

Adaptation, Learning, and Optimization

Volume 22

Series editors

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The role of adaptation, learning and optimization are becoming increasingly essential and intertwined. The capability of a system to adapt either through modification of its physiological structure or via some revalidation process of internal mechanisms that directly dictate the response or behavior is crucial in many real world applications. Optimization lies at the heart of most machine learning approaches while learning and optimization are two primary means to effect adaptation in various forms. They usually involve computational processes incorporated within the system that trigger parametric updating and knowledge or model enhancement, giving rise to progressive improvement. This book series serves as a channel to consolidate work related to topics linked to adaptation, learning and optimization in systems and structures. Topics covered under this series include:

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Computational Intelligence in Sports

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Preface

Sport can be defined in two different contexts, i.e. broader and narrower. From the broader context, it is treated as physical activity in general [1]. In line with this, the aim of sport is to improve fitness, well being, social relationships, and competition. In the narrower context, sport is a formalized, competitive, and physical type of play [2]. The formalization of sport means that:

- Rules are set, controlled and monitored by organizations.
- Only professional athletes can maintain the tempo demanded by high-level competitions throughout the season.
- Every athlete's performance can be measured in some way.
- Acceptable equipment and tools are strictly defined and monitored.
- Competitors have the same formal rights to claim the prize if they win regardless of gender, color of skin, political/religious affiliation, or the country for which they play.

Unfortunately, the only accepted norm in sport today is competitiveness, where players must play to win. This is possible only when both opponents are at the similar skill level. When this is not the case, the weaker opponent may try to win using strategy, which may be legal or illegal. For instance, a weaker soccer team plays defensively against the stronger team. While this runs counter to the Coubertain philosophical ideal "The important thing in life is not the triumph but the struggle", it is nonetheless all too fully in accordance with industrial capitalist society, which looks on sport as production, where winning is connected with material values. Finally, sport is referred to as a physical activity, where intellectual values are not given priority of place, as they are in certain other types of games (e.g., chess).

Sport cannot be dealt with outside of its social context. We might even say that modern sport is a form of surrogate religion and popular theater, in which people identify with the champions. Moreover, people make these champions into heroes in order to escape the banality of ordinary life for a little while. Typically, high-moral values such as honor, decency, courage, and loyalty are ascribed to these idols. However, there is another side to the story. If these disseminate heroes

inadvertently become ensnared in corruption, dealing drugs or betting scandals, their social position falls and they become the target of sharp criticism, as happened to cyclist Lance Armstrong.

This book focuses on the bright side of sport and deals with it primarily in its broader context. Nowadays, a sedentary lifestyle is a characteristic of the majority of people. A lack of activity causes obesity and loss of fitness. Moreover, the lifestyle of modern teenagers primarily involves sitting in front of computers, playing video games, and accessing mobile network sites and messengers. Mobile multimedia devices in particular have taken on a central role in the life of today's youth [3]. As a result, a mobile youth culture has emerged, where young people find an adequate form of exertion and reinforcement.

Transition from a classical network society caused by the spread of networked digital information and communication technologies to a personal communication based on mobile multimedia devices has caused challenges in social behavior as well. However, each behavioral change or even emerging new so-called mobile youth culture has brought with it risks as well as benefits. The more important risks of this culture are as follows:

- visual distraction by watching a mobile phone screen instead of the road while driving
- loss of control of vehicle due to redirection of attention to mobile phone
- use of mobile phone at all times and in all places distracts young people from more important activities and duties (e.g., studying)
- direct communication between people is declining due to the overuse of mobile technologies, where socializing has been replaced by virtual and much more impersonal communication

Actually, sport has an opportunity to help solve both these problems by helping sedentary people to be healthy and to feel fit, and offset the negative effects of mobile youth culture. Sport starts to play an important role in people's lives as early as the teenage years. Thus, physical education in schools increases the level of physical development. Playing in a team, for instance, becomes an excellent lesson in accepting loss and winning gracefully.

Later, individuals must decide for themselves whether to continue to engage in a specific sport or not. Typically, this decision is determined by costs, such as the renting of facilities, in the case of team sports, or hiring a trainer in the case of individuals. On the other hand, numerous mass individual sports (e.g., marathon, triathlon, etc.) have emerged recently that do not demand any athletic facilities and are therefore suitable for the modern individual athletes.

There still remains a lot of decision-making actions of trainers during the training process. However, their services are not cheap. That is why in this book, we put forth the concept of an artificial sports trainer based on computational intelligence algorithms that could render the real (human) trainer less relevant and give recreational athletes (especially teenagers and sedentary people) who could not afford the real trainers the opportunity to train under professional-level guidance. However, this

does not mean that the real trainer would be replaced by the artificial one in all elements of the training. Rather, the artificial trainer is an intelligent system that would be used in analyzing the big data generated during training sessions and making the proper decisions about furthering the athlete's development.

