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# Genetic Algorithms and Machine Learning for Programmers

Create AI Models and Evolve Solutions

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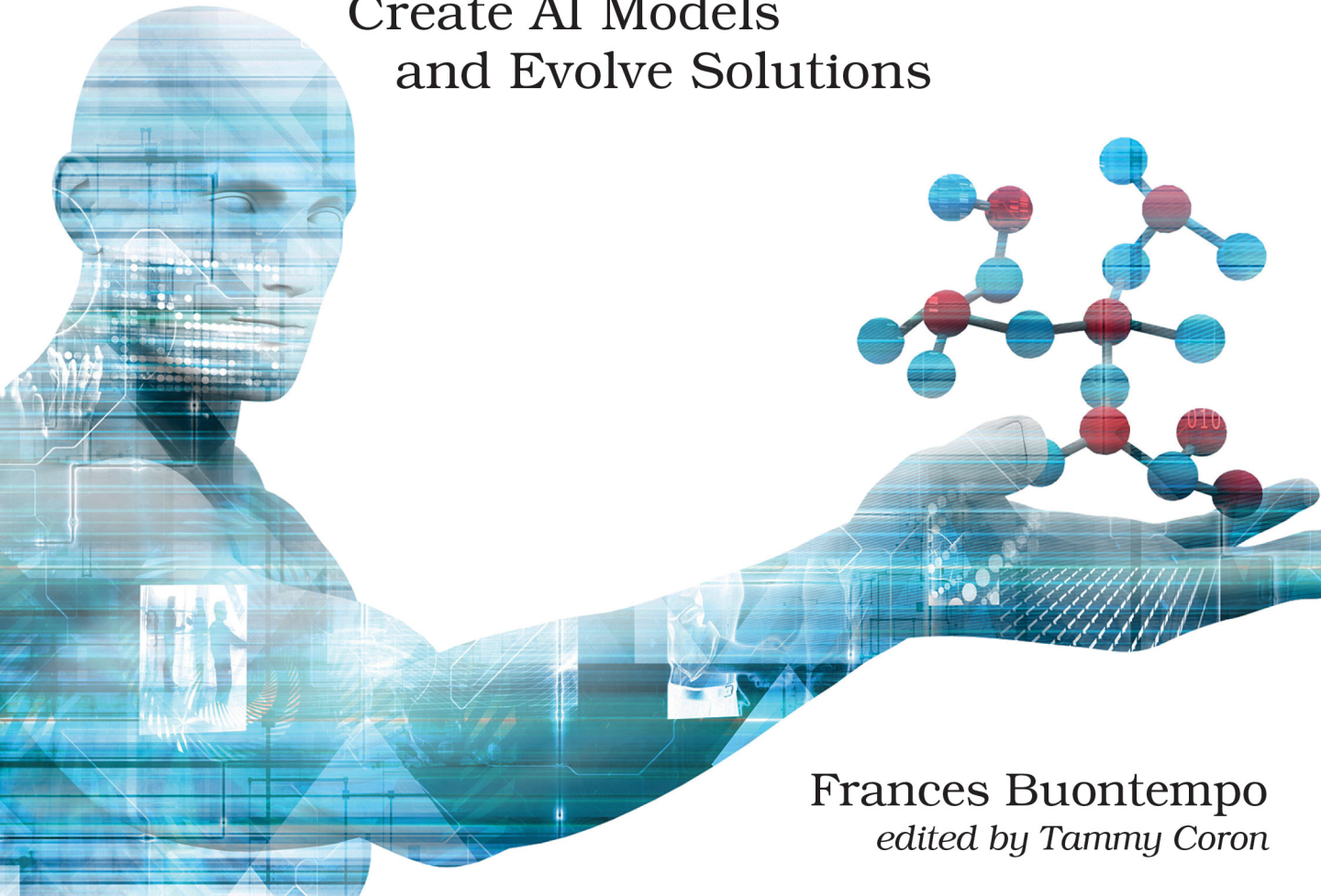
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The  
Pragmatic  
Programmers

# Genetic Algorithms and Machine Learning for Programmers

Create AI Models  
and Evolve Solutions



Frances Buontempo  
*edited by Tammy Coron*

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# Preface

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Have you ever heard the term, “Coding your way out of a paper bag,”? In this book, you’ll do exactly that. In each chapter, you’ll examine different machine learning techniques that you can use to programmatically get particles, ants, bees, and even turtles out of a paper bag. While the metaphor itself may be silly, it’s a great way to demonstrate how algorithms find solutions over time.

## Who is This Book for?

If you’re a beginner-to-intermediate programmer keen to understand machine learning, this book is for you. Inside its pages, you’ll create genetic algorithms, nature-inspired swarms, Monte Carlo simulations, cellular automata, and clusters. You’ll also learn how to test your ML code as you dive into even more advanced topics.

Experts in machine learning may still enjoy the “programming out of a paper bag” metaphor, though they are unlikely to learn new things.

## What’s In This Book?

In this book, you will:

- Use heuristics and design fitness functions
- Build genetic algorithms
- Make nature-inspired swarms with ants, bees and particles
- Create Monte Carlo simulations
- Investigate cellular automata
- Find minima and maxima using hill climbing and simulated annealing
- Try selection methods, including tournament and roulette wheels
- Learn about heuristics, fitness functions, metrics, and clusters

You’ll also test your code, get inspired to try new problems, and work through scenarios to code your way out of a paper bag—an important skill for any competent programmer. Beyond that, you’ll see how the algorithms explore

and learn by creating visualizations of each problem. Let this book inspire you to design your own machine learning projects.

## Online resources

You may find the code for this book on the book's main page<sup>1</sup> at the Pragmatic Bookshelf website.

The code throughout this book uses C++ ( $\geq$  C++11), Python (2.x or 3.x) and JavaScript (using the HTML5 canvas). It also uses matplotlib and some open source libraries, including SFML, Catch and Cosmic-Ray. These plotting and testing libraries are not required but their use will give you a fuller experience. Armed with just a text editor and compiler/interpreter for your language of choice, you can still code along from the general algorithm descriptions.

## Acknowledgments

I would like to thank Kevlin Henny, Pete Goodliffe and Jaroslaw Baranowski who encouraged me as I started thinking about this book. Furthermore, I would like to thank the technical reviewers, Steve Love, Ian Sheret, Richard Harris, Burkhard Kloss, Seb Rose, Chris Simons and Russel Winder, who gave up lots of spare time to point out errors and omissions in early drafts. Any remaining mistakes are my own.

**Frances Buontempo**

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1. <https://pragprog.com/book/fbmach/genetic-algorithms-and-machine-learning-for-programmers>