

BEST FRENEMIES: A COMPARISON OF SHELF STOCKING AND WEB SCRAPING

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Introduction

As part of a recent residential lighting shelf stocking study for two northeastern states, NMR employed two methods of data collection: traditional shelf stocking store visits and web scraping. This poster compares the methods and results.

Shelf Stocking

A traditional shelf stocking study includes visits to a sample of retail stores, where technicians take a complete inventory of the products of interest. Shelf stocking studies are commonly used as a method to evaluate residential upstream lighting programs. A shelf stocking study requires careful training of technicians, who must collect detailed information on a large selection of lighting products on the shelves of retail stores where store managers may limit the time available to do the inventory. Shelf stocking studies are relatively costly, in that they require travel and lodging expenses and training time. Store visits, however, are the only way to evaluate product display and accurately determine in-store pricing. Also, any type of retailer, depending on the cooperation of store management, can be visited during a shelf stocking study.

Web Scraping

Web scraping refers to software tools that programmatically extract data from websites. A familiar example is Google's search engine, which crawls websites extracting content to present search results. There is pre-made web scraping software available, and there are companies that provide it as a service, but the tools are typically custom-developed for a specific task. In this example, we used web scraping to gather data on lighting products from the websites of two major home improvement retailers. The most common methods for web scraping rely on open source software tools using the R or Python programming languages. Web scraping also requires knowledge of web technologies like HTML and relational database software such as FileMaker or MySQL. Web scraping is widely used, but may violate a website's terms of use. Websites and web scraping tools can change frequently in ways that require updates to scraping scripts.

A knowledgeable programmer can set up a web scraping script for a particular website in a few days. Scripts can extract any information that the website provides about their products, and can be run automatically on an arbitrary schedule to create time-series data. The data presented on web sites varies widely from site to site in content, quality, and structure, which may require data cleaning and regular updates to the scraping scripts. The potentially large amount of data available can create challenges for cleaning and filtering to extract relevant insights. Generally, only major retailers have web sites that provide extensive, well-formatted product information that justifies the work of webscraping.

Web scraping data can also be used to improve other tools. NMR was able to use the large database of products created via web scraping to populate the tablet-based data collection tool used on the shelf stocking visits, which reduced in-store time for technicians and improved data quality.

Comparison Results

NMR did shelf stocking visits and web scraping runs for the same two major home improvement retailers during the same week. At Retailer 1, the product selection by lamp type was very similar. At Retailer 2, we found a larger share of LED and halogen bulbs on the shelves compared to the web store. Comparing the prices at both retailers, we found that in-store prices were generally lower than online. We concluded that product rebates are inconsistently applied to online prices.

Conclusions

Web scraping and shelf stocking prove to be complementary methods. They both have advantages, insights, and limitations unavailable using one method alone. Shelf stocking visits are difficult and time-consuming, but are the only method to evaluate product display and in-store pricing, and the only way to collect data from all store channels. Web scraping can be done on a regular schedule at low cost, provides a high level of detail on product features, and the method can prove useful for many evaluation tasks.

Best Frenemies: A Comparison of Shelf Stocking and Web Scraping



Shelf Stocking

Definition	A traditional shelf stocking study includes visits to a sample of retail stores, where technicians take a complete inventory of the products of interest. Shelf stocking studies are commonly used as a method to evaluate residential upstream lighting programs.
Required Skills	Technicians must be familiar with the products they will inventory and trained to conduct the visits efficiently.
Concerns	Retail store managers are often unwilling to cooperate with shelf stocking visits. Visits may be cut short or cancelled unexpectedly.
Tasks	Training technicians, determining sample of stores, travel to stores, conducting inventory, data clearing.

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Web Scraping

Definition	Web scraping refers to software tools that programmatically extract data from web sites. A familiar example is Google's search engine, which crawls web sites extracting content to present search results. There is pre-made web scraping software available, and companies that provide it as a service, but typically the tools are custom-developed for a specific task. In this example, we used web scraping to gather data on lighting products from the web sites of two major home improvement retailers.
Required Skills	Custom tools require knowledge of several programming and web technologies, including: R or Python, HTML, and relational database software like FileMaker or MySQL.
Concerns	Web scraping can violate a web site's terms of use. Web sites may be modified by their owners in ways that require updates to the scraping scripts.
Tasks	Identifying web sites to scrape, programming of scraping scripts, monitoring, updating, data cleaning.

NMR used the database of hundreds of lighting products acquired through web scraping to pre-populate our tablet data collection tool for the shelf stocking visits.



	Shelf Stocking	Web Scraping
Staff	Technicians to conduct store visits, in-office staff to develop data collection tools, and provide training and support to field technicians.	One staff person can develop, deploy, and maintain web scraping routines for multiple web sites. Once tools are developed, most tasks can be automated.
Cost/Time	Relatively high costs driven by need for trained technicians to travel to stores and complete inventories.	Once you have the skills to develop the tools, it is relatively easy to apply them to new retailers or products, and to run data collection routines on a regular schedule. Set-up can be completed in 2-3 days.
Data Quality	Determined by technician training, time available in stores, and ease of use of data collection tools.	Quality is generally high, but can include errors. Requires tools and time to clean and filter data.
Stores/Channels Available	Any retailer, depending on cooperation of store managers.	Major retailers only
Distinct Features of this Method	Evaluate product display. Accurately determine in-store pricing.	Conduct time series analysis of product range and prices with multiple data points per year.

Web scraping is a useful tool for many evaluation tasks beyond shelf stocking studies: developing incremental cost estimates, appending additional product information to data collected in the field, and determining product trends to examine when planning new research.



Comparison Results



	LED		CFL	
All Lamps	\$6.09*	\$8.43*	\$4.72	\$9.39
Shelf Stg.	\$11.14*	\$13.76*	\$4.96	\$5.08
Web Scrp.	\$10.83	-	\$4.11	\$4.96
Diff. Stg.	\$5.05**	\$4.72*	\$4.03	\$4.94
Diff. Scrp.	\$4.72	\$4.78	\$2.74	\$3.32
Diff. Stg.	\$5.05	\$3.72	-	-

	LED		CFL	
All Lamps	\$11.45	\$12.35	\$4.92*	\$6.26*
Shelf Stg.	\$12.76	\$17.48	\$2.69*	\$6.49*
Web Scrp.	\$6.88*	\$14.14*	\$1.53	\$4.53
Diff. Stg.	\$5.88	\$3.29	\$4.96	\$1.18
Diff. Scrp.	-	\$10.83	-	-

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