PONTIFÍCIA UNIVERSIDADE CATÓLICA
DO RIO DE JANEIRO

Felipe Vieira Cortes

An alternative formalization of reference typing

Tese de Doutorado

Thesis presented to the Programa de Pós–graduação em Informática, do Departamento de Informática da PUC-Rio in partial fulfillment of the requirements for the degree of Doutor em Informática.

Advisor: Prof. Roberto Ierusalimschy

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do Rio de Janeiro

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Abstract

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Reference Typing is a ...

Keywords

Type References; Programming Languages; Formalization.

Resumo

Cortes,Felipe V.; Ierusalimschy, Roberto. **An alternative formalization of reference typing**. Rio de Janeiro, 2023. 22p. Tese de Doutorado – Departamento de Informática, Pontifícia Universidade Católica do Rio de Janeiro.

A tipagem de referencia eh ...

Palavras-chave

Type References; Programming Languages; Formalization.

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List of Abreviations

ADI – Análise Digital de Imagens

BIF – *Banded Iron Formation*

My beautifull epigraph

Wassily Kandinsky, *Regards sur le passé.*

1
Introduction

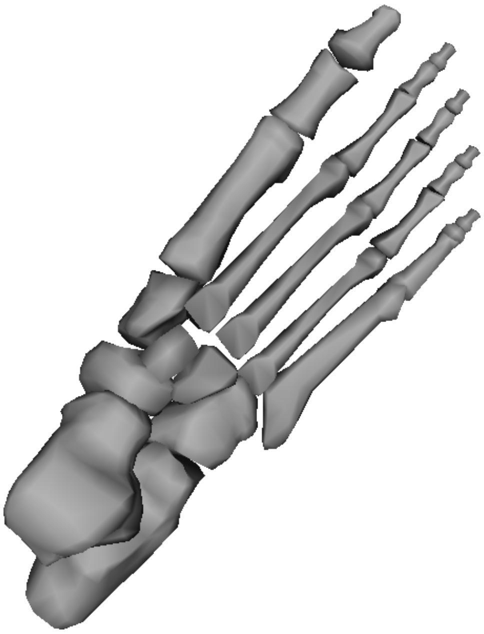
- What is Reference typing?
- What is the main representation (from Pierce)?
- What we want to propose studying?
- What is our alternative representation?
- What are the differences
- Why should we formalize an idea?
- Which Theorems we want to prove?
- Which usabilites can we identify by this formalization?
- Is this dissertation meant to be didatic?

Type Reference is a technique of representing the types of a program in a store. Some properties of this store can be defined to verify the correctness of a given representation. Formalizing these concepts makes it more understandable, in a way which computer scientists can comunicate their ideas through a standardized set of rules. Why coq? Coq is a expressive functional programming language used for stating and proving logical assertions and a standard tool for researchers to reason about complex language definitions (PIERCE et al., 2022)

This document is structured as follows. In Chapter 2 we present some previous work relevant to our problem. In Chapter 3 we explain our proposal. In Chapter 4 we show our results. Finally, in Chapter 5 we present our conclusion and future work.

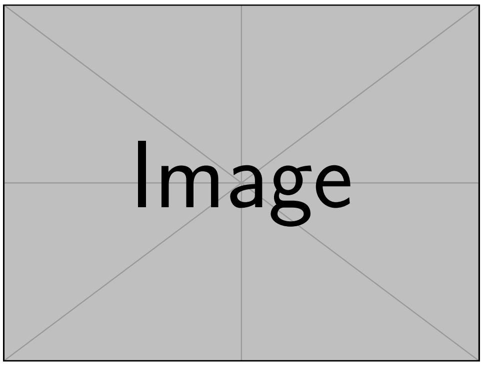
2
Previous Work

Early smoothing methods tried to minimize... In the figure 2.2d we see...



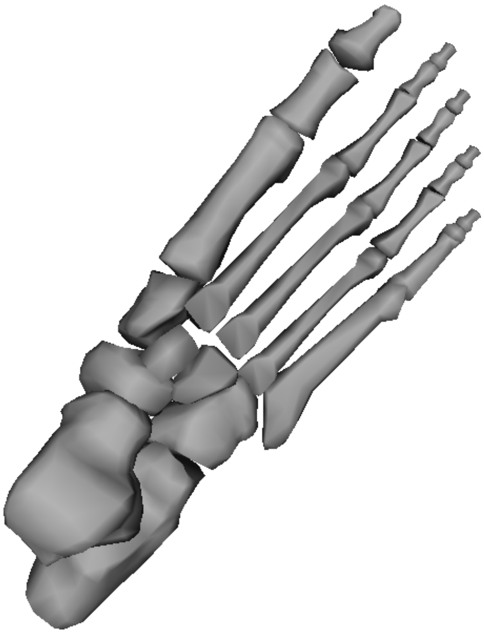
(a) Bamboo-pile Vertically Inserted Position

