

Keen: Kotlin Genetic Algorithms Framework

*Thesis for the degrees of
Civil Engineer in Computer Science
and
Master of Science in Computing*



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Abstract

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Chapter 1

Theoretical Background

1.1 Evolutionary Algorithms

In the field of computational intelligence, evolutionary algorithms (EA) [1] are a family of algorithms inspired by the process of natural selection. They are part of the larger field of evolutionary computation,¹ which is a subfield of metaheuristics.²

1.2 Genetic Algorithms

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¹See definition A.1

²See definition A.2

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1.3 Genetic Programming

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Chapter 2

Relevant Work (State of the Art)

2.1 Agile Artificial Intelligence in Pharo

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2.2 *DEAP*

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2.4 *ECJ*

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2.5 *GeneticSharp*

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Chapter 3

Introduction

3.1 Motivation

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3.2 Hyphotesis and Research Questions

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3.4 Methodology

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3.5 Structure

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Chapter 4

Keen: Kotlin Evolutionary Algorithms Framework

4.1 Introduction

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4.2 Architecture

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4.3 Genetic Algorithms

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4.4 Genetic Programming

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4.5 Parallelism

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4.6 Extensibility

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4.7 Conclusion

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Chapter 5

Case Study: OneMax

5.1 Introduction

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5.2 Problem Description

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5.4 Results

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5.5 Conclusion

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Chapter 6

Case Study: Knapsack Problem

6.1 Introduction

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6.2 Problem Description

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Chapter 7

Case Study: Crash Reproduction

7.1 Introduction

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7.4 Results

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Chapter 8

Conclusions

8.1 Summary

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8.2 Contributions

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Appendix A

Glossary

In this appendix we present a glossary of terms used throughout this document that may not be familiar to the reader, but are not explained in the main text due to their common use in the field.

E

Definition A.1 (Evolutionary computation). Family of algorithms for global optimization inspired by the process of natural selection.

This typically involves processes mimicking natural selection, mutation, recombination, and survival of the fittest. The solutions to a problem are encoded as a set of “individuals” in a “population”. Over multiple generations, these individuals are selected and modified (via genetic operators like crossover and mutation) in order to find better solutions.

M

Definition A.2 (Metaheuristics). Problem-independent algorithmic method that yields a sufficiently good solution within reasonable time for an optimization problem, especially for complex problems where an exact solution is not crucial.

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