Final Report for CSC 391: Development of Eulib

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Abstract

The internet is a primary source of knowledge for students and academics. The shortcomings of current technologies hinder people's ability to learn new mathematical concepts efficiently. That is why we created Eulib, a collaborative online encyclopedia for mathematics. In this report, we highlight what we have accomplished so far in Eulib's development and the steps we need to take in the future to make the website successful.

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The Problem and Our Solution

The internet is an essential source of knowledge for any math student or academic. Often learners of a new math concept find it convenient to search for a topic online instead of learning about it in a book.

In a survey done on college undergraduates, it was found if they are using the internet to learning about mathematics, they most often use Wikipedia to understand a concept more generally and Q&A websites like Stack Exchange to understand more specific, detailed concepts. But learning higher level math from Wikipedia is an arduous task; although the information is organized via hyperlinks, it isn't organized in a way that caters to the holistic understanding of a new concept. We'll illustrate this with an example.

Suppose a user is trying to learn about topology on the web. Most likely[1], they'll read the *Topology* article on Wikipedia and will find this:

> the study of qualitative properties of certain objects (called <u>topological spaces</u>)
> that are <u>invariant</u> under a certain kind of transformation (called a <u>continuous</u>
> <u>map</u>), especially those properties that are invariant under a certain kind of
> invertible transformation (called <u>homeomorphism</u>).[2]

This is an introduction to Topology for a learner, and this introduction already has four hyperlinks to concepts that need explanation. Suppose the beginner then clicks on <u>topological</u>

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[1] Mark Auden's data
[2] Topology. (2017, December 16). Retrieved December 20, 2017, from https://en.wikipedia.org/wiki/Topology

spaces because he doesn't understand what a topological space is. He is redirected to the

Wikipedia article on *Topological Spaces* which begins with:

> a **topological space** may be defined as a set of points, along with a set
>
> of neighbourhoods for each point, satisfying a set of axioms relating points and
>
> neighbourhoods.[3]

At this point, we can identify certain problems that are hindering user's learning process:

1.   The user is encountered with another four hyperlinks that explain even more

concepts that he must learn about and then redirect back to the original page.

2.   The page previous page is not in sight anymore, by now, the user has forgotten

what *Topology's* introduction text said.

3.   In the above example, when user clicks on the neighborhood hyperlink, he is

redirected to another page. The problem here is that the user must go back and forth

between pages multiple times and across a series of hyperlinks to revisit a page.

Thus, we can see that even though the information is very well organized on the web in

the form of hyperlinks, it is not presented to the user systematically to inspire learning.

Any internet user would know the benefits of multi-tabbed browsing. Multi-tabbed

browsing allows users to keep a page open on the background while they use some other web-

page. This ameliorates the problem of going through a series of webpages, by clicking "back"

repetitively, to go back to a previously visited page. At first, multi-tabbed browsing in coalition

with Wikipedia might seem like the ultimate solution for the problem of disorganized an

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[3] Topological Space. (2017, December 16). Retrieved December 20, 2017, from
https://en.wikipedia.org/wiki/Topological_space

inefficient navigation; however, tabs are prone to becoming cluttered and hard to find after only

a few new tabs are opened. The different Wikipedia articles very quickly become cluttered and

it's taxing for a beginner to a concept to keep track of how the different articles are related to

each other, which articles are sub-articles of a parent article and so on. Even tabbed browsing

does not help with learning of new concepts systematically. This was our motivation to create

Eulib. We wanted to create an encyclopedia that allows people to learn mathematics efficiently.

Eulib is a collaborative encyclopedia. All its content is created by its users. What

differentiates Eulib from other online encyclopedias is that it prioritizes efficient, faster

navigation and provides a user-friendly design, thereby reducing the time taken to learn a new

concept. Instead of storing its content in various webpages, Eulib uses interactive entries called

Knowls. It is also an attempt to cater to the problem of "where should I start learning about this

topic?"

Eulib employs a top-down design approach to concept learning. Let's suppose a user

wants to learn topology, but uses Eulib instead of trying to make his way through a myriad of

Wikipedia articles. With Eulib, he will make a search query for topology, and would be

presented with a Knowl[4] on the topic. This Knowl will have the most general, expansive

information about topology, which may include the definition, examples, theorems. After

reading only the *Topology* Knowl, it is likely that the user doesn't understand the concept at all,

because perhaps the definition of topology contains words or concepts that the user is not

familiar with. Eulib provides hyperlinks to each word that itself requires an explanation, just like

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[4] Knowl.js is a JavaScript plugin that enables serving of DOM content on the same page the user clicked a hyperlink on. The DOM content that is served is called a Knowl.

Wikipedia. However, clicking hyperlinks in Eulib opens Knowls on the same page in an organized fashion.

Progress

- We started by brainstorming all of Eulib's features and how the features would be presented to the user. The design in fact changed a lot during the development of the prototype.

- Making mockups of the various elements of Eulib's UI[5].

- Designing a prototype with the following functionality:

    - Create an account and add new Knowls to the database.

    - Search the Knowls by title.

    - Make multiple searches, with subsequent searches adding a Knowl to a display stack.

    - While creating a Knowl, highlight a keyword, search and attach a pre-existing Knowl to the highlighted keyword.

- Evaluating different designs sent by prospective graphic designers and hiring the designer with competent designs.

- Collaborating with the graphic designer to finish the final designs and the logo[6].

- Weekly meetings with Mark Auden to work on the website, debugging etc.

- Weekly meetings with Professor Kostin to discuss Eulib's design and to present working code.

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[5] https://goo.gl/kedL13
[6] https://goo.gl/aDHxnM

- Meetings with Michael Keane, the designer.

Next steps

- Each Knowl scrolls horizontally to show various difficulty levels of definitions and vertically to show definitions of the same concept but in terms of different areas of mathematics.

- Implementing the designs and the logo into the website.

- Rewriting the UI elements of the website in React and Redux for better scalability.

References

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