td>
</tr>
</tbody>
</table>

**Browse Through:** 394 Data Sets

### Default Task
- Classification (289)
- Regression (74)
- Clustering (57)
- Other (54)

### Attribute Type
- Categorical (37)
- Numerical (244)
- Mixed (55)

### Data Type
- Multivariate (306)
- Univariate (16)
- Sequential (40)
- Time-Series (73)
- Text (37)
- Domain-Theor (22)
- Other (21)

### Area
- Life Sciences (89)
- Physical Sciences (47)
- CS / Engineering (129)
- Social Sciences (23)
- Business (25)
- Game (25)
What is WordNet?

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the creators of WordNet and do not necessarily reflect the views of any funding agency or Princeton University.

When writing a paper or producing a software application, tool, or interface based on WordNet, it is necessary to properly cite the source. Citation figures are critical to WordNet funding.

Due to funding and staffing issues, we are no longer able to accept comment and suggestions.

We get numerous questions regarding topics that are addressed on our FAQ page. If you have a problem or...
Use D3 to transform the data into an SVG visualization that responds when data is updated. It uses a functional style of programming, which can be a bit confusing, but makes it easy to compose data transformations. The Chicago streets data is from the Chicago Data Portal.
Use D3 to transform the data into an SVG visualization

visualization responds when data is updated

uses a functional style of programming, which can be a bit confusing, but makes it easy to compose data transformations
D3 exercise

Explore https://bl.ocks.org

Choose a block – replace with a small subset of your data
D3 exercise

Look over the code from class

a) change the circles to different shapes

b) map some of the different data fields to different visual encodings (you could choose color, stroke, opacity, or size, etc).

You can also add new data elements to the JSON code (by cloning the jsbin.com/zozukof.json file or including it directly in your code).

Feel free to collaborate with or get help from others.
SpaceTime 2018
SIGGRAPH 2018 Vancouver
https://s2018.siggraph.org/

Student Competition and Exhibition
At SIGGRAPH 2018 theme - “Generations.”

Over the years, a long legacy of scientists, thinkers, artists, engineers, and visionaries have made SIGGRAPH the best place to experience the bleeding edge of computer animation and interactive techniques. I invite you to continue inspiring the next generation of dreamers and thinkers and submit your best work today.

The theme for SpaceTime 2018 is: “Generations” in keeping with the theme of 2018 conference. We are looking for posters that depict this idea.
Submission Requirements:

jpg file:
- Image size is A3 (11.7" x 16.5"--297 x 420 mm) 300-ppi RGB, JPG format.
- Name your file: firstname_lastname_s2018.jpg

Word document named firstname_lastname_s2018.docx with:
- Student’s name: First Name, Last Name
- Title of Work
- Student’s email address
- School and Department/Program name with City and Country
- Professor's name
- A brief artist’s statement (maximum 250 words) and a brief technical statement (maximum 150 words)
You should not use any copyrighted imagery for your poster. You may use images released under a Creative Commons license that allows for derivative works, or images that are in the public domain.

Submission Methods:
Email attachments: one image, one statement sent to anna.ursyn [at] unco.edu, Cc: aursyn [at] gmail.com. (Please use both addresses to avoid getting lost in SPAM)
Project 2 - SpaceTime2018

SpaceTime2017 Gallery
https://education.siggraph.org/spacetime/gallery/2017

SpaceTime2016 Gallery

SpaceTime2015 Gallery
https://education.siggraph.org/spacetime/gallery/2015