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Machine Learning Paradigms

Advances in Learning Analytics

Springer

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To our beloved daughters, Evina, Konstantina and Andreani

Maria Virvou and George A. Tsihrintzis

To my beloved family

Efthimios Alepis

To my beloved family

Lakhmi C. Jain

Foreword

The recent availability of smaller, more powerful and affordable computing hardware, along with advanced technologies such as artificial intelligence and virtual and augmented reality, is transforming the education and training landscape and shifting it towards a student-centered, technology-enhanced approach that is data intensive. Educators now have access to a large amount of data related to trainees' background and performance. Although the analysis of educational data is not a new phenomenon, these advanced educational technologies are resulting in a large amount of data that may be difficult to interpret and make sense of, particularly in real time.

As a result, one of the sub-disciplines of *Machine Learning*, namely *Learning Analytics*, is emerging as a very active research discipline worldwide. The techniques of Learning Analytics come from a combination of methodologies from Artificial Intelligence, Software Engineering and Big Data, as well as Pedagogical and Psychological Sciences. Learning Analytics is also taking advantage of recent advances in technological infrastructure in Human–Computer Interaction, Communications, the Internet and Mobile Computing. Consequently, Learning Analytics appears as a promising research area with the potential to impact educational processes in the decades to come.

But what is Learning Analytics? As the field is still emerging, it is difficult to define it in a way that covers all of its aspects. However, we can describe Learning Analytics as the field concerned with the collection, advanced processing and useful information extraction from both educators and learners' data with the goal of continuously improving education and learning systems.

In this volume, the Editors have invited internationally respected researchers to examine and present aspects of the emerging field of Learning Analytics and some of its application areas, including

- *Learning Analytics with the purpose to measure Student Engagement, to quantify the Learning Experience and to facilitate Self-Regulation;*
- *Learning Analytics to predict Student Performance;*

- *Learning Analytics incorporated in Tools for Building Learning Materials and Educational Courses; and*
- *Learning Analytics as Tools to support Learners and Educators in Synchronous and Asynchronous e-Learning.*

The book audience includes professors, graduate students, practitioners and researchers in *Advances in Learning Analytics* and other related areas. As such, it is self-contained and its chapters are appropriately grouped into four parts, which correspond to the items in the previous paragraph. An extensive list of references at the end of each chapter guides readers to probe further into application areas of interest to them.

I believe that the Editors have done an outstanding job in addressing the pertinent topics and associated problems. I consider the book to be a great addition to the area of *Advances in Learning Analytics*. I am confident that it will help professors, graduate students, researchers and practitioners to understand and explore further Learning Analytics methods and apply them in real-world systems.

Oshawa, ON, Canada

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Preface

Over the recent years, a new research discipline has been emerging worldwide, which is concerned with the collection, advanced processing and useful information extraction from both educators' and learners' data with the goal of improving and, hopefully, optimizing education and learning systems. This discipline is termed *Learning Analytics* and, despite it being a sub-field of *Machine Learning*, it is evolving into a field of its own.

In this volume, we have invited world-class researchers to examine and present aspects of the emerging field of *Learning Analytics* and some of its application areas, including

(1) Learning Analytics with the purpose to measure Student Engagement, to quantify the Learning Experience and to facilitate Self-Regulation;
(2) Learning Analytics to predict Student Performance;
(3) Learning Analytics incorporated in Tools for Building Learning Materials and Educational Courses; and
(4) Learning Analytics as Tools to support Learners and Educators in Synchronous and Asynchronous e-Learning.

This research book is directed towards professors, researchers, scientists, engineers and students of all disciplines. Extensive bibliography at the end of each chapter guides readers to probe further into their application areas of interest. We hope that they all find it useful in their works and researches.

We are grateful to the authors and the reviewers for their excellent contributions and visionary ideas. We are also thankful to Springer for agreeing to publish this book. Last, but not least, we are grateful to the Springer staff for their excellent work in producing this book.

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