Part One: Tool Overview

For this assignment I am using three tools in total, D3, WebGL and Matlab. Since D3 and WebGL are both HTML-based tools, they are often used in combination.

Data-Driven Documents is a powerful scientific visualization tool. It is a javascript library and uses W3C web standards which makes it really easy to use. Combining the power of SVG, Canvas, and HTML with the flexibility of javascript scripting environment it gives the user accessibility of visualizing data on device-independent web browsers. Since it works by manipulating Data Object Model (DOM), data in any format (e.g. CSV, JSON etc.) can be transformed into a DOM and subjected to manipulations. For instance, an array of data can be transformed into a table a bunch of SVG objects with dimensions corresponding to the data values. The visualization starts with an empty canvas and then elements keep getting added with in accordance with the data representation requirements, this makes it truly data-driven.

The entire tool has been written in javascript and since it does not define its own core representations it is very fast can be easily scaled to very large datasets. As a programming-based tool, it is highly flexible. Simple SVG constructs like rectangles, circles etc. can be used as basic building blocks to generate beautiful visualizations of the data. The HTML elements are chained to each other which enables hierarchical transformations. Changing color of bars in bar chart does not need a loop to be run over all bar elements, d3 can do this transformation in a single line of code.

WebGL is a javascript adaptation of OpenGL (which is originally written in C language). Since WebGL uses javascript, the visualizations can be embedded in HTML pages. The shader is the component in WebGL graphics pipeline that determines how triangles (fundamental objects in WebGL) are filled with colors. This opens the way beautiful color effects and textures which can further accentuate the data visualization.
Unlike D3 WebGL is a much lower level scientific visualization tool which makes it even more flexible. The user can define his/her own primitive shapes and come up with unique data representations.

One important advantage of WebGL is easy to create animation effects. D3 has animation effects too but they are limited by the SVG and CSS. But WebGL is a powerful tool that people use to create their own animation effects.

Matlab is a powerful programming and scientific data analysis tool that is used in almost all the branches of science. The most common use of Matlab is the dirty implementation of the code to get preliminary results. But unlike D3 and WebGL it is limited to standard visualization methods like charts and plots, which makes it perfect for visualizing record data (for example EHR data in Assignment).

Due to ubiquity of this tool, it can read data in almost any format with a single line of code. Since it is programmer friendly, data representations like scatter plots and bar charts can be easily generated in no time.

Many programming languages have library support Matlab visualization toolkits. Python, for instance, has support for matplotlib library that brings all the scientific visualization capabilities to python. This not only improves the coding experience but also increases the scalability of the Matlab toolkits due to the speed of Python.