High-Dimensional Data Visualization Exploration

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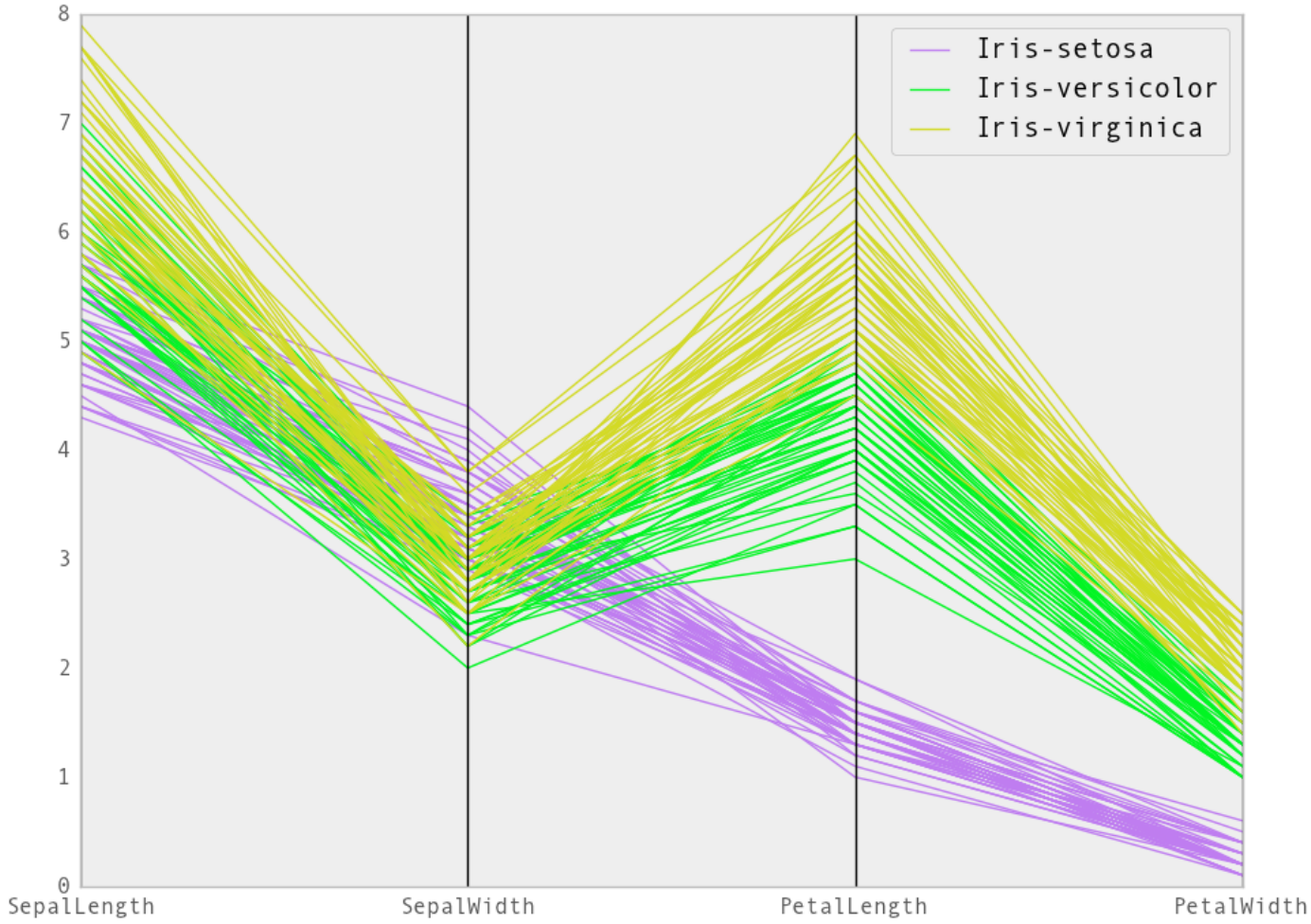
Definition

When we talk of high-dimensional data in the context of visualization we are concerned with visualizing multivariate datasets. This is difficult because we typically think visually in terms of 3 dimensions. When dealing with very high dimensionality we are forced to used algorithms designed to flatten the dimensional space into something more manageable and projectable to 2/3D.

