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Web-VizLib: Web-Tool for Visualizing Library Data

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Abstract. In this paper, we present a web-based tool for domain-specific data visualization. The tool is called "Web-VizLib" and is a simple web-platform visualization that can help librarians better-understand the usages of the books in the library. The tool provides book data visualizations, including category-specific visualization as well as location-specific visualization. The visualization tool is designed to follow information visualization guidelines that are important for describing information via graphical representations. A user-study was performed to evaluate the tool and its results showed that the tool is useful and promising.

Keywords; data visualization; domain-specific visualization; library data; web tool.

1. Introduction

Visualization is a necessity for not only scientific research domains, but also for all domains relevant to our lives (e.g., medicine [1, 2], business [3, 4], etc.). Visualization plays a key role for making important decisions. However, design of visualization challenges have become difficult due to various issues, including issues from a user-centered perspective, technical challenges, discipline-specific issues, etc. [5].

In this paper, a domain-specific tool, called "Web-VizLib" (for web-platform visualization of library data), for exploring the book usages in a library is presented. It is a simple web-platform visualization tool that enables effective visualization of the data while exploiting the important guidelines in designing the tool. The primary goal of the

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new visualization tool is to help the librarians better understand the usages of the books in the library for them to make effective decisions for their book management.

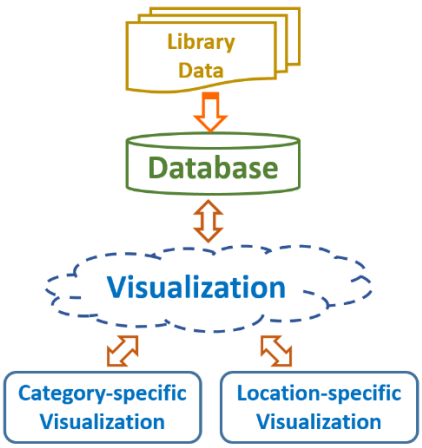


Fig. 1. Overview of the Web-VizLib

2. New Visualization Tool and Data

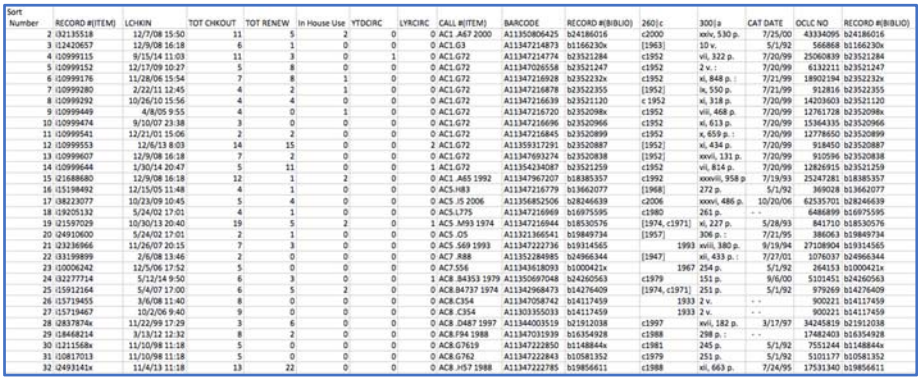
In this section, the overview of the visualization tool and the data considered for the visualization are discussed.

The new visualization tool is a web-based tool that has been implemented using Apache, MySQL, and PHP. In addition, the visualization components were created using Highcharts [8]. Highcharts is a SVG-based, multi-platform charting library that can provides interactive JavaScript charts for a web/mobile access. Figure 1 illustrates the overview the new tool. Various library book attributes were considered to create a database for efficient visualization processing. Two primary aspects of the visualization components are the category-specific visualization and the location-specific visualization. The category-specific visualization presents the book information for certain book categories and the location-specific visualization presents similar information in floor-oriented and book-shelf-oriented ways. (Demonstrations of these visualization are shown in Section 3.) When designing the visualization, various commonly-used visualization types (defined in [6]) were considered. In addition, various guidelines for effective visualization (defined in [7]) were considered. Some of the guidelines used in the visualization tool are listed in Table 1.