(b) Bamboo-pile Normal Inserted Position

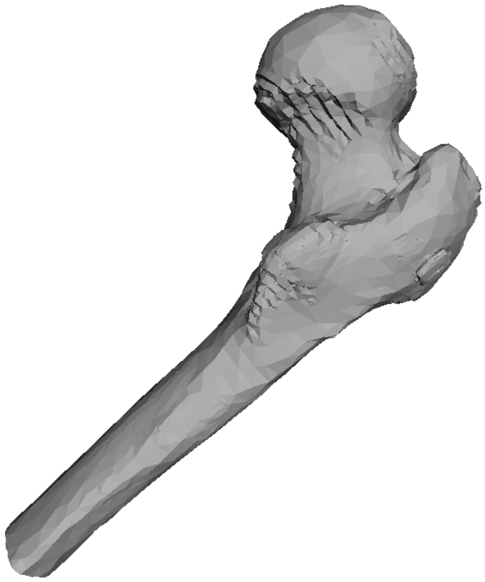


(c) bamboo-pile Inserted 45° angle

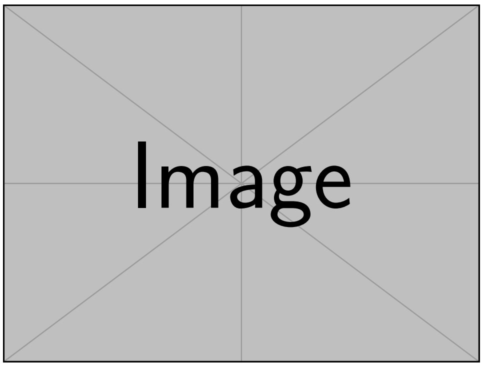
Figure 2.1: A set of three subfigures: (a) describes the first subfigure; (b) describes the second subfigure; (c) describes the third subfigure.



(a) Bamboo-pile Vertically Inserted Position

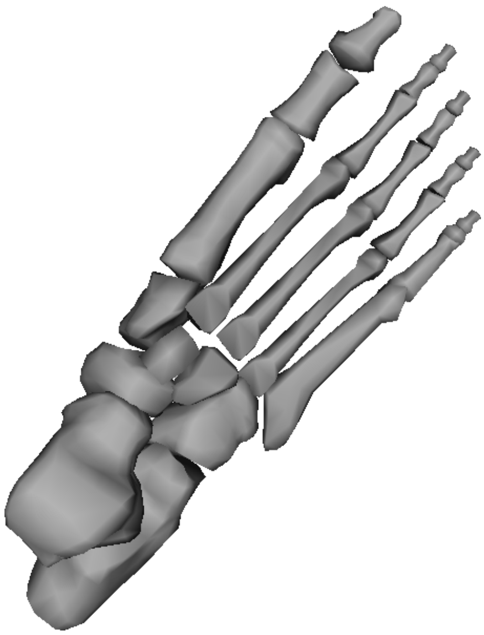


(b) Bamboo-pile Normal Inserted Position

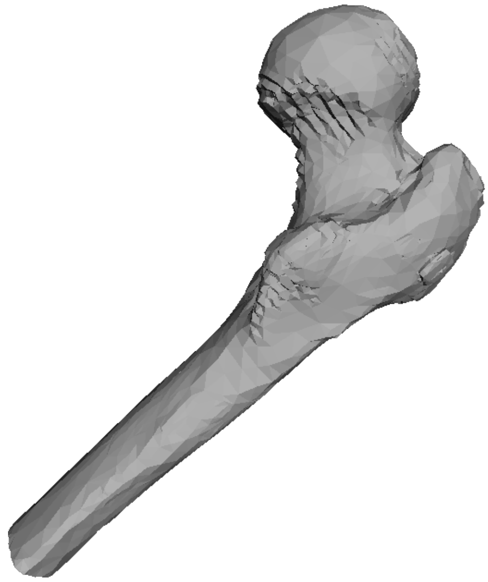


(c) bamboo-pile Inserted 45° angle

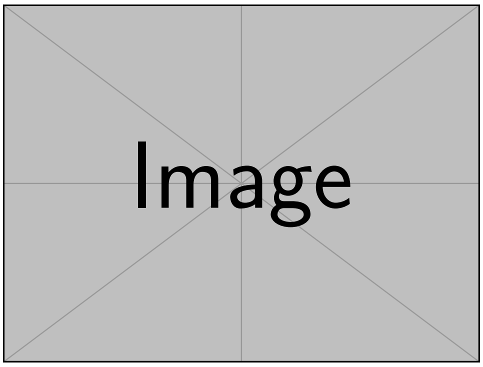
Figure 2.2: A set of six subfigures in two pages.



