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Introduction

Genetic and evolutionary computation (GEC) is now attracting considerable interest, since the first algorithms were developed some 30 years ago. Although often regarded as a theoretical pursuit, research and development of a wide range of real-world applications of GEC has long been evident at conferences and in the scientific literature. Medicine and healthcare is no exception and the challenge, and worthy aim, has motivated many to apply GEC to a wide range of clinical problems.

The aim of this book is to provide an overview of the range of GEC techniques being applied to medicine and healthcare, in a context that is supportive not only for existing GEC practitioners, but also for those from other disciplines, particularly health professionals. This encompasses doctors, consultants and other clinicians, as well as those who act in a technical role in the health industry, such as medical physicists, technicians and those who have an interest in learning more with a view to implementing systems or just understanding them better. Consequently, a concise introduction to genetic and evolutionary computation is required, and this has been provided in Chapter 2 for those readers who are not familiar with the more common paradigms of GEC.

It was also felt important that an overview of recent work should be reported as concisely and fully as practically possible, and this has been provided in Chapter 3. The problem with any review is that, despite the best efforts of the author, it is outdated, incomplete and unbalanced as soon as it has been published. It is also impossible to know which papers are going to be of future significance, for the individual or community as a whole, regardless of the subject, author or source of publication. There is also the risk

Genetic and Evolutionary Computation: Medical Applications Edited by Stephen L. Smith and Stefano Cagnoni

that the review becomes too cumbersome to maintain the reader's interest, comprising an endless list of summaries with little structure or context. For these reasons, this review has adopted two guiding principles. Firstly, it is limited to the last five years of publications, as it is felt that this will encompass very recent approaches and yet previous work of merit will have been refined, extended or combined with other techniques and reported in more recent publications. Secondly, no distinction has been made on the grounds of source of publication, whether it is a journal, conference or workshop presentation. It is anticipated, however, that all papers will have been peer reviewed to provide some level of confidence in the work presented. The overriding aim of the review is to stimulate thought on how techniques investigated to date may be used to the reader's advantage.

The main component of this book is a set of nine case examples on the application of GEC to different areas of medicine, which have been grouped into three chapters covering medical imaging, the analysis of medical data sets, and medical modelling, diagnosis and treatment. This is by no means a representative selection, but one that conveys the breadth of techniques employed. The source of these contributions has been the Genetic and Evolutionary Computation Conference (GECCO) Workshop on Medical Applications of Genetic and Evolutionary Computation (MedGEC), which has been part of GECCO since 2005. The Workshop has provided a valuable venue for reporting work, often in early stages of development, but which has then matured to be published in GEC journals – notable examples are special issues in the journal *Genetic Programming and Evolvable Machines* and the *Journal of Artificial Evolution and Applications*.

The final chapter of this book will then consider the future of medical applications of GEC, the opportunities, challenges and rewards that practitioners face.