

Preface

Data Mining and Multi-agent Integration aims to reflect state-of-the-art research and development of *agent mining interaction and integration* (for short, agent mining).

The book was motivated by increasing interest and work in the agents data mining, and vice versa. The interaction and integration comes about from the intrinsic challenges faced by agent technology and data mining respectively; for instance, multi-agent systems face the problem of enhancing agent learning capability, and avoiding the uncertainty of self-organization and intelligence emergence. Data mining, if integrated into agent systems, can greatly enhance the learning skills of agents, and assist agents with predication of future states, thus initiating follow-up action or intervention. The data mining community is now struggling with mining distributed, interactive and heterogeneous data sources. Agents can be used to manage such data sources for data access, monitoring, integration, and pattern merging from the infrastructure, gateway, message passing and pattern delivery perspectives. These two examples illustrate the potential of agent mining in handling challenges in respective communities.

There is an excellent opportunity to create innovative, dual agent mining interaction and integration technology, tools and systems which will deliver results in one new technology. For example, if an open complex agent system is powered with actionable knowledge discovery capabilities, it then has the potential to deal with very complex problem solving with super-intelligent information processing, knowledge discovery, collective intelligence emergence, and actionable decision-making skills in complex environments. Currently, systems of this magnitude are not possible without the integration of agents and data mining.

This book, as the first in this area, does not intend to cover the field of agent mining. Rather, it features the latest methodological, technical and practical progress on promoting the successful use of agent mining. In 22 chapters, the book reflects state-of-the-art agent mining research and development. The book is divided into three parts. Part I provides an introduction to agents and data mining integration. Part II addresses data mining-driven agents, and Part III focuses on agent-driven data mining.

Part I has three introductory chapters. Chapter One presents a comprehensive introduction to interaction and integration of agents and data mining, which covers driving forces, disciplinary frameworks, agent-driven distributed data mining, data mining driven agents, mutual issues in agent mining, applications and case studies, trends and directions, and agent-mining community development. Chapter Two presents a brief overview of agent mining interaction, and two case studies. Chapter Three provides a survey on agent-based distributed data mining.

Part II has nine chapters outlining the latest progress and techniques for data mining driven agents. Chapter Four explores agent behavior by particle swarm optimization based web usage clustering. Chapter Five enhances agent learning through mining temporal patterns of agent behavior. Chapter Six summarizes the use of Web and structure mining to form an agent system which detects user interaction information. Chapter Seven presents an e-commerce-oriented distributed recommender system with peer profiling and selection strategy. Chapter Eight uses multi-class classification to build a multi-agent-based intrusion detection system. Chapter Nine proposes genetic algorithms and regular expressions to automatically learn about software entities. Chapter 10 proposes a words weight vectors driven network module for establishing and maintaining a knowledge network. Chapter 11 proposes goal mining of query logs for commonsense knowledge to equip intelligent agents. Chapter 12 proposes an agent-based interactive diagnostic workbench with diagnostic rules.

In Part III, we present 10 chapters on agents-driven data mining. Chapter 13 proposes an extensible multi-agent data mining system powered by association rule and classification. Chapter 14 proposes an anytime multi-agent approach to on-line unsupervised learning, which handles continuous agglomerative hierarchical clustering of streaming data. Chapter 15 proposes an agent system utilizing a divide and conquer approach and data dependent schemes for clustering large data. Chapter 16 proposes a multi-ant colony and a multi-objective clustering algorithm by combining the results of all colonies. Chapter 17 proposes an interactive environment for psychometrics diagnostics, where agents supervise the users actions and data mining for searching of potentially interesting information. Chapter 18 uses static agent to execute mine firewall policy rules, and mobile agent to exploit optimized rules to detect eventual anomalies. Chapter 19 uses game-theory modeling for competitive knowledge extraction, hierarchical knowledge mining, and Dempster-Shafer result combination. Chapter 20 discusses a normative multi-agent enriched data mining architecture and ontology frameworks. Chapter 21 presents static and dynamic agent societies responsible for group formation, to execute a data mining classification process. Chapter 22 describes an agent based video contents identification scheme using a watermark based filtering technique.

This book is directed to students, researchers, engineers and practitioners in both the agent and data mining areas, who are interested in the marriage of agents with data mining, or are experiencing challenges in one area that could be managed by incorporating the other technology. The book will also be of interest to students and researchers in many related areas such as machine learning, artificial intelligence, intelligent systems, knowledge engineering, human-computer interaction, intelligent

information processing, decision support systems, knowledge management, organizational computing, social computing, complex systems, and soft computing.

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