(d) Bamboo-pile Vertically Inserted Position



(e) Bamboo-pile Normal Inserted Position



(f) bamboo-pile Inserted 45° angle

Figure 2.2: A set of six subfigures in two pages.(Continuation)

3
Proposal

Equation example 1:

$$\begin{aligned} \min_{u} \int_{x_i \in X} \int_{x_j \in X} q_{ij} u_i u_j dada + \int_{x_i \in X} ||x' - x_i|| u_i da \\ s.t. \quad u \in [0,1] \quad \wedge \quad \int_{x_i \in X} uda = a_0, \end{aligned} \tag{3-1}$$

Equation exmaple 2:

$$\begin{aligned} \min_{\mathbf{u}} \alpha \mathbf{u}^T \mathbf{A}^T \mathbf{Q} \mathbf{A} \mathbf{u} + \beta \mathbf{d}^T a' \mathbf{A} \mathbf{u} + \gamma \mathbf{u}^T \mathbf{G}^T \mathbf{G} \mathbf{u} + \delta \mathbf{f}^T a' \mathbf{A} \mathbf{u} \\ s.t. \quad \mathbf{0} \le \mathbf{u} \le \mathbf{1} \wedge \mathbf{a}^T \mathbf{u} = a_0. \end{aligned} \tag{3-2}$$

Equation example 3:

$$\mathbf{G} = (g_{ij}) = \begin{cases} \sum_{f_k \in N_f(f_i)} l_{ik} & i = j \\ -l_{ij} & e_{ij} \in E \\ 0 & \text{otherwise} \end{cases} \tag{3-3}$$

Code 1: Mean Filter

```
# ----------------------------------------------------------------------#
# Create filter function
# l is the width of window
# ----------------------------------------------------------------------#
meanfilter <- function( l, imagem ) {
  if( l%%2 == 0 )
    print("Please, type an odd number!")
  imagem.result <- imagem
  lp1d2 <- (l-1)/2
  L <- dim(imagem)[1]
  C <- dim(imagem)[2]
  for( j in as.integer(lp1d2+1) : as.integer(C-lp1d2)) {
    for( i in as.integer(lp1d2+1) : as.integer(L-lp1d2)) {
      imagem.result[i,j] <- mean(imagem[as.integer(i-lp1d2):as.integer(i+lp1d2), as.integer(j-lp1d2):as.integer(j+lp1d2)])
    }
  }
```

```
  print("Image filtred with success!")
  return(imagem.result)
}
# -------------------------------------------------------------------#
# End of Script.
# -------------------------------------------------------------------#
```

Algorithm 1: Escolha das amostras inicias

Input: Malha e quantidade de pontos a ser amostrado

Output: Pontos amostrados na malha

```
Crie um vetor de números randômicos entre [0, 1] com a quantidade de
  pontos a ser amostrada e ordene-o
Calcule a área total dos triângulos da malha
for i = 0 to numeroDePontos do
    Navegue entre as faces acumulando a sua area/areaTotal até achar a face
      com valor acumulado ⩾ numerosRandomicos[i]
    Pegue um ponto randômico dentro da face utilizando o método de
      Turk e adicione no vetor do resultado
```

4
Results

Table example. Table 4.1 shows results.

Table 4.1: Results for devil mesh

	Mean Vertex Distance	L2 Vertex Based	Mean Quadric	MSAE	L2 Normal Based	Tangential	Mean Discrete Curvature	Area Error	Volume Error
(FLEISHMAN; DRORI; COHEN-OR, 2003)	0.061277	0.110973	0.236219	19.697900	0.055170	0.047678	0.090284	0.051443	0.045645
(JONES; DURAND; DESBRUN, 2003)	0.001293	0.002800	0.002289	21.237300	0.021589	0.013026	0.087991	0.000364	0.002621
(SUN et al., 2007)	0.001439	0.002880	0.003540	14.043200	0.012654	0.008911	0.055849	0.007806	0.000582
(ZHENG et al., 2011)	0.000713	0.001537	0.001824	12.171400	0.009654	0.005781	0.054567	0.005617	0.000425
(HE; SCHAEFER, 2013)	0.002531	0.004560	0.007108	13.830100	0.017459	0.010314	0.114528	0.001686	0.001786
(ZHANG et al., 2015)	0.001623	0.003079	0.005048	10.454200	0.015233	0.008054	0.094668	0.002629	0.001326
(YADAV; REITEBUCH; POLTHIER, 2016)	0.000737	0.001548	0.001493	16.880800	0.014129	0.006974	0.079952	0.000209	0.002375
Ours	0.000987	0.001902	0.002686	11.574200	0.010632	0.006796	0.075106	0.003970	0.000722

4.1
Comparison

5
Conclusion and future work

We proposed an algorithm for triangular mesh denoising with detail preservation...

Code 2: Mean Filter

```
# --------------------------------------------------------------------#
# Create filter function
# l is the width of window
# --------------------------------------------------------------------#
meanfilter <- function( l, imagem ) {
  if( l%%2 == 0 )
    print("Please, type an odd number!")
  imagem.result <- imagem
  lp1d2 <- (l-1)/2
  L <- dim(imagem)[1]
  C <- dim(imagem)[2]
  for( j in as.integer(lp1d2+1) : as.integer(C-lp1d2)) {
    for( i in as.integer(lp1d2+1) : as.integer(L-lp1d2)) {
      imagem.result[i,j] <- mean(imagem[as.integer(i-lp1d2):as.integer(i+lp1d2), as.integer(j-lp1d2):as.integer(j+lp1d2)])
    }
  }
  print("Image filtred with success!")
  return(imagem.result)
}
# --------------------------------------------------------------------#
# End of Script.
# --------------------------------------------------------------------#
```

6
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