Most Related To Our Project

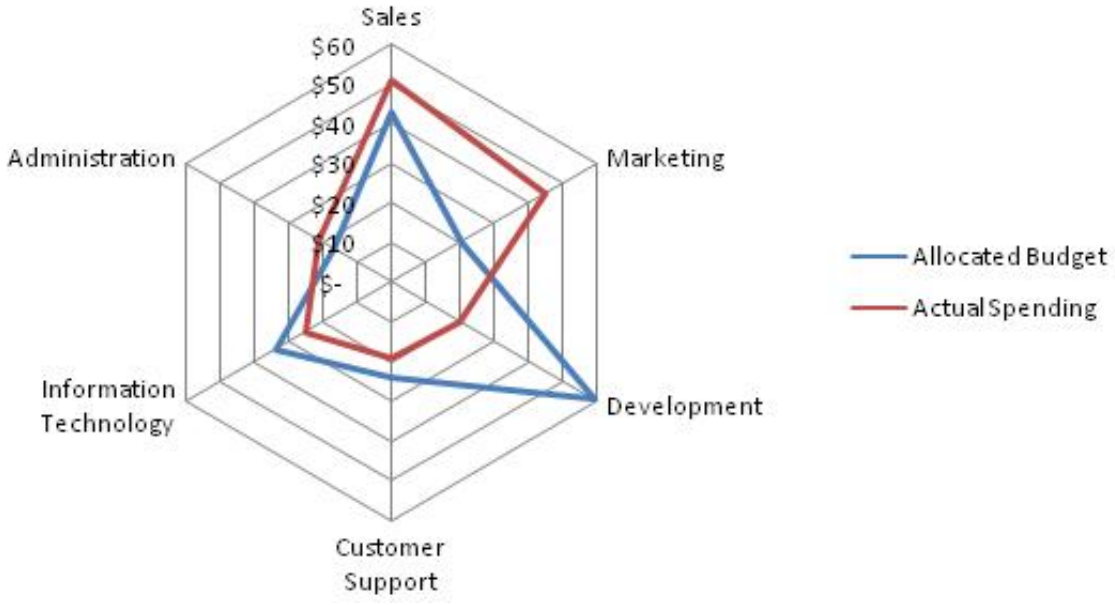
Parallel Coordinates

> Our dataset has a large number of attributes per item and being able to brush over various attribute ranges would be a useful way to find interesting correlations in the data.



