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BACHELORARBEIT

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BACHELOR'S THESIS

submitted in partial fulfillment of the requirements for the degree of

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Abstract

200-250 words Enter your text here.

Contents

List of Figures

List of Tables

List of Algorithms

CHAPTER 1

Introduction

1.1 Motivation

- software -> bug -> understand(up to 60% [Bas97] [Pig96]) to fix
  - Industrial software, due to its(steady growning) complexity [LB85](need to read)
    structured programming http://dl.acm.org/citation.cfm?id=1243380
  - software evolution
    Evelyn Barry , Sandra Slaughter , Chris F. Kemerer, An empirical analysis of software evolution profiles and outcomes, Proceedings of the 20th international conference on Information Systems, p.453-458, December 12-15, 1999, Charlotte, North Carolina, USA
  - maintainance [LS80] [ISO06]
    T. H. Ng , S. C. Cheung , W. K. Chan , Y. T. Yu, Do Maintainers Utilize Deployed Design Patterns Effectively?, Proceedings of the 29th international conference on Software Engineering, p.168-177, May 20-26, 2007
    code has to be understood [Boe76] in order to make changes or add features [SLea97]
- program comprehension
  - strategies as stated by [SFM99]
  - dynamic analysis as defined by [Bal99] [CZvD+09]
  - static analysis as defined by [Bal99]
  - mental model(LaToza et al., 2006)
    read: @inproceedingsLieberman:1995:BGC:223904.223969, author = Lieberman, Henry and Fry, Christopher, title = Bridging the Gulf Between Code

and Behavior in Programming, booktitle = Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, series = CHI '95, year = 1995, isbn = 0-201-84705-1, location = Denver, Colorado, USA, pages = 480–486, numpages = 7, url = http://dx.doi.org/10.1145/223904.223969, doi = 10.1145/223904.223969, acmid = 223969, publisher = ACM Press/Addison-Wesley Publishing Co., address = New York, NY, USA,

  - documentation artifacts(requirements to component diagram)
    * source code level documentation
      Ninus Khamis , Juergen Rilling , RenÃĪ Witte, Assessing the quality factors found in in-line documentation written in natural language: The JavadocMiner, Data & Knowledge Engineering, 87, p.19-40, September, 2013

- concatenative languages -> forth, postscript, factor
- comparisson to oo langs
  - paradigm promotes a single shared data structure of high importance and thus may simplify the task of putting all the necesarry runtime information visually together(cite someone who says that its important to have all information visible at every point in time). Although there are several stacks, features like arbitary memory allocation, the focus on stacks is clearly stated.
  - TODO implications from the concatenative nature...

David Shepherd , Lori Pollock , K. Vijay-Shanker, Case study: supplementing program analysis with natural language analysis to improve a reverse engineering task, Proceedings of the 7th ACM SIGPLAN-SIGSOFT workshop on Program analysis for software tools and engineering, p.49-54, June 13-14, 2007, San Diego, California, USA

Martin P. Robillard , Wesley Coelho , Gail C. Murphy, How Effective Developers Investigate Source Code: An Exploratory Study, IEEE Transactions on Software Engineering, v.30 n.12, p.889-903, December 2004

Darren C. Atkinson , William G. Griswold, The design of whole-program analysis tools, Proceedings of the 18th international conference on Software engineering, p.16-27, March 25-29, 1996, Berlin, Germany

1.2 problem statement (which problem should be solved?)

- much work and tools on oo-languages

- not so much on concatenative ~~stack oriented~~ languages
- applicability of oo-methods for concatenative ~~stack oriented~~ languages at the example of forth
- applicability of oo-visualization methods
- suggestions of (new) methods

1.3 aim of the work

- identify all the information to be considered (and helpful) for program comprehension
- actual visualization methods for these information
- improve efficiency of program comprehension of concatenative languages
- demonstration by enhancing the gforth stepping debugger(trace recording, trace visualization, goal-based approach possible)

1.4 methodological approach

- qualitative approach(?)
- proposal
- Preliminary evaluations as defined by [CZvD+09]
- outcome is a subjectiv view of the available methods, and proposed enhancements which have been implementet
- case study of the implemented enhancement
- suggestions of further enhancements

1.5 structure of the work

- summary of information to be considered helpful
- summary on the available methods for program comprehension in gforth
- summary and applicability of available methods for other paradigms and languages
- enhancement or modification of existing methods to fit the target program paradigm and proposal for further enhancements
- conclusion

- further work / suggestion for further research

CHAPTER 2

State of the art / analysis of existing approaches

2.1 literature studies

- about program comprehension
  - top down
  - bottom up
  - knowledgebased
  - systematic and as-needed
  - integrated approaches
- dynamic analysis
  - actual behavior
  - incomplete view [Bal99]
  - observer effect
    Andrews, J. (1997). Testing using log file analysis: tools, methods, and issues. In Proc. International Conference on Automated Software Engineering (ASE), pages 157âĂŞ 166. IEEE Computer Society Press
  - scalability
    Zaidman, A. (2006). Scalability Solutions for Program Comprehension through Dynamic Analysis. PhD thesis, University of Antwerp
  - debugging -> different kind of paradigms and languages and tools
    see @incollectionreiss1993trace, title=Trace-based debugging, author=Reiss, Steven P, booktitle=Automated and Algorithmic Debugging, pages=305–314, year=1993, publisher=Springer

