Journal Article

Streetlights, augmented intelligence, and information discovery

Author(s):
Saffer, Jeffrey D.; Burnett, Vicki L.

Publication Date:
2018

Permanent Link:

https://doi.org/10.3929/ethz-b-000294368 →

Jeffrey D. Saffer and Vicki L. Burnett
Quertle

Streetlights, augmented intelligence, and information discovery

Finding and understanding previously published information is the foundation for advancement in any field. As important as this is, it may be surprising to learn that search engines – by the very nature of how they work – generally intensify human cognitive biases, often limiting our ability to discover the most impactful information. Recognizing this is critical for designing smarter search engines that surf information better, drill down to details better, and combine these two aspects into a powerhouse approach that gives tremendously better insights.

Observational biases in search engines

Cognitive biases [1] can be introduced, or made worse, by search engines. Here we address two biases that specifically decrease search effectiveness.

1. Streetlight effect

This bias [2] is explained by a story of a man seen on his hands and knees under a streetlight one night. Asked what he was doing, he said he was looking for his keys, which he lost near the tavern. "Why look here when the tavern is down the street?" "Because this is where the light is!"

This funny situation is not so humorous when looking for critical documents. There are often so many irrelevant results that we are forced to narrow down the search, thus creating our own streetlight in the process. We have been "trained" to drill directly for what we need, bypassing a broader and potentially critical view.

2. Availability cascade

The availability cascade [3] occurs when information seen more frequently is viewed as more important. A form of this bias arises in search engines such as Google [4, 5] where discoverability is not only based on the content, but reflected by other users interest. This may be a great problem, since even the same person doing the query a second time may now be interested in a different perspective. Biasing future exploration using past history is not a valid way to evaluate scientific information.

Modern approach to search engines

The biases above are introduced by traditional search engines because of:

(a) poor search precision, making it impossible to search for a higher-level perspective
(b) ineffective exploration of results, making it impossible to drill down effectively

Artificial intelligence (AI) is one approach to solve these problems. Keep in mind, though, that AI is a very broad category of methods. Just like the choice of which hand tool to use is critical, the choice of AI method – or even how a given method is applied – determines success or failure. However, appropriate AI methods can help remove observational biases if these issues are considered in the very foundation of the implementation.

1. Getting the big picture (surfing with a purpose)

Enabling the big picture is one of the most critical aspects for elevating "search" to "discovery". Suppose you want to know something about the genes that contribute to melanoma. A search for "genes and melanoma" will give over 15K papers. It is not only impractical to understand these results, but most relevant articles will be missing because traditional engines look for articles using the generic term "gene". Questions like this can, however, be effectively addressed by implementing the right AI methods to understand what the user is looking for and, in this example, to search simultaneously for every gene and its relationship to melanoma. This investigation at the systems biology level – finding biological processes in context of the whole – enables greater understanding.

2. Getting down to details (effective drilling)

We have found that effective drilling requires AI-based conceptual searching; that is, finding content based on meaning. For example, "induction" and "activation" are similar conceptually and a searcher would want to find both aspects. In addition, search terms should have meaningful connections in the document, either explicit or implied. Just because a document [6] mentions "banana" and "elbow" doesn't mean bananas affect elbows.

3. Combining surfing and drilling

The need for a big picture as well as details are not mutually exclusive. With combined technologies the real fun – and productive discovery – can begin.

AI can seamlessly combine surfing and drilling. One approach is to use AI methods to automatically identify the concepts of interest to the user. These concepts need not be limited to categories implicit in the user's query and can be extended so that there are no preconceived bounds on what is relevant. In this way, serendipitous discoveries are possible.

The bridge between surfing and drilling can be further enhanced using predictive visual analytics. Here a picture really is worth a thousand words, as Figure 1, an example from a search for "genes and melanoma" shows.

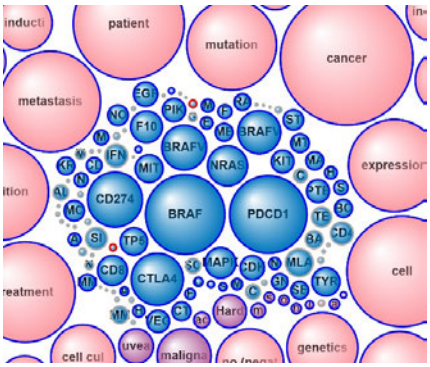

Figure 1

This image helps the user see that BRAF and PDCD1 are more important in the literature (bigger bubbles). The red border on two of the smallest gene (blue) bubbles is an indication that those genes will become more important over time. And by being interactive, the visual analysis allows the user to easily drill down to information that would be missed by traditional methods. Furthermore, when the results are updated based on the user interaction, the information is shown in context so that the user can quickly evaluate the importance.

Summary

From the discussion above, it should be clear that neither surfing alone nor drilling down alone can provide the integrated knowledge, broad context, and opportunity for serendipity that combining the approaches provides. The combination provides augmented intelligence, leading to deeper knowledge with much greater efficiency.

References

[1] List of cognitive biases. Wikipedia http://bit.ly/biasgraph
[2] Streetlight effect. Wikipedia https://en.wikipedia.org/wiki/Streetlight_effect
[3] Kuran T, Sunstein CR: Stanford Law Review 1999, 51, 683-768. DOI: 10.2307/1229439
[4] Schwartz B: Google Posts That Local Results Are Influenced By Clicks, Then Deletes That https://searchengineland.com/google-posts-that-local-results-are-influenced-by-clicks-then-deletes-that-237579
[5] Fishkin R: Queries & Clicks May Influence Google's Results More Directly Than Previously Suspected https://sparktoro.com/blog/queries-clicks-influence-googles-results
[6] Attarian S et al: Orphanet Journal of Rare Diseases 2014, 9, 199. DOI: 10.1186/s13023-014-0199-0

Dr. Jeffrey D. Saffer
Co-founder and CEO
Quertle
2505 Anthem Village Drive, Suite E170, Henderson, Nevada 89052, USA
saffer@quertle.com
https://quertle.com
ORCID 0000-0002-9066-3224

Dr. Vicki L. Burnett
Co-founder and COO
Quertle
2505 Anthem Village Drive, Suite E170, Henderson, Nevada 89052, USA
burnett@quertle.com
https://quertle.com
ORCID 0000-0002-3489-305X

Citation: Saffer JD, Burnett VL: Streetlights, augmented intelligence, and information discovery. Infozine **2018**, Special Issue 2, 34–35
DOI 10.3929/ethz-b-000294368

Published: November 15, 2018