As mentioned previously, the target domain of the visualization tool is the data in a library. In particular, one of the primary data used in the visualization is the numbers of

Table 1: Examples of visualization guidelines used in the tool

G1	Design graphic representations of data by taking into account human sensory capabilities in such a way that important data elements and data patterns can be quickly perceived.
G2	Important data should be represented by graphical elements that are more visually distinct than those representing less important information.
G3	Avoid using high-contrast grating patterns in visual displays.
G4	Use more saturated colors when color coding small symbols, thin lines, or other small areas. Use less saturated colors for coding large areas.
G5	To minimize the cost of visual searches, make visualization displays as compact as possible, compatible with visual clarity.
G6	Use different visual channels to display aspects of data so that they are visually distinct.
G7	Make every effort to standardize the mapping of data to visual patterns within and across applications.



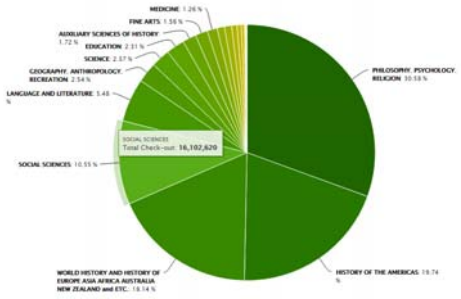
Sort Number	RECORD #(ITEM)	LCHKIN	TOT CHKOUT	TOT RENEW	In House Use	YTDCIRC	LYRCIRC	CALL #(ITEM)	BARCODE	RECORD #(BIBLIO)	260{c	300{a	CAT DATE	OCLC NO	RECORD #(BIBLIO)
2	i32135518	12/7/08 15:50	11	5	2	0	0	AC1 .A67 2000	A11350806425	b24186016	c2000	xxiv, 530 p.	7/25/00	43334095	b24186016
3	i12420657	12/9/08 16:18	6	1	0	0	0	AC1.G3	A11347214873	b1166230x	[1963]	10 v.	5/1/92	566868	b1166230x
4	i10999115	9/15/14 11:03	11	3	0	1	0	AC1.G72	A11347214774	b23521284	c1952	vii, 322 p.	7/20/99	25060839	b23521284
5	i10999152	12/17/09 10:27	5	8	0	0	0	AC1.G72	A11347026558	b23521247	c1952	2 v. :	7/20/99	6132211	b23521247
6	i10999176	11/28/06 15:54	7	8	1	0	0	AC1.G72	A11347216928	b2352232x	c1952	xi, 848 p. ;	7/21/99	18902194	b2352232x
7	i10999280	2/22/11 12:45	4	2	1	0	0	AC1.G72	A11347216878	b23522355	[1952]	ix, 550 p.	7/21/99	912816	b23522355
8	i10999292	10/26/10 15:56	4	4	0	0	0	AC1.G72	A11347216639	b23521120	c 1952	xi, 318 p.	7/20/99	14203603	b23521120
9	i10999449	4/8/05 9:55	4	0	1	0	0	AC1.G72	A11347216720	b2352098x	c1952	viii, 468 p.	7/20/99	12761728	b2352098x
10	i10999474	9/10/07 23:38	3	0	0	0	0	AC1.G72	A11347216696	b23520966	c1952	xi, 613 p.	7/20/99	15364335	b23520966
11	i10999541	12/21/01 15:06	2	2	0	0	0	AC1.G72	A11347216845	b23520899	c1952	x, 659 p.	7/20/99	12778650	b23520899