  - about debugging

  - dataflow analysis(Backward Analysis)(not sufficient in demo)
    Darren C. Atkinson , William G. Griswold, Implementation Techniques for Efficient Data-Flow Analysis of Large Programs, Proceedings of the IEEE International Conference on Software Maintenance (ICSM'01), p.52, November 07-09, 2001

- about visualization maybe some examples(and tools)

  - sequence diagram
  - circular diagram and interactive interaction sequance diagram [Cor09]
  - interaction diagrams (Jacobson, 1992)/ scenario diagrams (Koskimies and MÃűssenbÃűck 1996)
  - information murals (Jerding and Stasko, 1998)
  - polymetric views (Ducasse et al., 2004)
  - fisheye views (suggested by George W. Furnas, 1986, and formulated by [SM96] and [SB94])
  - hierarchical edge bundling (Holten, 2006)
  - structural and behavioral views of object-oriented program (Kleyn and Gingrich, 1988)
  - matrix visualization and âĂIJexecution patternâĂİ notations [PLVW98] to visualize traces in a scalable manner(De Pauw et al. 1993, 1994, 1998)
  - architecture oriented visualization (Sefika et al. 1996)
  - a continuous sequence diagram, and the âĂIJinformation muralâĂİ (Jerding and Stasko, 1998)
  - architecture with dynamic information (Walker et al. 1998)
  - frequency spectrum analysis (Ball 1999)

- about realtime/interactive vs post mortem

2.2 analysis

- existing methods abstract(abstract like print debugging and stepping and so on) furthermore the abstraction of all those methods mentioned above

- applicability for concatenative languages

2.3 comparison and summary of existing approaches

- existing methods(actual methods)
  - factoring (http://en.wikipedia.org/wiki/Modular_programming https://www.complang.tuwien.ac.at/html/Factoring-Tutorial.html http://www.ultratechnology.com/Forth-factors.htm)
    has to be considered during initial development
  - dump
  - . / type
  - dbg
  - see/ code-see
  - ~~

CHAPTER 3

Methodology

- case study(maybe exploratory)
- prototype
- sketches
- trying to understand programs developed withing stackbased languages vl?

3.1 used concepts

- prototyping
- reading codes
- print-debugging
- step-debugging

3.2 methods and/or models

- prototyping

3.3 languages

- postscript
- forth
- shell script

- c
- m2

3.4 design methods

?

3.5 data models

?

3.6 analysis methods

- reading code
- tail and error

3.7 formalisms

?

CHAPTER 4

Suggested solution/implementation

- kind of an ide
  light table ide(js) continuous reverse engineering idea of [MJS+00] to provide immediate resonse of the systems output... although probably not applicable or very time consuming in setup(or not more than integration testing...) for most industrial scale software
  eclipse ide(java)
  - adequate search and corss reference facilities to support systematical investigation to benefit from effective program understanding as stated by [RCM04]
  - interactive program manipulation: state of the system before a word, after a word and by clicking on the word jumping to its definition or inserting it and there also providing those features
  - stepping debugger mode: simply stepping through the whole code word by word
  - goal-oriented strategy: the definition of an execution scenario such that only the parts of interest of the software system are analyzed (Koenemann and Robertson, 1991; Zaidman, 2006).
  - other data structures and variables should be displayed
    * memory maybe like [Rei95] or [AKG+10] but since there is no underlying object orientation and no standardized oo system this would be hard do accomplish
    * fisheye or word cloud like display(tree or sugiyama as of [SWFM97])
  - display of the 'vocabulary'

  - emphasis on on comprehension code while writing. factoring suggestion, documentation, aliases(same code with multiple aliases to read more natural at different points in programs), expressive naming, hard to generalize cause of the flexibility the language provides

- proof of concept by enhancement of stepping debugger on forth code level(cause it has turned out to be the fastest and simples approach) by showing additional data: the other stacks

CHAPTER 5

Critical reflection

5.1 comparison with related work

? is there any? maybe the modifications to oo methods? or listing of the methods which did work and those which did not

5.2 discussion of open issues

- not scaling well cause of limited irgnedwas screen[...] and thus the need to scroll
- not scalign well cause of unpredictable stack height
- nature of gforth
  - interpretation/compilation mix(how to integrate the adhook changes between modes)
  - implementation within the executing system
  - lack of static(and dynamic?) information
- not suitable for performance meassuring
- quantitative data on the effects the enhancement

CHAPTER 6

Summary and future work

summary of what has been done and the subjective conclusion

- see suggested solution
- using a standard data type to store traces
- display of variable content
- display of allocated memory areas
- display of color diff with tooltip of previous values for stacks and memory areas
- better visualization of loops and control structures
- display of the full program as a graph
- customizable inspection depth
- static code analysis
  - stack depth per word
  - type system for forth
  - ...

conclusion like what i contributed to the community!!
good overview of the field [CDPC11] and [Cor09]

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