Doctoral Thesis in Information and Communication Technology

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TEKLA ANDERSSON

KTH ROYAL INSTITUTE OF TECHNOLOGY

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TEKLA ANDERSSON

Academic Dissertation which, with due permission of the KTH Royal Institute of Technology, is submitted for public defence for the Degree of Doctor of Philosophy onMonday, the 21st October 2025, at 09:00 in Sal-C, Kistagången 16, Stockholm.

Doctoral Thesis in Information and Communication Technology
KTH Royal Institute of Technology
Stockholm, Sweden 2025

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Dedicated to someone special.

Abstract

This thesis explores the curious and occasionally confounding world of doctoral research. While the journey begins with a clear question, it often detours through the land of literature reviews, the valley of imposter syndrome, and the mountain of experimental revisions. Early chapters introduce the reader to concepts that will later be challenged, redefined, or entirely abandoned after an unexpected reviewer comment. Methods are applied with scientific rigor and just a dash of caffeine-fueled optimism. Results are presented with the hope that they mean something, and conclusions are drawn with the confidence of someone who has rewritten them five times. In the end, this work contributes a small but sincere piece to the grand puzzle of human knowledge—and proves that persistence, curiosity, and a decent version control system can carry one far.

Keywords
word1, word2

Sammanfattning

Träutensilierna i ett tryckeri äro ingalunda en oviktig faktor, för trevnadens, ordningens och ekonomiens upprätthållande, och dock är det icke sällan som sorgliga erfarenheter göras på grund af det oförstånd med hvilket kaster, formbräden och regaler tillverkas och försäljas Kaster som äro dåligt hopkomna och af otillräckligt.

Nyckelord
word1, word2

Acknowledgment

First and foremost, I would like to express my sincere gratitude to my advisor for invaluable guidance and support throughout this research. Thanks also to my colleagues, whose engaging discussions and insightful comments have greatly improved my work.

Special appreciation goes to Donald Knuth, whose pioneering contributions to computer science and meticulous attention to detail continue to inspire me and countless researchers.

Finally, I would like to thank my family and friends for their unwavering support and encouragement throughout this journey.

This work was partially supported by the Wallenberg AI, Autonomous Systems and Software Program (WASP) funded by the Knut and Alice Wallenberg Foundation.

Sincerely,

Tekla Andersson
Stockholm, June 11, 2025

List of included papers

Contributions This doctoral dissertation consists of two parts. The first part provides an overview of the research field on which I focused and a summary of my contributions to it. The second part comprises the contributions that I have made to this research field through published works and patent applications.

Paper A **It's Turtles All the Way Down: Debugging the Universe One Bit at a Time**, Tekla Andersson and Grace Hopper. In Journal of Theoretical Computation, 2021

Paper B **Poetic Algorithms: A Symphonic Approach to Machine Creativity**, Tekla Andersson and Ada Lovelace. In Proceedings of the 10th International Conference on Computational Whimsy, 2019

Paper C **Code Like a Nun: Structured Programming and Silent Reflection**, Tekla Andersson and Mary Keller. 2020

Patent applications In addition to academic papers, several patent applications have been submitted. Please note that this is not a comprehensive list, as some patent filings might not be public yet and due to the time frame considered.

Patent 1 Some patent

Other contributions by the author not included in the thesis.

Paper D **From Macy's Basement to Mainframe Optimization: Retail Origins of Compiler Theory**, Tekla Andersson and Frances E. Allen. In Journal of Optimized Computing, 2022

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Acronyms

KTH KTH Royal Institute of Technology 3

Terminology

PhD A Doctor of Philosophy — not necessarily in philosophy, and not the kind of doctor that helps in medical emergencies. Involves surviving years of existential dread, caffeine-fueled research, explaining your thesis to confused relatives, and convincing yourself that writing 300 pages on a niche topic is a good idea. 3

Introduction

1 Introduction

This template is for PhD thesis documents at KTH. For writing mathematical texts see [5].

