Title: Proposed Research: Search Result Surrogates for Structured Learning Material

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Motivation. The Web is an increasingly important learning resource. In 2012, 94% of teachers claimed students were "very likely" to use Google as a resource for research, while only 18% claimed students equally likely to use print resources [6]. General web search has proven successful at solving a widespread need – quick access to information scattered across billions of documents – but today's leading search user interfaces (SUIs) provide an article-centric view of the Web. *Surrogates*, or text snippets and summaries, extract relevant passages of what is assumed to be several pages of text like blog postings or articles. Structured online learning leveraging contextual prior knowledge reaps higher learning benefits [3].

Abstract. This work aims to fill a gap in current SUI research to present search results for structured learning material, like books, to provide greater ability to select the resources that will be most beneficial for understanding. My research intends to construct surrogates for structured learning material that improve ease of use, search success, and learning outcomes. AH: Insert appropriate learning metrics here.

Approach. This two-year research project involves three distinct steps, including extracting helpful summaries from structured learning material, developing an SUI to leverage these materials, and performing a user study to evaluate the effectiveness of results presentation.

Learning Material Identification. I will start by differentiating between online resources that *offer strong potential to aid in learning* from others. Some resources like publicly accessible books may be more beneficial to learners by providing exposition to new topics and more in-depth examples. An open source set of texts, such as the O'Reilly volumes on computer programming [4], may provide a central repository of such resources. Observations of ~~how~~ advanced information seekers scour through physical and digital books may provide insight into which of these characteristics are most relevant to carefully selecting texts.

Search User Interface Development. Characteristics extracted from structured learning texts must be displayed in a way that is quickly useful to information seekers without requiring high cognitive load. A search user interface will be developed to present search results in this way. Principles of good SUI design [7][2] will be leveraged to make sure the interface is accessible by its full user group. This stage is naturally interdependent with the previous one, ~~and~~ I expect ~~that~~ it will take several iterations of both to find a set of indicative book features and a measurably effective way of presenting these as search results to learners.

Evaluation. Ultimately, the question this research seeks to answer is *what surrogates can shape a quicker and more fruitful search through structured learning texts?* To answer this, I will conduct a formal user study. One approach to this would be the crowd-based ~~approach~~ described in [5], hiring crowd members to complete tasks in a new knowledge domain using our SUI and assessing learners' understanding of search results and learning material using objective measures or subsequent crowd-driven quality judgment. We will compare our surrogates to those of typical search engines to determine change in search experience.

Additional questions worth considering during this project but peripheral to the main purpose include how such techniques could apply to large-scale general search indexes, how to direct users to helpful content within returned learning material, and detecting need for structured learning material instead of one-page articles from learner search behavior.

Intellectual Merit. My current advisor, Björn Hartmann, and ~~my~~ research group currently conduct work tangentially related to this problem. Past work on creating video digests or summaries [5] and automatic demo video abbreviations [1] address the problem of increasing accessibility of massively available learning content, albeit in a different domain. Marti Hearst from the School of Information has written one of the seminal works on search user interfaces [2] and would serve as an advisor for this project. She has done significant reseach in the design and development of novel search user interfaces, and is an expert in computational linguistics. Both advisors are working in technology for online education. I will seek out learning expertise from elsewhere on campus.

My past research in educational technology provides me ~~experience~~ in prototyping user interfaces and leading user studies to assess satisfaction with technology and learning outcomes. My past professional work has provides me skills to develop scalable software systems with some complexity for more making robust prototypes and even publishable SUIs.

Broader Impacts. General web search has shown to be helpful in connecting users from all backgrounds to information contained in billions of documents. The principles of good design in these interfaces such as document surrogates could be powerful when specialized to other domains including education. This research is part of an intended larger research trajectory that asks how resources can be selected and represented to knowledge-hungry users to allow them to gain complex, comprehensive understanding from their searches. Such tools deployed in real-world interfaces could encourage deeper learning through vetted learning resources such as books and the smooth navigation through new knowledge for subject novices everywhere.

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