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PREFACE

The appearance of a computer with huge memory is probably one of the most remarkable technological developments during the past two decades. We are now in the stage that sofisticated utilization of computers could make constructing an intelligent machine possible.

The study of artificial intelligence has been extensively done by many researchers. However, in spite of their efforts, its present state of development is still in its infancy. Active researches are now needed in order to utilize it for human welfare.

A concept of a learning automaton operating in an unknown random environment is one of the most important models that simulates an intelligent behavior of living beings. It was originally introduced by Tsetlin [T4], and since then, developed by many researchers. Since this model is fairly general, it would find various application areas.

This monograph presents some recent developments in the learning automata theory which are mainly concerned with the learning behaviors of stochastic automata under unknown multi-teacher environments. Although learning behaviors of stochastic automata have been considered quite extensively, almost all of the researches so far have dealt with only learning behaviors of stochastic automata under single teacher environment. Those researches should be extended in order to be applied to the problems (which we encounter considerably often) where one action elicits multi-responses from unknown multi-criteria environments. This monograph extends the researches having been obtained and deals with learning behaviors of stochastic automata under general multi-teacher environments.

Much of the research reported in this monograph is my recent work, and some part appears here for the first time. Chapter 2 deals with the learning behav-

iors of stochastic automata under unknown stationary multi-teacher environment. In Chapter 3, the learning behaviors of stochastic automata under nonstationary multi-teacher environment are discussed. Chapter 4 and Chapter 5 are concerned with the applications of the learning behaviors of stochastic automata. In particular, Chapter 4 deals with the parameter self-optimization problem with noise-corrupted, multi-objective functions as an application of learning behaviors of stochastic automata operating in an unknown nonstationary multi-teacher environment. Chapter 5 has no direct connections with the topics being dealt in this monograph. However, it deals with an application to the cooperative game by using the concept of the hierarchical structure automata which would become one of the most important tools in the near future. In the appendix, the learning behaviors of the hierarchical structure stochastic automata operating in the general multi-teacher environments are discussed.

If this monograph could make any contributions to the literature of learning automata and stimulate discussions among the researchers, it should give me a great pleasure.

It is a pleasure to acknowledge the encouragement of my teachers, Prof. Y. Sawaragi, Prof. T. Soeda, and Prof. T. Shoman. I am also indebted to my students Mr. H. Takeda and Mr. Y. Wajima for their assistance in preparing the manuscript. Finally, I would like to express my gratitude to my family, my father Yoshiyuki, my mother Fumiko, my wife Michiyo, and our children Hiroaki and Ayako for their encouragement and patience.

September 1984

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