

PREFACE

The past few years have witnessed a rapid growth in the number and variety of applications of fuzzy logic, ranging from consumer products and industrial process control to medical instrumentation, information systems, and decision analysis. The foundations of fuzzy logic have become firmer and its impact within the basic sciences has become more visible and more substantive.

In a wide sense, fuzzy logic is more or less synonymous with the theory of fuzzy sets, i.e., a theory of classes with unsharp boundaries. It is in this sense that any field X can be fuzzified — and hence generalized — by replacing the concept of a crisp set in X by a fuzzy set. What is gained through fuzzification is greater generality, higher expressive power, and enhanced ability to model real-world problems.

The notion of soft computing has emerged recently; it concerns modes of computing in which imprecision is traded for tractability, robustness, ease of implementation, and lower solution cost. The main components of soft computing are fuzzy logic, neural networks, probabilistic reasoning, genetic algorithms, chaos theory, and parts of learning theory. A natural evolution in soft computing has been the emergence of hybrid systems, which is of particular interest when combining fuzzy logic with neural networks or, more recently, with genetic algorithms.

Genetic algorithms are search algorithms based on the mechanics of natural selection and natural genetics; they use a computationally simulated version of survival of the fittest, acting on string structures. Genetic algorithms are iterative procedures which maintain a population of candidate solutions to optimize a fitness function. The fitness function, an evaluation function in a search problem, can be nonlinear and discontinuous. Genetic algorithms are not based on gradient search and they can avoid local minima problems: they search large spaces efficiently without the need of derivative information. They have been applied to several classes of search and optimization problems, with impressive results.

The papers presented in this volume address applications combining fuzzy logic and genetic algorithms in soft computing perspectives. Applications of these combined fields cover fuzzy logic control (helicopter flight, intelligent robots, active suspension; cell recognition; level of water tanks; ball-and-beam); neural networks and fuzzy inference (function approximation, fuzzy classification, and medical diagnosis; fraud detection); information retrieval (query optimization); interactive genetic algorithm (cartoon face search); cognitive feedback (medical diagnosis). Furthermore, an extensive annotated bibliography of fuzzy logic–genetic algorithms is included.

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