

D3

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Paper-2, April 12, 2017

Data Driven Documents (D3) is a open source JavaScript library used to create dynamic, interactive visualizations on a webpage. D3 uses HTML, SVG and CSS to create visualizations with a data-driven approach to Document Object Model (DOM) manipulation, enabling users to utilize the full capabilities of modern browsers and the freedom to design the right visual interface for their data [?]. This paper provides a brief introduction to D3 and its various features. It also discusses D3's use cases, advantages and limitations.

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Keywords: Document Object Model, Data Visualization, Chart

<https://github.com/cloudmesh/sp17-i524/blob/master/paper2/S17-IR-2035/report.pdf>

1. INTRODUCTION

Several graphical forms can be used to envision large quantitative data sets such as graphs, charts, maps and diagrams. These data sets are increasing exponentially since the advent of the World Wide Web, making the task of efficient data visualization more challenging. As a result, web browsers are considered as ideal platforms for visualizing large data sets.

Designers often employ multiple tools simultaneously for building visualizations like HTML for page content, CSS for aesthetics, JavaScript for interaction, SVG (Scalable Vector Graphics) for vector graphics [?]. One of the most important advantages is the uninterrupted cooperation between most of the technologies using the web as a platform, which is enabled by a document object model (DOM). The DOM reveals the ordered structure of a web page, aiding its manipulations.

Data Driven Documents (D3) is an open source JavaScript library, which helps in efficient manipulation of the document object models based on data. It was released in 2011 by Heer, Ogievetsky and Bostock, then part of Computer Science Department of Stanford University. D3 provides a toolkit for visualizing data using web standards such as HTML, SVG, and CSS.[?].

D3 resembles to document transformers such as jQuery [?] that simplify the act of document transformation in web browsers. D3 uses the DOM's standard SVG syntax, that shows similarities with the graphical abstractions used in graphics libraries such as Processing and Raphaël [?]. D3 is a generalization of Protovis [?], and through helper modules more complex visualizations can be achieved efficiently.

D3's main features include selections, transitions and update, enter and exit functions. We will glance through these features in the next section.

2. FEATURES

D3's basic operand is the selection. Operators act on selections, modifying content. Data joins bind input data to elements, producing enter and exit sub-selections for the creation and destruction of elements with respect to data. Animated transitions interpolate attributes and styles smoothly over time [?].

2.1. Selections

Selections allow the user to select and manipulate HTML elements in a very simple way. D3 adopts the W3C Selectors API [?] that contain predicates to select elements by tag, class, unique identifier, attribute, containment, or adjacency [?]. Unique selection methods like union and intersection can be used on these predicates. Multiple operations can be performed after selecting an element by chaining the operations.

D3 provides select and selectAll methods for single and multiple element selections. The former selects only the first element that matches the predicates, while the latter selects all matching elements in document traversal order [?].

2.2. Data

Styles, attributes, and other properties are represented as functions of data in D3. They are simple, but powerful. D3 provides many built-in reusable functions and function factories, such as graphical primitives for area, line, and pie charts.

The data operator binds input data to selected nodes. Data is specified as an array of values such as numbers, strings or objects, and each value is passed as the first argument, along with the numeric index to selection functions. By default, data is joined to elements by index, the first element in the data array is passed to the first node in the selection, the second element to the second node, and so on. Once the data has been bound to