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Master's Thesis Specification

“CLI Tutor”

Introduction

Despite the arguably dated appearance, difficult learning curve and practical non-existence in the general personal computing space, Command Line Interfaces (CLIs) have more than stood the test of time in the software development world. There are a multitude of extremely popular tools and applications that primarily focus on the command line as an interaction medium. Some examples include version control software like ‘git’, compilers and interpreters for programming languages, package managers and various core utilities that are popular in areas such as software development, scripting and system administration.

As mentioned before, the use of the command line as an interaction paradigm has effectively disappeared from a mainstream personal computer usage perspective. This contributes greatly to the intimidation factor and learning difficulty for those interested in getting into software engineering or system administration. This unfamiliarity, paired with the inevitability of usage of CLIs in the development space highlights a need to make the command line more accessible to new users for whom text-based interaction with their computer is an alien concept. In recent years interactive learning utilising tools such as sandboxed environments have been gaining in popularity and have the potential to be a suitable medium for learning command line basics through actual usage, examples and practice.

The goals of this Master's thesis

This thesis aims to create a forgiving shell like interface for the purpose of teaching beginners basic CLI usage. The goal is to cover topics such as shell scripting basics and Unix-like core utility usage through the use of interactive examples. We draw inspiration from the ‘vimtutor’ [2] utility shipping alongside the popular terminal based text editor *Vim*. The proposed tool shall allow for opt-in analytics that are sent back to a data collection service for the purpose of learning which mistakes are



most commonly made, and to improve the tool accordingly. To validate the tool, a user study will be conducted, most likely with bachelor students at the University of Zurich. A secondary goal is to embed the shell like learning tool in a prototypical web application in order to make it more accessible and portable.

Research questions

TODO ▷*Refine the questions a bit: They still feel a little 'overlappy'.*◁

- Are there identifiable patterns of difficulty when it comes to adopting CLIs? Can the 'indimidation factor' be pinned down?
- Can an interactive learning tool help to address the difficulty and indimidation factor of CLIs?
- Is an interactive tool more effective than text based learning methods?
- Are novice CLI users more likely to continue using CLI interfaces after using such a tool?

Tasks

Literature review. A look into some of the existing work performed in this space, in order to ascertain what the core difficulties and issues that would need to be tackled are.

Outlining the curriculum. Deciding what lessons and examples the tutor utility should comprise. This will be done by looking at existing learning tools, guides and through insights gained from the literature research.

Development of the forgiving shell. The task here is to implement a CLI or TUI interface that allows for mistakes and can gently guide the user toward a correct answer rather than producing intimidating or cryptic errors as using a traditional shell directly might do. The 'GoCui' library might be an appropriate candidate for building a tool such as this.

Development of the analytics service. The CLI tutor shall include an opt-in feature that allows users to share their input and output logs with an analytics service that allows us to investigate common mistakes and usage patterns to make improvements to the tool.

Web tool Embed the teaching tool into a website for demonstration purposes and to gather more data from a broader audience.

Validation Performing a user study in order to measure the effectiveness of such a tool.



Milestones

Deadline	What (<i>thesis-related</i>)
March 8th	Official start of thesis.
March 15th	Literature review complete. <i>Related work section written. Research questions defined.</i>
March 21st	First draft of curriculum completed.
March 29th	Curriculum defined. <i>Introduction and curriculum written.</i>
March 29th	Development of tool begins.
April 15th	Interaction framework completed.
April 30th	Majority of lessons implemented.
May 15th	Analytics service implemented. <i>Method section mostly written.</i>
May 31st	Web demo implemented.
June 10th	Validation and study defined and begun.
June 29st	Data from web users and study participants collected. <i>Method section completed.</i>
July 14th	Analysis of findings completed. <i>Results and future work sections mostly completed.</i>
July 31st	Tool, documentation and thesis finalized.
August 31st	<i>Final thesis due date.</i>
September	Presentation including demo.

General thesis guidelines

The typical rules of academic work must be followed. In [1], Bernstein describes a number of guidelines which must be followed. At the end of the thesis, a final report has to be written. The report should clearly be organized, follow the usual academic report structure, and has to be written in English using our s.e.a.l. L^AT_EX-template.

Since implementing software is also part of this thesis, state-of-the-art design, coding, and documentation standards for the software have to be obeyed.

Effective feedback can only be provided to the student if the thesis draft is handed in well before the final deadline!

The diploma thesis has to be concluded with a final presentation for the members of the Software Evolution and Architecture Lab (s.e.a.l.).

Special remarks

Copyright. In accordance with current regulations, the student retains the copyright to his work, while providing a non-exclusive, non-revocable, time-unlimited license for it to the university. For this particular thesis, the student intends to keep all source code public so as to provide maximum accessibility to the proposed learning aid.

Responsible assistant: Dr. Carol V. Alexandru-Funakoshi

Signatures:

Student Name

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References

- [1] A. Bernstein. So what is a (diploma) thesis? a few thoughts for first-timers. Technical report, Dynamic and Distribution Information System Group, University of Zurich, 2005.
- [2] M. C. Pierce, R. K. Ware, C. Smith, and B. Moolenaar. vimtutor - the vim tutor, Nov 2019.