A lot of researchers have begun looking into sport domain recently. Unfortunately, they have discovered what a hard nut to crack it is, especially for beginners without the necessary domain-specific knowledge. This book is an attempt to help all researchers to get into the sport more quickly. The book is also intended to help students of computer science to recognize how computational intelligence algorithms could be applied in solving the problems that occur in sport.

The book is divided into four parts. In the first part, the relationship between sport and science is elucidated. The social aspect of sport is discussed in Chap. 1. Chapter 2 reviews the state of knowledge discovery from data in sport. The first part concludes with Chap. 3, which provides an overview of pervasive computing in sport, i.e., technology that radically changes human lives and obviously has a big impact on the development of modern sport.

The relationship between human beings and sport is analyzed in the second part. In line with this, Chap. 4 focuses especially on principles of human movement, where those functional systems in the human body are described that are responsible for the motion. This chapter reveals how sports training can influence the functional systems that enable the athletes to improve their performance.

The third part deals with the relationship between training and computational intelligence. Initially, a theory of sports training is introduced in Chap. 5. Then, in Chap. 6, the concept of the artificial sports trainer is introduced.

The last part focuses on the applications of computational intelligence in sport. At first, the problem of generating sports training plans is presented in Chap. 7. Chapter 8 deals with the adaptation of training plans due to unexpected events disrupting the normal realization of the training plan (e.g., injury, illness, burnout and so on). The subject of Chap. 9 is BatMiner, which is capable of association rule mining. These rules serve to help identify the characteristics of an athlete in the training process. Chapter 10 is devoted to a visualization of sports training sessions, where the modern visualization approaches are applied. The last application described in Chap. 11 touches upon the problem of sports nutrition, where the dietary plan construction, based on the existed sports training plan, is illustrated using differential evolution.

Maribor, Slovenia
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Contents

Part I Sport and Science

1	Introduction	3
1.1	Sport and Society	3
1.1.1	Deviance in Sports	6
1.1.2	Violence in Sports	6
1.1.3	Gender Inequality in Sports	7
1.1.4	Racism and Ethnicity in Sports	7
1.1.5	Economics in Sports	7
1.1.6	Politics in Sports	8
1.1.7	Religion in Sports	9
1.2	History of Sports	9
1.2.1	Modern Sports	11
1.2.2	Extreme Sports	12
1.3	Sports Science	13
1.3.1	Sociology in Sport	14
1.3.2	Philosophy of Sport	15
1.3.3	Psychology of Sport	16
1.3.4	Physiology	17
1.3.5	Biomechanics	18
1.3.6	Coaching Science	20
1.3.7	Physical Activity and Health	22
1.3.8	Strength and Conditioning	23
1.3.9	Sports Nutrition	24
	References	25
2	Knowledge Discovery in Sport	27
2.1	Introduction	27
2.2	Architecture of Knowledge Discovery Applications in Sport	30
2.2.1	Association Rule Mining	31

- 2.3 Computational Intelligence 32
 - 2.3.1 Evolutionary Algorithms 35
 - 2.3.2 Swarm Intelligence 38
 - 2.3.3 Particle Swarm Optimization 42
 - 2.3.4 Firefly Algorithm 43
- 2.4 Computational Intelligence Algorithms in Sport 45
 - 2.4.1 Data Acquisition 46
 - 2.4.2 Data Mining Applications 47
 - 2.4.3 Intelligent Sport Systems 47
- References 48
- 3 Pervasive Computing in Sport 53**
 - 3.1 Introduction 53
 - 3.2 Sensors and Wearable Technologies 54
 - 3.2.1 How to Measure? 55
 - 3.2.2 How to Be Deployed? 59
 - 3.2.3 How to Transmit Data? 60
 - 3.2.4 How to Use Energy? 61
 - 3.3 Internet Of Things 62
 - 3.3.1 Radio-Frequency Identification 63
 - 3.3.2 Wireless Sensor Networks 64
 - 3.3.3 Global Positioning System 65
 - 3.4 Pervasive Applications in Sport 66
 - 3.4.1 Performance Analysis Applications 67
 - 3.4.2 Applications in Sports Training 69
 - 3.4.3 Referee Decision-Making Applications 71
 - 3.4.4 Applications for Leisure and Entertainment 72
 - 3.5 Future Sport 74
 - References 75
- Part II Human in Sports**
- 4 Principles of Human Movement 83**
 - 4.1 Anatomy and Physiology of Human Movement 83
 - 4.2 Skeletal System 84
 - 4.2.1 Bone Types 86
 - 4.2.2 Joints 87
 - 4.3 Muscular System 88
 - 4.3.1 The Macro-structure of the Skeletal Muscle 88
 - 4.3.2 The Micro-structure of the Skeletal Muscle 88
 - 4.3.3 Fast Versus Slow Muscle Fibers 89
 - 4.3.4 Molecular Mechanism of Muscle Contraction 89
 - 4.4 Nervous System 90
 - 4.5 Respiratory system 92