12	i10999553	12/6/13 8:03	14	15	0	0	2	AC1.G72	A11359317291	b23520887	[1952]	xi, 434 p.	7/20/99	918450	b23520887
13	i10999607	12/9/08 16:18	7	2	0	0	0	AC1.G72	A11347693274	b23520838	[1952]	xxvi, 131 p.	7/20/99	910596	b23520838
14	i10999644	1/30/14 20:47	5	11	0	0	1	AC1.G72	A11354234087	b23521259	c1952	vii, 814 p.	7/20/99	12826915	b23521259
15	i21688680	12/9/08 16:18	12	1	2	0	0	AC1 .A65 1992	A11347967207	b18385357	c1992	xxxviii, 958 p	7/19/93	25247281	b18385357
16	i15198492	12/15/05 11:48	4	1	0	0	0	AC5.H83	A11347216779	b13662077	[1968]	272 p.	5/1/92	369028	b13662077
17	i38223077	10/23/09 10:45	5	4	0	0	0	AC5 .I5 2006	A11356852506	b28246639	c2006	xxxvi, 486 p.	10/20/06	62535701	b28246639
18	i19205132	5/24/02 17:01	4	1	0	0	0	AC5.L775	A11347216969	b16975595	c1980	261 p.	- - -	6486899	b16975595
19	i21597029	10/30/13 20:40	19	5	2	0	1	AC5 .M93 1974	A11347216944	b18530576	[1974, c1971]	xi, 227 p.	5/28/93	841710	b18530576
20	i24910600	5/24/02 17:01	2	1	0	0	0	AC5 .O5	A11321366541	b19849734	[1957]	306 p. :	7/21/95	386063	b19849734
21	i23236966	11/26/07 20:15	7	3	0	0	0	AC5 .S69 1993	A11347222736	b19314565	1993	xviii, 380 p.	9/19/94	27108904	b19314565
22	i33199899	2/6/08 13:46	2	0	0	0	0	AC7 .R88	A11352284985	b24966344	[1947]	xii, 433 p. :	7/27/01	1076037	b24966344
23	i10006242	12/5/06 17:52	5	0	0	0	0	AC7.S56	A11343618093	b1000421x	1967	254 p.	5/1/92	264153	b1000421x
24	i32277714	5/12/14 9:50	6	3	0	0	1	AC8 .B4353 1979	A11350697048	b24260563	c1979	151 p.	9/6/00	5101451	b24260563
25	i15912164	5/4/07 17:00	6	5	2	0	0	AC8.B4737 1974	A11342968473	b14276409	[1974, c1971]	251 p.	5/1/92	979269	b14276409
26	i15719455	3/6/08 11:40	8	0	0	0	0	AC8.C354	A11347058742	b14117459	1933	2 v.	- - -	900221	b14117459
27	i15719467	10/2/06 9:40	9	0	0	0	0	AC8 .C354	A11303355033	b14117459	1933	2 v.	- - -	900221	b14117459
28	i2837874x	11/22/99 17:29	3	6	0	0	0	AC8 .D487 1997	A11344003519	b21912038	c1997	xvii, 182 p.	3/17/97	34245819	b21912038
29	i18468214	3/13/12 12:32	8	2	0	0	0	AC8.F94 1988	A11347031939	b16354928	c1988	298 p. :	- - -	17482403	b16354928
30	i1211568x	11/10/98 11:18	5	0	0	0	0	AC8.G7619	A11347222850	b1148844x	c1981	245 p.	5/1/92	7551244	b1148844x
31	i10817013	11/10/98 11:18	5	0	0	0	0	AC8.G762	A11347222843	b10581352	c1979	251 p.	5/1/92	5101177	b10581352
32	i2493141x	11/4/13 11:18	13	22	0	0	0	AC8 .H57 1988	A11347222785	b19856611	c1988	xii, 663 p.	7/24/95	17531340	b19856611

