

## Preface

We are honored to welcome you to the 1st International Workshop on Advanced Analytics and Learning on Temporal Data (AALTD), which is held in Porto, Portugal, on September 11th, 2015, co-located with The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2015).

The aim of this workshop is to bring together researchers and experts in machine learning, data mining, pattern analysis and statistics to share their challenging issues and advance researches on temporal data analysis. Analysis and learning from temporal data cover a wide scope of tasks including learning metrics, learning representations, unsupervised feature extraction, clustering and classification.

This volume contains the conference program, an abstract of the invited keynote and the set of regular papers accepted to be presented at the conference. Each of the submitted papers was reviewed by at least two independent reviewers, leading to the selection of seventeen papers accepted for presentation and inclusion into the program and these proceedings. The contributions are given by the alphabetical order, by surname. An index of authors can be also found at the end of this book.

The keynote given by Gustavo Camps-Valls on “Capturing Time-Structures in Earth Observation Data with Gaussian Processes” focuses on machine learning models based on Gaussian processes which help to monitor land, oceans, and atmosphere through the estimation of climate and biophysical variables.

The accepted papers spanned from innovative ideas on analytic of temporal data, including promising new approaches and covering both practical and theoretical issues. Classification of time series, estimation of graphical models for temporal data, extraction of patterns from audio streams, searching causal models from longitudinal data and symbolic representation of time series are only a sample of the analyzed topics. To introduce the reader, a brief presentation of the problems addressed at each of papers is given below.

A novel approach to analyze the evolution of a disease incidence is presented by Andrade-Pacheco *et al.* The method is based on Gaussian processes and allows to study the effect of the time series components individually and hence to isolate the relevant components and explore short term variations of the disease. Bailly *et al.* introduce a series classification procedure based on extracting local features using the Scale-Invariant Feature Transform (SIFT) framework and then building a global representation of the series using the Bag-of-Words (BoW) approach. Billard *et al.* propose to highlight the main structure of multiple sets of multivariate time series by using principal component analysis where the standard correlation structure is replaced by lagged cross-autocorrelation. The symbolic representation of time series SAXO is formalized as a hierarchical coclustering approach by Bondu *et al.*, evaluating also its compactness in terms

of coding length. A framework to learn an efficient temporal metric by combining several basic metrics for a robust  $k$ NN is introduced by Do *et al.* Dupont and Marteau introduce a sparse version of Dynamic Time Warping (DTW), called coarse-DTW, and develop an efficient algorithm (Bubble) to sparse regular time series. By coupling both mechanisms, the nearest-neighbor classification of time series can be performed much faster.

Gallicchio *et al* study the balance assessment of elderly people with time series acquired with a Wii Balance Board. A novel technique to estimate the well-known Berg Balance Scale is proposed by using a Reservoir Computing network. Gibberd and Nelson address the estimation of graphical models when data change over time. Specifically, two extensions of the Gaussian graphical model (GGM) are introduced and empirically examined. Extraction of patterns from audio data streams is investigated by Hardy *et al* considering a symbolization procedure combined with the use of different pattern mining methods. Jain and Spiegel propose a strategy to classify time series consisting of transforming the series into a dissimilarity representation and then applying PCA followed by an SVM. Kreml addresses the problem of forecasting the density at spatio-temporal coordinates in the future from a sample of pre-fixed instances observed at different positions in the feature space and at different times in the past. Two different approaches using spatio-temporal kernel density estimation are proposed. A fuzzy  $C$ -medoids algorithm to cluster time series based on comparing estimated quantile autocovariance functions is presented by Lafuente-Rego and Vilar.

A new algorithm for discovering causal models from longitudinal data is developed by Rahmadi *et al.* The method performs structure search over Structural Equation Models (SEMs) by maximizing model scores in terms of data fit and complexity, showing robustness for finite samples. Salperwyck *et al* introduce a clustering technique for time series based on maximizing an inter-inertia criterion inside parallelized decision trees. An anomaly detection approach for temporal graph data based on an iterative tensor decomposition and masking procedure is presented by Sapienza *et al.* Soheily-Khah *et al* perform an experimental comparison of several progressive and iterative methods for averaging time series under dynamic time warping. Finally, Sorokin extends the factored gated restricted Boltzmann machine model by adding discriminative component, thus enabling it to be used as a classifier and specifically to extract translational motion from two related images.

In sum, we think that all these contributions will provide valuable feedback and motivation to advance research on analysis and learning from temporal data. It is planned that extended versions of the accepted papers will be published in a special volume of Lecture Notes of Artificial Intelligence (LNAI).

We wish to thank the ECML PKDD council members for giving us the opportunity to hold the AALTD workshop within the framework of the ECML PKDD Conference and the members of the local organizing committee for their support. Also our gratitude to several colleagues that helped us with the organi-

zation of the workshop, particularly Saeid Soheily (Université Grenoble Alpes, France).

The organizers of the AALTD conference gratefully thank the financial support of the “Programme d’Investissements d’Avenir” of the French government through the IKATS Project as well as the support received from LIG-AMA, IRISA, MODES, Université Joseph Fourier and Universidade da Coruña.

Last but not least, we wish to thank the contributing authors for the high quality works and all members of the Reviewing Committee for their invaluable assistance in the selection process. All of them have significantly contributed to the success of AALTD 2105.

We sincerely hope that the workshop participants have a great and fruitful time at the conference.

September, 2015

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