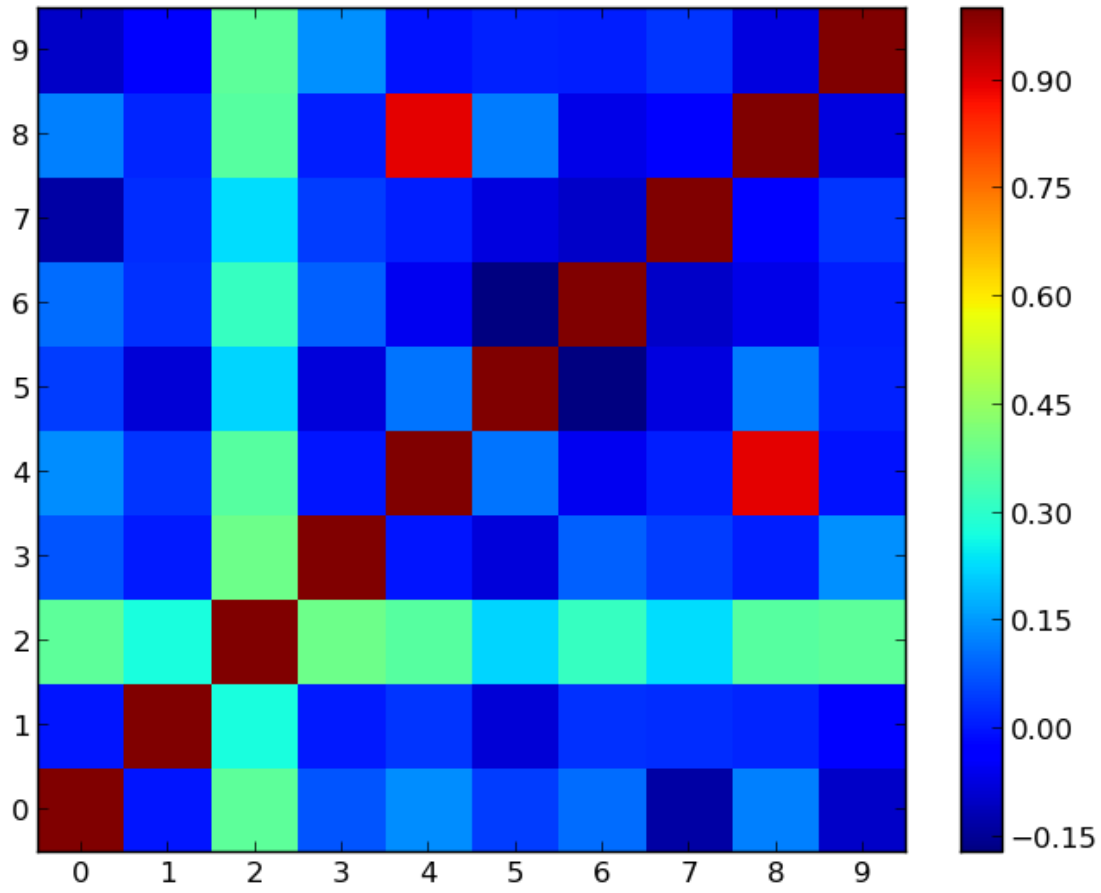
Star Plot aka. Spider Chart, etc

> I like the idea of using this kind of chart in a small multiples arrangement to be able to quickly compare a set of attributes between up to a dozen groups or so. For example it could be one chart per geographical region with various spending metrics on each spoke.



Correlation Matrix

> One of the interesting things to discover when exploring a dataset with many dimensions is unexpected correlations. A corelation matrix is good way to identify which dimensions "move together" in the same direction.



Ref: Visualizing Correlation Matrices

Additional Picks

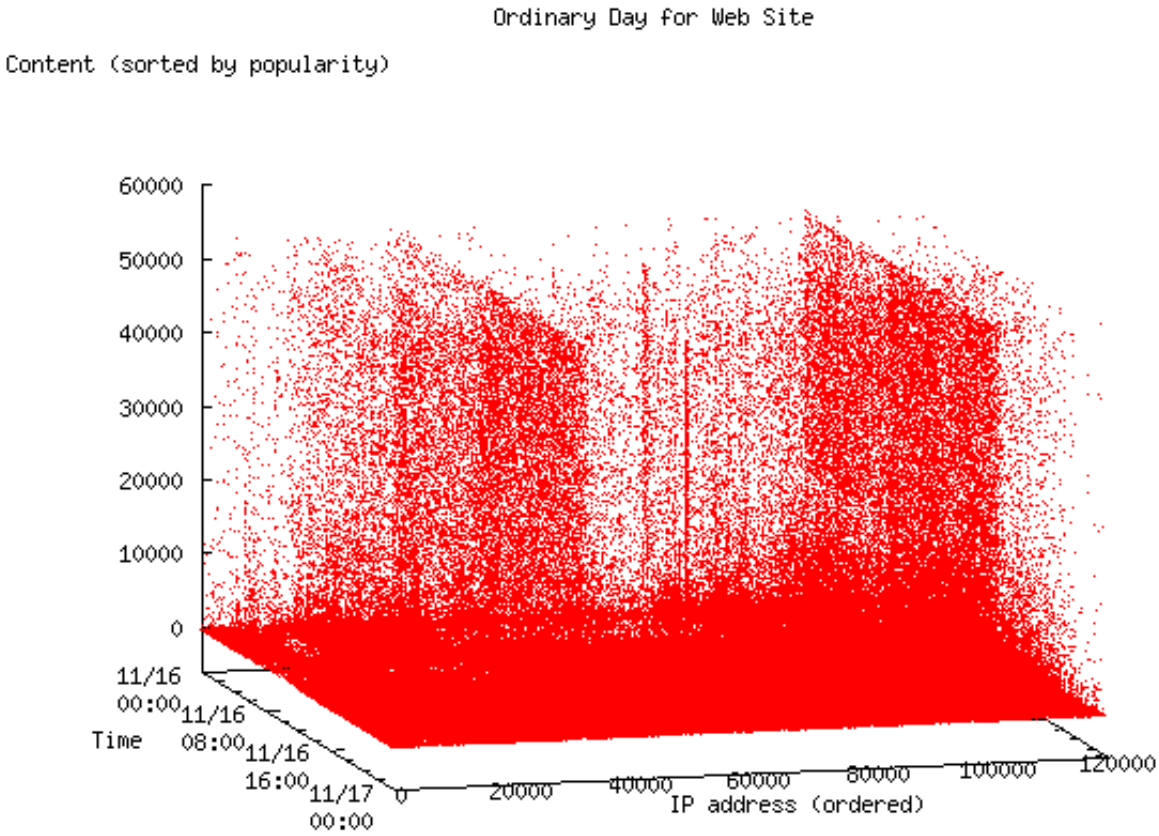
Used Often: 3d Scatterplot

The scatterplot seems to be used a lot because it is quite easy to read when used with ~5 dimensions. The color and shape of the scatter can be used as a channel and the 3 dimension of the cube afford another 3 dimensions.

