MASARYK UNIVERSITY
FACULTY OF INFORMATICS

Parameter Synthesis from Hypotheses Formulable in CTL Logic

BACHELOR THESIS

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Brno, Spring 2015

Declaration

Hereby I declare, that this paper is my original authorial work, which I have worked out by my own. All sources, references and literature used or excerpted during elaboration of this work are properly cited and listed in complete reference to the due source.

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Advisor: John Foo, Ph.D.

Acknowledgement

I would like to thank my supervisor . . .

Abstract

The aim of the bachelor work is to provide . . .

Keywords

keyword1, keyword2 . . .

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1 Introduction

Lorem Ipsum [1]

2 Algorithm

2.1 Common operations

In this section, we define functions used to simplify the algorithm description. Let us fix a formula ϕ and a parametrized kripke fragment $\mathcal{K} = (id, f, \mathcal{P}, S, I, \xrightarrow{p}, L)$ as input of the algorithm.

Intuitively, function $validStates : cl(\phi) \times AS^{\phi}_{\mathcal{K}} \to S \times 2^{\mathcal{P}}$ computes a set of states and parameters where truth of given formula is assumed.

$$validStates(\phi, \mathcal{A}) = \{(s, p) \mid \mathcal{A}(s, p, \phi) = \texttt{tt}\}$$

Function $predecessors : S \to S \times 2^{\mathcal{P}}$ computes set of direct predecessors of given node including the color sets labeling the appropriate transitions.

$$predecessors(to) = \{(from, P) \mid P = \{p \mid from \xrightarrow{p} to\}\}$$

Symetrically, $successors : S \to S \times 2^{\mathcal{P}}$ computes set of direct successors of given node including the color sets labeling the appropriate transitions.

$$predecessors(from) = \{(to, P) \mid P = \{p \mid from \xrightarrow{p} to\}\}$$

2.2 Exist Next Operator

Process variables:
$\mathcal{K} = (id, f, \mathcal{P}, S, I, \xrightarrow{p}, L)$ ▷ Kripke fragment
$\phi = \mathrm{EX}\phi_1$ ▷ CTL formula
$\mathcal{A}$ ▷ Initial assumption function
procedure INIT
    for all *state* **in** $validStates(\phi_1, \mathcal{A}, \mathcal{K})$ **do**
        for all $(pred, tranCol)$ **in** $predecessors(state, \mathcal{K})$ **do**
            SEND$(f(state), (pred, \mathcal{P} \cup tranCol))$
procedure RECEIVE$(colSet, to)$
    $\mathcal{A} \leftarrow \mathcal{A} \cup \{(p, to, \phi) \mid p \in colSet\}$

2.3 Exist Until Operator

Process variables:
$\mathcal{K} = (id, f, \mathcal{P}, S, I, \xrightarrow{p}, L)$ ▷ Kripke fragment
$\phi = \mathrm{E}\phi_1 \mathrm{U} \phi_2$ ▷ CTL formula
$\mathcal{A}$ ▷ Initial assumption function
procedure INIT
  for all *state* **in** $validStates(\phi_2, \mathcal{A}, \mathcal{K})$ **do**
    $\mathcal{A} \leftarrow \mathcal{A} \cup (\mathcal{P}, state, \phi)$
    for all $(pred, tranCol)$ **in** $predecessors(state, \mathcal{K})$ **do**
      SEND$(f(state), (state, pred, \mathcal{P} \cup tranCol))$
procedure RECEIVE$(colSet, from, to)$
  $colSet \leftarrow colSet \cap valid(\phi_1, to, \mathcal{A})$
  if $colSet \neq \emptyset$ **and** $colSet \setminus valid(\phi, to, \mathcal{A}) \neq \emptyset$ **then**
    $\mathcal{A} \leftarrow \mathcal{A} \cup (colSat, to, \phi)$
    for all $(pred, tranCol)$ **in** $predecessors(to, \mathcal{K})$ **do**
      SEND$(f(pred), (to, pred, colSat \cup tranCol))$

2.4 All Until Operator

Process variables:
$\mathcal{K} = (id, f, \mathcal{P}, S, I, \xrightarrow{p}, L)$ ▷ Kripke fragment
$\phi = \mathrm{A}\phi_1 \mathrm{U} \phi_2$ ▷ CTL formula
$S = \emptyset$
$\mathcal{A}$ ▷ Initial assumption function
procedure INIT
  for all *state* **in** $validStates(\phi_2, \mathcal{K})$ **do**
    for all $(pred, tranCol)$ **in** $predecessors(state, \mathcal{K})$ **do**
      SEND$(f(state), (state, pred, \mathcal{P} \cup tranCol))$
procedure RECEIVE$(colSet, from, to)$
  $S \leftarrow S \cup (to, from, colSet)$
  $colSet \leftarrow colSet \cap valid(\phi_1, to, \mathcal{K})$
  if $colSet \neq \emptyset$ **and** $colSet \setminus valid(\phi, to, \mathcal{K}) \neq \emptyset$ **then**
    $\mathcal{A} \leftarrow \mathcal{A} \cup (colSat, to, \phi)$
    for all $(pred, tranCol)$ **in** $predecessors(to, \mathcal{K})$ **do**
      SEND$(f(pred), (to, pred, colSat \cup tranCol))$

A First appendix

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

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Bibliography

[1] S. author, "Assumption-based distribution of CTL model checking," *STTT*, vol. 7, no. 1, pp. 61–73, 2005.