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Ahlame Douzal-Chouakria · José A. Vilar
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Advanced Analysis and Learning on Temporal Data

First ECML PKDD Workshop, AALTD 2015
Porto, Portugal, September 11, 2015
Revised Selected Papers

Springer

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ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Artificial Intelligence
ISBN 978-3-319-44411-6 ISBN 978-3-319-44412-3 (eBook)
DOI 10.1007/978-3-319-44412-3

Library of Congress Control Number: 2016947506

LNCS Sublibrary: SL7 – Artificial Intelligence

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Preface

This book brings together advances and new perspectives in machine learning, statistics, and data analysis on temporal data. Temporal data arise in several domains such as bio-informatics, medicine, finance, and engineering, among many others. They are naturally present in applications covering language, motion, and vision analysis, and particularly in emerging applications such as energy-efficient building, smart cities, dynamic social media, or Internet of Things. Contrary to static data, temporal data are of a complex nature, they are generally noisy, of high dimensionality, they may be nonstationary (i.e., first-order statistics vary with time) and irregular (involving several time granularities), they may have several invariant domain-dependent factors such as time delay, translation, scale, or tendency effects. These temporal peculiarities make limited the majority of standard statistical models and machine learning approaches, that mainly assume *i.i.d.* data, homoscedasticity, normality of residuals, etc. To tackle such challenging temporal data, one appeals for new advanced approaches at the bridge of statistics, time series analysis, signal processing, and machine learning. Defining new approaches that transcend boundaries between several domains to extract valuable information from temporal data will undeniably be a hot topic in the near future, that has, however, been the subject of active research this past decade.

The aim of this book is to present recent challenging issues and advances in temporal data analysis addressed in machine learning, data mining, pattern analysis and statistics. Analysis and learning from temporal data cover a wide scope of tasks including learning metrics, learning representations, unsupervised feature extraction, clustering, and classification. This book is organized as follows. The first part focuses on learning new representations and embeddings for time series classification, clustering, or dimensionality reduction. The second chapter presents several approaches to classification and clustering with challenging applications in medicine or earth observation data. These works show different ways to consider temporal dependency in clustering or classification processes. The last part of the book is dedicated to metric learning and time series comparison, it addresses the problem of speeding up the dynamic time warping or dealing with multimodal and multiscale metric learning for time series classification and clustering. The papers presented were reviewed by at least two independent reviewers, leading to the selection of 11 papers among 22 initial submissions. An index of authors is provided at the end of this book.

The editors are grateful to the authors of the papers selected in this volume for their contributions and for their willingness to respond so positively to the time constraints in preparing the final version of their papers. We are especially grateful to the reviewers, listed herein, for their careful reviews that helped us greatly in selecting the papers

included in this volume. We also thank all the staff at Springer for their support and dedication in publishing this volume in the series–Lecture Notes in Artificial Intelligence.

July 2015

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