- 4.6 Cardiovascular System 93
- 4.7 Energy Processes in the Human Body 94
 - 4.7.1 Energy Systems 95
 - 4.7.2 Energy Systems and Sports 99
- References 100

Part III Sports Training and Computational Intelligence

- 5 Theory of Sports Training 103**
 - 5.1 Introduction to Sports Training 103
 - 5.2 Fundamentals of Sports Training Theory 105
 - 5.2.1 Training Load 106
 - 5.2.2 Physical Stress 110
 - 5.2.3 Performance Analysis 113
 - 5.2.4 Adaptation of Sports Training 114
 - 5.3 Phases of Sports Training 115
 - 5.3.1 Planning 115
 - 5.3.2 Realization 116
 - 5.3.3 Control 117
 - 5.3.4 Evaluation 118
 - References 118
- 6 Design and Implementation of an Artificial Sports Trainer 121**
 - 6.1 Introduction 121
 - 6.2 Model of Real Sports Training 122
 - 6.3 Design of the Artificial Sports Trainer 124
 - 6.4 Implementation of the Artificial Sports Trainer 127
 - 6.4.1 Planning with AST 128
 - 6.4.2 Realization of Sports Training with AST 129
 - 6.4.3 Controlling Sports Training Sessions Using AST 132
 - 6.4.4 Evaluation of the Training Process Using AST 133
 - 6.5 Future Challenges in Developing AST 134
 - References 134

Part IV Applications of Computational Intelligence in Sports

- 7 Generating Training Plans Based on Existing Sports Activities . . . 139**
 - 7.1 Introduction 139
 - 7.2 Planning the Training Sessions 140
 - 7.2.1 Identification and Preprocessing 141
 - 7.2.2 Optimization 142
 - 7.2.3 Visualization 150

7.3	Experiments	150
7.3.1	Experimental Design	151
7.3.2	Algorithm Design	153
7.3.3	Test Problems	154
7.3.4	Measurements and Statistics	155
7.4	Results	156
7.4.1	Analysis of Results Obtained by Cyclist 1	156
7.4.2	Analysis of Results Obtained by Cyclist 2	165
7.4.3	Analysis of Results Obtained by Runner 1	171
7.5	Conclusion	176
	References	179
8	Adaptation of Training Plans	181
8.1	Introduction	181
8.2	Background Information	182
8.2.1	Overload	183
8.2.2	Adaptation of the Training Plan	184
8.2.3	Specificity	185
8.2.4	Reversibility	185
8.3	Problem Description	185
8.4	Materials and Methods	186
8.4.1	The Training Plan in the Case-Study	186
8.4.2	The PSO for Adapting the Training Plan	189
8.5	Experiments and Results	192
8.5.1	Evaluation of the Results with Regard to Boundary Functions	193
8.5.2	A Deeper Analysis of Boundary Functions	198
8.5.3	Discussion	199
8.6	Conclusion	199
	References	200
9	BatMiner for Identifying the Characteristics of Athletes in Training	201
9.1	Introduction	201
9.2	Developing BatMiner for Association Rule Mining	203
9.2.1	Data Pre-processing	203
9.2.2	Feature Extraction	205
9.2.3	Model Building	207
9.3	Experiments and Results	211
9.3.1	Algorithm Design	211
9.3.2	Creating a Training Database	212
9.3.3	Transaction Dataset	213

- 9.3.4 Measurements and Statistics 213
 - 9.3.5 Model Verification 214
 - 9.3.6 Discussion 219
 - 9.4 Conclusion 219
 - References 220
- 10 Visualization of Sports Activities Created by Wearable Mobile Devices 223**
 - 10.1 Introduction 223
 - 10.2 Theoretical Background 225
 - 10.3 Glyph-Based Visualization 227
 - 10.3.1 Domain Analysis 228
 - 10.3.2 Visual Design 231
 - 10.3.3 Evaluation 238
 - 10.4 Experiments and Results 239
 - 10.4.1 Visualization of the Short Training Session 240
 - 10.4.2 Visualization of the Time-Trial Cycling Competition 241
 - 10.4.3 Visualization of the Endurance Training in Cycling 242
 - 10.4.4 Visualization of the Running Competition 242
 - 10.4.5 Discussion 243
 - 10.5 Conclusion 244
 - References 245
- 11 Sports Nutrition 247**
 - 11.1 Introduction 247
 - 11.2 Background Information 249
 - 11.3 Automatic Construction of Sports Dietary Plans 253
 - 11.3.1 Input Datasets 254
 - 11.3.2 Differential Evolution for Sports Dietary Plan Construction 257
 - 11.4 Experiments and Results 265
 - 11.4.1 Case-Study: Macro-nutrition Requirement Estimation and Formulation of Nutrient Recommendation 267
 - 11.4.2 Case-Study: Basic Translation of Nutrient Recommendations into Actual Food Selection 268
 - 11.4.3 Case-Study: Advanced Translation of Nutrient Recommendations into Actual Foods 269
 - 11.4.4 Discussion 273
 - 11.5 Conclusion 275
 - References 276