University of Johannesburg

Masters Dissertation

A NEAT Inspired GEP Algorithm

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A dissertation submitted in fulfillment of the requirements for the degree of Msc in Computer Science

in the

Faculty of Science

Academy of Computer Science and Software Engineering

> “It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change. In the struggle for survival, the fittest win out at the expense of their rivals because they succeed in adapting themselves best to their environment.”
>
> — Charles Darwin

Acknowledgements

I would like to sincerely thank my supervisor, Prof Coulter, for his guidance and support throughout this research. His expertise and feedback were invaluable.

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1. Introduction

1.1 Publications Resulting from this Work

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2. Sectioning Examples

2.1 Section Title

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2.1.1 Subsection Title

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Unnumbered Subsection

Unnumbered Subsubsection

3. In-text Element Examples

3.1 Referencing Publications

This statement requires citation [0]; this one is more specific [0, page 162].

3.2 Link Examples

This is a URL link: LaTeX Templates. This is an email link: example@example.com. This is a monospaced URL link: `https://www.LaTeXTemplates.com`.

3.3 Lists

Lists are useful to present information in a concise and/or ordered way.

3.3.1 Numbered List

1. First numbered item
    a. First indented numbered item
    b. Second indented numbered item
        i. First second-level indented numbered item
2. Second numbered item
3. Third numbered item

3.3.2 Bullet Point List

- First bullet point item
  - First indented bullet point item
  - Second indented bullet point item
    - First second-level indented bullet point item
- Second bullet point item
- Third bullet point item

3.3.3 Descriptions and Definitions

Name Description

Word Definition

Comment Elaboration

3.4 International Support

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3.5 Ligatures

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4. Mathematics

4.1 Theorems

4.1.1 Several equations

This is a theorem consisting of several equations.

Theorem 4.1 — Name of the theorem. In $E = \mathbb{R}^n$ all norms are equivalent. It has the properties:

$$\big|||\mathbf{x}|| - ||\mathbf{y}||\big| \leq ||\mathbf{x} - \mathbf{y}|| \tag{4.1}$$

$$||\sum_{i=1}^{n} \mathbf{x}_i|| \leq \sum_{i=1}^{n} ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \tag{4.2}$$

4.1.2 Single Line

This is a theorem consisting of just one line.

Theorem 4.2 A set $\mathscr{D}(G)$ in dense in $L^2(G)$, $|\cdot|_0$.

4.2 Definitions

A definition can be mathematical or it could define a concept.

Definition 4.1 — Definition name. Given a vector space E, a norm on E is an applica-

tion, denoted $||\cdot||$, E in $\mathbb{R}^+ = [0, +\infty[$ such that:

$$||\mathbf{x}|| = 0 \;\Rightarrow\; \mathbf{x} = \mathbf{0} \tag{4.3}$$

$$||\lambda \mathbf{x}|| = |\lambda| \cdot ||\mathbf{x}|| \tag{4.4}$$

$$||\mathbf{x} + \mathbf{y}|| \leq ||\mathbf{x}|| + ||\mathbf{y}|| \tag{4.5}$$

4.3 Notations

▪ **Notation 4.1** Given an open subset G of $\mathbb{R}^n$, the set of functions φ are:

1. Bounded support G;
2. Infinitely differentiable;

a vector space is denoted by $\mathscr{D}(G)$.

4.4 Remarks

This is an example of a remark.

R The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

4.5 Corollaries

Corollary 4.1 — Corollary name. The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

4.6 Propositions

4.6.1 Several equations

Proposition 4.1 — Proposition name. It has the properties:

$$\big|\,||\mathbf{x}|| - ||\mathbf{y}||\,\big| \leq ||\mathbf{x} - \mathbf{y}|| \tag{4.6}$$

$$||\sum_{i=1}^{n} \mathbf{x}_i|| \leq \sum_{i=1}^{n} ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \tag{4.7}$$

4.6.2 Single Line

Proposition 4.2 Let $f,g \in L^2(G)$; if $\forall \varphi \in \mathscr{D}(G)$, $(f,\varphi)_0 = (g,\varphi)_0$ then $f = g$.

4.7 Examples

4.7.1 Equation Example

▪ **Example 4.1** Let $G = \{x \in \mathbb{R}^2 : |x| < 3\}$ and denoted by: $x^0 = (1,1)$; consider the function:

$$f(x) = \begin{cases} e^{|x|} & \text{si } |x-x^0| \leq 1/2 \\ 0 & \text{si } |x-x^0| > 1/2 \end{cases} \tag{4.8}$$

The function f has bounded support, we can take $A = \{x \in \mathbb{R}^2 : |x-x^0| \leq 1/2+\varepsilon\}$ for all $\varepsilon \in]0;5/2-\sqrt{2}[$. ▪

4.7.2 Text Example

▪ **Example 4.2 — Example name.** Aliquam arcu turpis, ultrices sed luctus ac, vehicula id metus. Morbi eu feugiat velit, et tempus augue. Proin ac mattis tortor. Donec tincidunt, ante rhoncus luctus semper, arcu lorem lobortis justo, nec convallis ante quam quis lectus. Aenean tincidunt sodales massa, et hendrerit tellus mattis ac. Sed non pretium nibh. Donec cursus maximus luctus. Vivamus lobortis eros et massa porta porttitor. ▪

4.8 Exercises

Exercise 4.1 This is a good place to ask a question to test learning progress or further cement ideas into students' minds. ▪

4.9 Problems

Problem 4.1 What is the average airspeed velocity of an unladen swallow?

