Senior Project Proposal

Department of Computer Science

Calvin College

Title: Alternative Wordings

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Mentor: Kenneth Arnold

Vision and General Overview of Proposal

Background and Problem

While writing, variety in vocabulary and sentence structure is vital in staving off monotony and retaining reader interest. There are always multiple ways in which a sentence can communicate the same idea yet switching between various sentence structures can often be difficult even for experienced writers. A tool which can generate various sentence structures for an idea could therefore be useful for all writers as they experiment with the style of their text. Creating a tool which can switch the overall structure of a sentence while still retaining meaning requires a system which can, in some form, understand the abstract meaning of a sentence, something which can now be done with machine learning translation models. Over the summer of 2020, Calvin student April Volzer, working with Professor Arnold, created such a tool to generate alternative wordings of a given sentence. This alternative wording generator allows users to switch single words in a sentence with other likely words for the same context and generates sentence structure alternatives with some limitations.

Brief Description of Solution Being Provided

We wish to expand the current existing tool created by April Volzer to allow for better overall functionality and further user control over a sentence. To do this, we will continue using the same general structure employed by April Volzer in the original tool's creation. In order to continue the goal of allowing writers to experiment with sentence restructuring we will add dragging and dropping of sentence clauses to allow easy reordering of sentences by the writer, allow choosing multiple words to replace in a sentence, and other features which enable sentence exploration. Our solution's UI interactions and should be discoverable and understandable and should be usable with minimal training. It should also provide reasonable sentence alternatives as output for a variety of sentence inputs while supporting a multitude of user manipulations on the sentence. Our tool should provide measurable qualitative and quantitative value to someone's writing process and help with real world revision tasks.

Your Interest and Qualifications
Hellen Makuei:

In my work experience at ABC undercar group I learned a lot about AI and machine learning and its application. As a quality auditor for the automotive company that makes different car parts that mold by mold programed. Therefore, I have passion to learn more and work with AI in my career. And there is need for the solution for this project for students like me whose English is second language.

Noah Madrid:

I have taken CS344, Artificial Intelligence during my time at Calvin. Due to this experience, I have a strong interest in furthering my study of AI, including the machine learning involved with this project. This experience in AI also gave me understanding of and experience with machine learning. My experience with machine learning in the past should enable me to understand new machine learning concepts quicker and be able to implement them.

Review of Relevant Design Norms

As we work on creating and developing our application, we will keep in mind our own part in God's command to renew the world. To do this we will focus on a few of the design norms Professor Derek Schuurman relates in "Technology and the Biblical Story." The main design norm our team will focus on is engaging users in delightful harmony with our application. This will involve providing an intuitive UI that makes our application a joy to use. This UI should also add a level of transparency to our users, so they understand the limitations of our system along with its strengths, so our technology does not mislead. We will also seek to develop a tool that is reliable and enables a user to trust in our system. Finally, we will focus on justly preserving the privacy of the users of our application.

Mentor Selection, Expert User and Collaboration
Our mentor for this project is Kenneth Arnold. He was chosen due to his experience with AI and machine learning, as well as his past experience with our project itself as he mentored for April Volzer, the original creator of the tool we are working on. Professor Arnold will provide us with feedback on our progress as well as guidance. We will also be collaborating with April Volzer, in order to gain better understanding of the current code base implementation.

Research Question
We are creating a tool for writers that will allow them to visualize different ways of wording a given sentence and interact with those alternatives in a meaningful way. Our research question that we are focusing on is: how should the alternative wordings best be generated and how should these alternatives be displayed?

Development Approach

We foresee our developmental approach as most like iterative. We currently have a working prototype which we will iterate on to make better and better. We foresee using user testing to evaluate our current prototype which we will use to make a better prototype.

Quality Assurance

Critical Delivery Dates

Nov 1: Complete code review with April, add detailed comments to code, add API document

Nov 15: **Complete draft project status report,** complete analysis of failure points and required upgrades

Dec 1: **Project updates/presentation at CS195,** show proficiency with current model by using different languages to generate text

Dec 15: **Complete draft project website and project status report**

- Currently on target for delivery dates

Feb 1: Implement the multiple words/sentence chunk replacement feature

Feb 15: Implement drag and drop feature

March 1: Finalize testing prototype

March 15: Complete detailed testing plan

April 1: Conduct testing and analyze results

April 15: Apply testing results to new project website

May 1: Finish first draft of project report, finalize final project website

May 11: **Complete and deliver final senior project presentation**

May 15: **Submit final project website and report**

Reviews

Our mentor will be reviewing our code and our prototype throughout our time working on this project.

Testing

We expect to have a fully functional prototype built by early spring with which we will conduct usability testing online. Testing will involve recruiting users, running the testing, evaluating our results, and applying our new knowledge gained from testing to our prototype. Our plan for

testing is to give users specific realistic tasks and observe how differences in our prototype impact user experience. We will alter our prototype by removing certain features for groups of users to see how the absence of features impacts a user's overall experience. We will measure how many options of our prototype the user explored and observe which areas of the UI users struggle with.

Risk Analysis

Risk	Exposure Analysis	Mitigation Strategy
Do you have a dependency on others completing work for your project to be a success?	The two team members of this team are relying on each other to complete work on the project. This exposure will be severe as if any one of the team members stops completing work, productivity may drop by 50%.	We will mitigate this issue through meeting weekly in order to check on each other's progress as well as ensuring a dedicated amount of time spent working on the project each week.
Is there any doubt about the availability of financial resources?	N/A	N/A
Do you have a dependency on an expert user to provide advice and who may not always be available at critical times?	This is unlikely to occur with April Volzer as will only rarely be meeting with her to gain extra insight into the code. Professor Arnold, our mentor, will also be a vital resource to us.	We will mitigate this issue by having April introduce us to the code and gain an understanding of it early in the project. We will also have a mentor meeting once a week.
If success depends on testing by an outside source, are there any barriers to completing testing?	Covid-19 may present a problem to testing in person.	We will investigate testing over the internet or while following school Covid-19 guidelines.
Will this project involve new skills for you?	We will undoubtedly be learning new frameworks and programming skills in this project.	We will mitigate the difficulty of learning these new skills by investing time in research and learning.
Will there be anything preventing you from investing at least six hours a week on this at a minimum?	Other classes at Calvin may interfere with investing six hours a week.	We will mitigate this issue by putting aside a consistent block of time each week to work on the project.