Fig. 2. A sample of partial library data

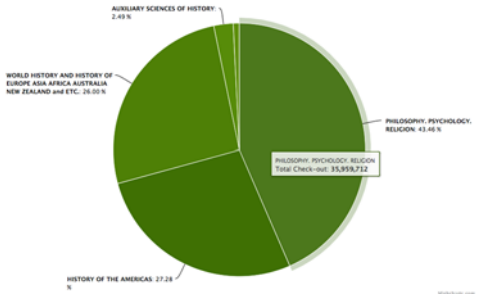
checkouts of the all the books available in a library. The library data was provided by our university library. The data contained typical library book attributes for over 400,000 books, such as title, categories, location, status, checkout date, renewal information, etc. Figure 2 shows a sample of partial data used in our tool. As shown in the table, there are many data attributes associated with each book.

3. Demonstration and Evaluation

Figures 3 and 4 show the key visualization views of the new tool. In Figure 3, subfigure (a) shows the visualization of the all category book checkout information and subfigure (b) shows the visualization of one sub-category (e.g., history category) book checkout information. In both visualizations, the percentages of specific category's book checkouts are shown. When the mouse cursor is on one category, it also shows the total

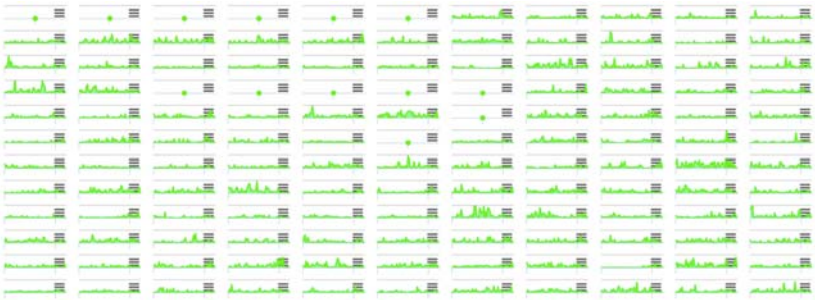


(a) all category visualization

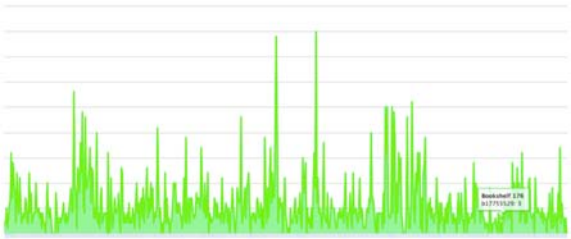


(b) sub-category visuslization

Fig. 3. Category-specific visualization



(a) one floor visualization: each block represents one bookshelf



(b) one bookshelf visualization

visualization of checkout information for all books on one floor in the library as a collection of bookshelf visualizations and subfigure (b) shows the visualization of checkout information for books on one bookshelf. In subfigure (a), only 200 of randomly selected (e.g., every 10th books if there are 2,000 books on a bookshelf) book information are shown. In subfigure (b), all books information on one bookshelf is shown. In one bookshelf visualization, the user can select a range of books by mouse dragging on a range of the visualization and view a focused visualization for those books. Moreover, the user can view a particular book of interest by selecting a specific book information in the chart. Specifically, when selected, the tool will open up a browser tab to the book information webpage on the library website.

To evaluate the effectiveness of the visualization tool, a user-study was performed. There were 20 participants for the user-study, including CS undergraduate students with minimal visualization experience, CS graduate students who had taken a graduate-level visualization course, and university library staffs. After showing the demo of the visualization tool, the participants were asked a questionnaire and to rate the tool in the range of 1 (strongly disagree) and 5 (strongly agree). Table 2 shows the questionnaire and summarized responses. Here, we note that while various questions were asked, only the key questions and responses are presented in the table. (The responses to other questions were very much in favor of the tool.) As shown in the table, the user-study results indicated that the tool is quite useful for library book management.

4. Conclusions

A new web-based visualization tool for library book information was presented. The tool was designed to follow important information visualization guidelines while supporting the domain specific needs by providing multiple visualization views for specific purposes. A user-study performed to evaluate the tool showed that the tool is useful and promising.

For future work, we plan to redesign the visualization to supplement the weakness suggested from the user-study and to utilize the real floor maps of the library. In addition, visualization for other similar domains may be explored.

Acknowledgment

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Table 2: User-study: questionnaire and responses

Questions	Responses (1 strongly disagree - 5 strongly agree)		
	Max.	Avg.	Min.
Was the tool designed well for visualization guideline G1?	5	4.60	4
Was the tool designed well for visualization guideline G2?	5	4.10	2
Was the tool designed well for visualization guideline G5?	5	4.75	4
Was the tool designed well for visualization guideline G6?	5	3.90	1
Was the category-specific visualization intuitive and easy to use?	5	4.65	4
Was the location-specific visualization intuitive and easy to use?	5	4.60	4
Is the category-specific visualization useful for book management?	5	4.70	4
Is the location-specific visualization useful for book management?	5	4.55	3
Would recommend this tool for library data visualization?	5	4.60	3

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