> Example: Logfile Visualization

The scatter plot in Figure 1 shows more than half a million HTTP page requests (each request is a dot) in 3D space. The axes are:

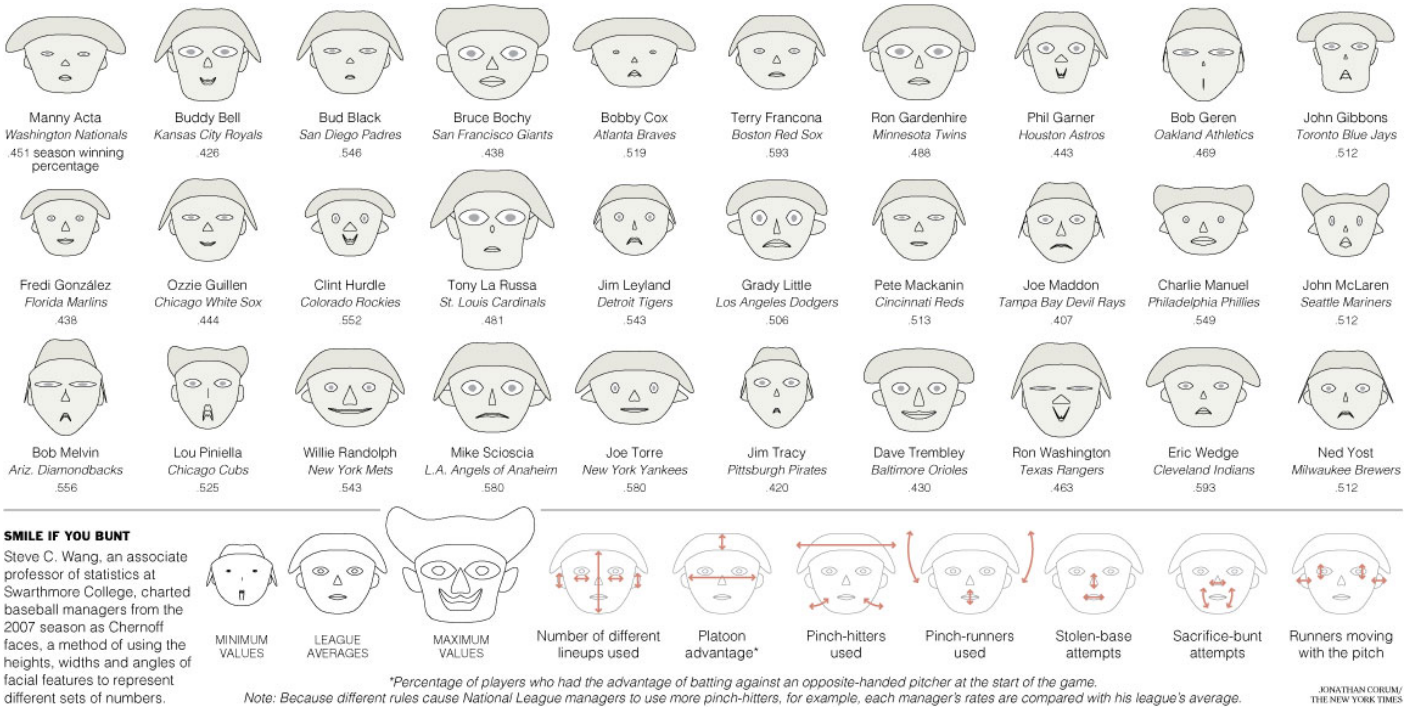
- X, the time axis--a full day from midnight to midnight of November 16.
- Y, the requester's IP address, with the conventional dotted decimal format sorted and given an ordinal number between 1 and 120,000, representing the number of clients that accessed the web server.
- Z, the URL (or content) sorted by popularity. Of the approximately 60,000 distinct pages on the site, the most popular URLs are near the zero point of the Z-axis and the least popular ones at the top.



Creative and Effective: Chernoff Faces

I picked this because I had never heard of it and while it definitely is a peculiar (and somewhat silly) type of visualization, once you familiarize yourself with the parameters it becomes pretty easy to track 3-4 dimensions at once.

