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Computational Intelligence

A Methodological Introduction

Second Edition

With contributions from Frank Klawonn
and Christian Moewes

Springer

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Preface

Computational Intelligence comprises concepts, paradigms, algorithms, and implementations of systems that are supposed to exhibit intelligent behavior in complex environments. It relies heavily on sub-symbolic, predominantly nature-analog or atleast nature-inspired methods. These methods have the advantage that they tolerate incomplete, imprecise and uncertain knowledge and thus also facilitate finding solutions that are approximative, manageable and robust at the same time.

The choice of topics in this book reflects the most important fields in the area of computational intelligence. Classical fields such as *artificial neural networks*, *fuzzy systems*, and *evolutionary algorithms* are described in considerable detail. However, methods such as *ant colony optimization* and *probabilistic graphical models* are discussed as well, although a complete coverage of all approaches and developments is clearly impossible to achieve in a single volume.

Rather than to strive for completeness, our goal is to give a methodical introduction to the area of Computational Intelligence. Hence we try not only to present fundamental concepts and their implementations, but also explain the theoretical background of proposed problem solutions. In addition, we hope to convey to a reader what is necessary in order to apply these methods successfully.

In the second edition we paid tribute to recent developments in computational intelligence. We also considered the helpful remarks of our readers while revising the book. In addition to the previous edition you can find the new chapters on swarm intelligence and new sections on deep learning, fuzzy data analysis, and decision graphs.

This textbook is primarily meant as a companion book for lectures on the covered topics in the area of computational intelligence. However, it may also be used for self-study by students and practitioners from industry and commerce. This book is based on notes of lectures, exercise lessons, and seminars

that have been given by the authors for many years. On the book's website http://www.computational-intelligence.eu/ a lot of additional material for lectures on neural networks, evolutionary algorithms, fuzzy systems and Bayesian networks can be found, including module descriptions, lecture slides, and exercises.

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