1.1 Heading 2

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2 Background

2.1 Heading 2

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3 Materials and methods

3.1 Nice examples

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See (3.1.1) to (3.1.3) for equations, Figures 3.1.1 and 3.1.2a for figures, Listing 3.1 for a listing and Table 3.1.1 for a table.

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{3.1.1}$$

$$\mathbf{A}\boldsymbol{x} = \boldsymbol{b} \tag{3.1.2}$$

$$\int_a^b f(x)\,\mathrm{d}x = \lim_{\|\Delta x\| \to 0} \sum_{i=1}^{n} f(x_i^\star)\,\Delta x_i. \tag{3.1.3}$$

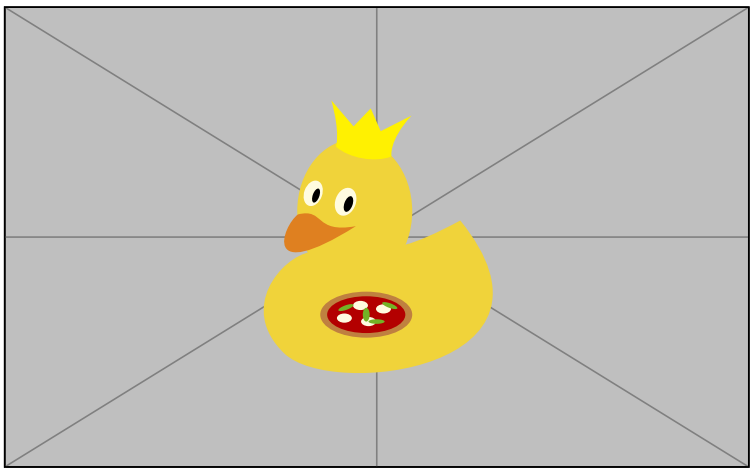
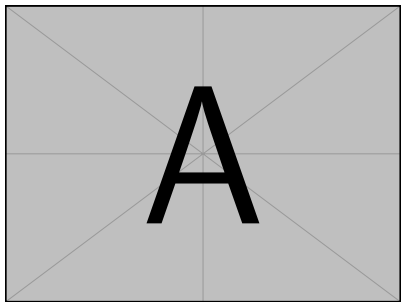


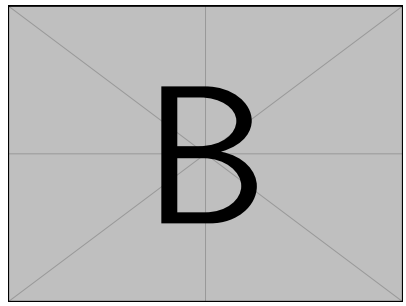
Figure 3.1.1: Placeholder figure. Description of figure.

Table 3.1.1: Summary of results.

Item		
Animal	Description	Price ($)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99



(a) First image



(b) Second image

Figure 3.1.2: Two subfigures side by side.

Listing 3.1: Example Python listing

```python
def greet(name):
    print(f"Hello, {name}!")

greet("Alice")
```

4 Results

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5 Conclusions and future work

5.1 Concluding remarks

This is the end.

5.2 Future Research Directions

6 Points of perspective

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[1] Tekla Andersson and Grace Hopper. “It’s Turtles All the Way Down: Debugging the Universe One Bit at a Time”. In: *Journal of Theoretical Computation* 42.1 (2021), pp. 1–23. DOI: 10.1234/jtc.2021.0042.

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[5] Donald E. Knuth, Tracy Larrabee, and Paul M. Roberts. *Mathematical Writing*. Vol. 14. MAA notes. Mathematical Association of America, 1989.

Appended papers

Paper A

Paper A

It's Turtles All the Way Down: Debugging the Universe One Bit at a Time

TEKLA ANDERSSON AND GRACE HOPPER

Published in
Journal of Theoretical Computation

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Paper B

Paper B

Poetic Algorithms: A Symphonic Approach to Machine Creativity

TEKLA ANDERSSON AND ADA LOVELACE

Published in
Proceedings of the 10th International Conference on Computational Whimsy

Paper C

Paper C

Code Like a Nun: Structured Programming and Silent Reflection

TEKLA ANDERSSON AND MARY KELLER

Published in

A Something Extra

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