Example: Professor Puts a Face on the Performance of Baseball Managers

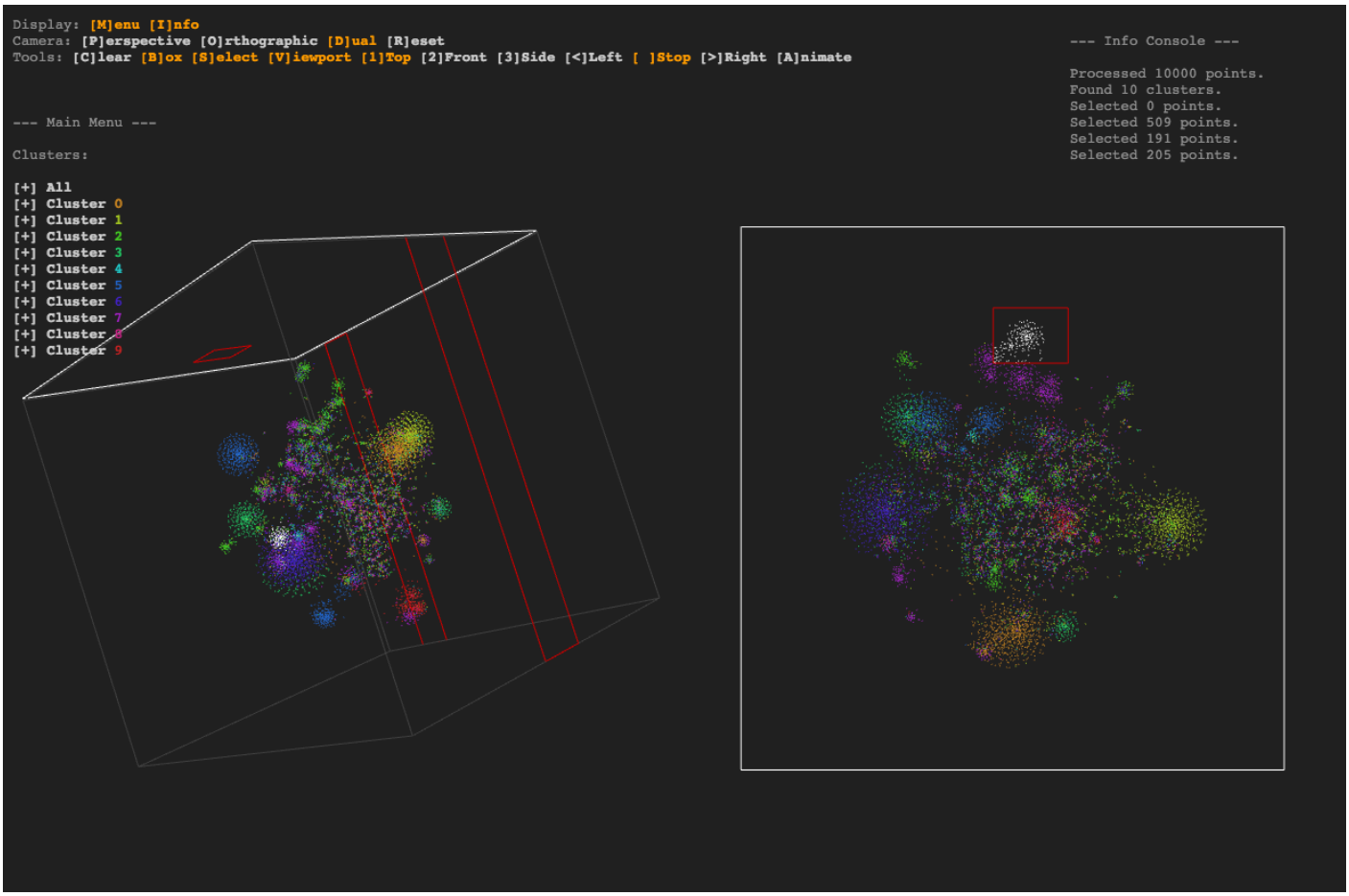


Favourite: Data projector

Fully interactive, very cool 3d visualization. I picked this because it is both a technical challenge in terms of programming for the browser but also because the result is a reasonably usable way to view clusters of related data in a 3 dimensional space.

Data Projector

- VISUALIZING HIGH-DIMENSIONAL DATA IN THE BROWSER WITH SVD, T-SNE AND THREE.JS



Addional Material (for further research)

- A Beginner's Guide to Eigenvectors, PCA, Covariance and Entropy