

Efficient regularized least-squares algorithms for conditional ranking on relational data

Tapio Pahikkala · Antti Airola · Michiel Stock ·
Bernard De Baets · Willem Waegeman

Received: 2 December 2011 / Accepted: 10 April 2013 / Published online: 7 June 2013
© The Author(s) 2013

Abstract In domains like bioinformatics, information retrieval and social network analysis, one can find learning tasks where the goal consists of inferring a ranking of objects, conditioned on a particular target object. We present a general kernel framework for learning conditional rankings from various types of relational data, where rankings can be conditioned on unseen data objects. We propose efficient algorithms for conditional ranking by optimizing squared regression and ranking loss functions. We show theoretically, that learning with the ranking loss is likely to generalize better than with the regression loss. Further, we prove that symmetry or reciprocity properties of relations can be efficiently enforced in the learned models. Experiments on synthetic and real-world data illustrate that the proposed methods deliver state-of-the-art performance in terms of predictive power and computational efficiency. Moreover, we also show empirically that incorporating symmetry or reciprocity properties can improve the generalization performance.

Editors: Eyke Hüllermeier and Johannes Fürnkranz.

T. Pahikkala (✉) · A. Airola
Department of Information Technology and Turku Centre for Computer Science, University of Turku,
20014 Turku, Finland
e-mail: Tapio.Pahikkala@utu.fi

A. Airola
e-mail: Antti.Airola@utu.fi

M. Stock · B. De Baets · W. Waegeman
Department of Mathematical Modelling, Statistics and Bioinformatics, Ghent University,
Coupure links 653, 9000 Ghent, Belgium

M. Stock
e-mail: michiel.stock@ugent.be

B. De Baets
e-mail: Bernard.DeBaets@ugent.be

W. Waegeman
e-mail: willem.waegeman@ugent.be