4.10 Vocabulary

Define a word to improve a students' vocabulary.

▪ **Vocabulary 4.1 — Word.** Definition of word.

5. Presenting Information and Results with a Long Chapter Title

5.1 Table

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Treatments	**Response 1**	**Response 2**
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table 5.1: Table caption.

Referencing Table 5.1 in-text using its label.

5.2 Figure

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Treatments	**Response 1**	**Response 2**
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table 5.2: Floating table.

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Figure 5.1: Figure caption.

Referencing Figure 5.1 in-text using its label.

Figure 5.2: Floating figure.

Bibliography

Articles

[0] A. B. Jones and J. M. Smith. “Article Title”. In: *Journal title* 13.52 (Mar. 2022), pages 123–456. DOI: 10.1038/s41586-021-03616-x (cited on page 15).

Books

[0] J. M. Smith and A. B. Jones. *Book Title*. 7th. Publisher, 2021 (cited on page 15).

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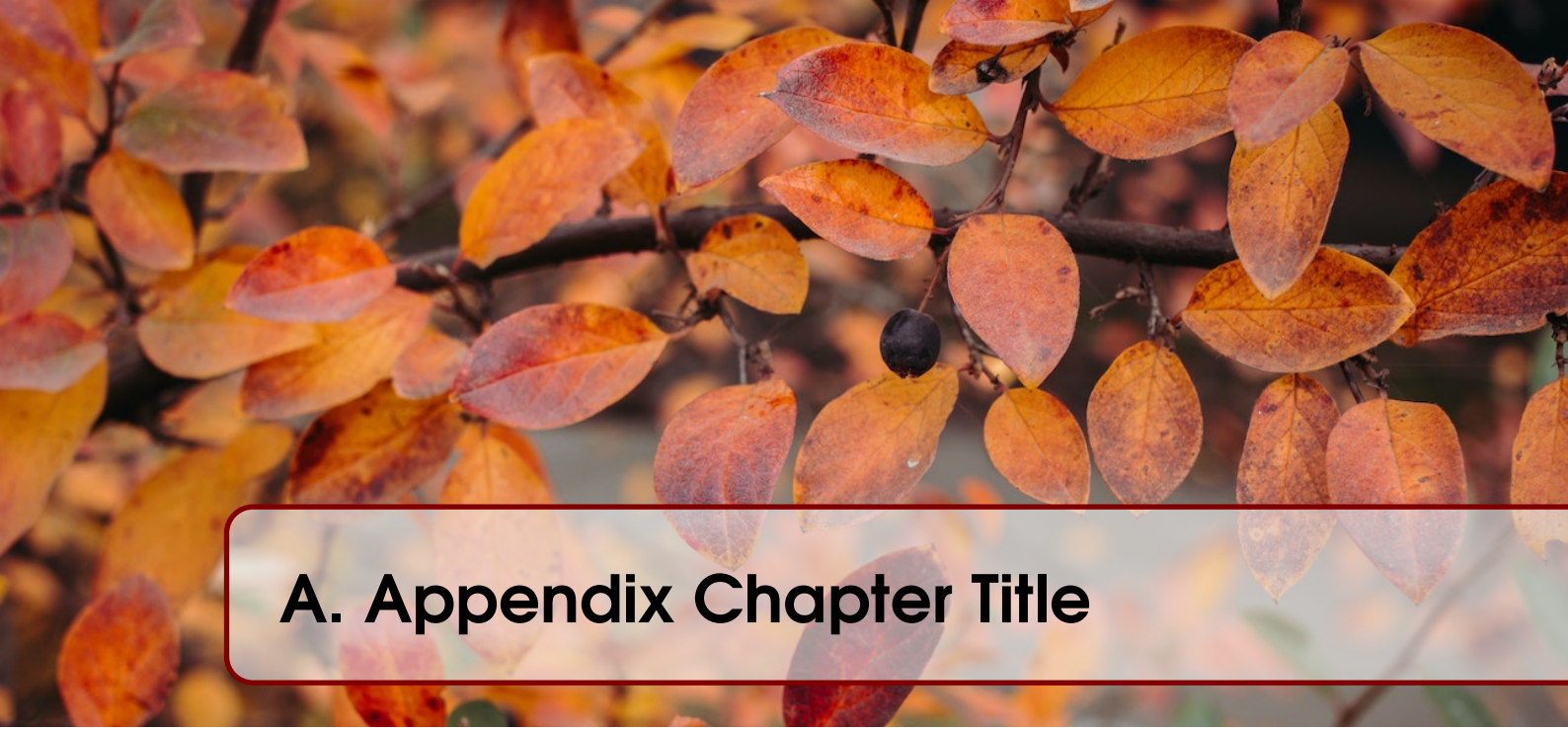

A. Appendix Chapter Title

A.1 Appendix Section Title

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B.1 Appendix Section Title

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