DA2PL'2012

from Multiple Criteria Decision Aid to Preference Learning

PROGRAM

Thursday November 15th, 2012

9h00 Registration

9h15 Welcoming Address

9h30 Session 1

– Invited speaker : "*Preference Learning : an Introduction*",
Eyke Hüllermeier,
Department of Mathematics and Computer Science, Philipps-Universität Marburg, Germany

The topic of "preferences" has recently attracted considerable attention in artificial intelligence in general and machine learning in particular, where the topic of preference learning has emerged as a new, interdisciplinary research field with close connections to related areas such as operations research, social choice and decision theory. Roughly speaking, preference learning is about methods for learning preference models from explicit or implicit preference information, typically used for predicting the preferences of an individual or a group of individuals. Approaches relevant to this area range from learning special types of preference models, such as lexicographic orders, over "learning to rank" for information retrieval to collaborative filtering techniques for recommender systems. The primary goal of this tutorial is to survey the field of preference learning in its current stage of development. The presentation will focus on a systematic overview of different types of preference learning problems, methods and algorithms to tackle these problems, and metrics for evaluating the performance of preference models induced from data.

10h30 Coffee break

11h00 Session 2

– "*A New Rule-based Label Ranking Method*",
M. Gurrieri[1], X. Siebert[1], Ph. Fortemps[1], S. Greco[2] and R. Slowinski[3]
[1] MATHRO, Faculté Polytechnique, U-MONS,
[2] University of Catania, Italy,
[3] Poznan University of Technology, Poland
This work focuses on a particular application of preference ranking, wherein the problem is to learn a mapping from instances to rankings over a finite set of labels, i.e. label ranking. Our approach is based on a learning reduction technique and provides such a mapping in the form of logical rules : if [antecedent] then [consequent], where [antecedent] contains a set of conditions, usually connected by a logical conjunction operator (AND) while [consequent] consists in a

ranking (linear order) among labels. The approach presented in this paper mainly comprises four phases : preprocessing, rules generation, classification and ranking generation.

– "*Preference-based clustering of large datasets*",
A. Olteanu[1] and R. Bisdorff[1]
[1] Université du Luxembourg
Clustering has been widely studied in Data Mining literature, where, through different measures related to similarity among objects, potential structures that exist in the data are uncovered. In the field of Multiple Criteria Decision Analysis (MCDA), this topic has received less attention, although the objects in this case, called alternatives, relate to each other through measures of preference, which give the possibility of structuring them in more diverse ways. In this paper we present an approach for clustering sets of alternatives using preferential information from a decision-maker. As clustering is dependent on the relations between the alternatives, clustering large datasets quickly becomes impractical, an issue we try to address by extending our approach accordingly.

– "*Learning the parameters of a multiple criteria sorting method from large sets of assignment examples*",
O. Sobrie[1,2], V. Mousseau[1] and M. Pirlot[2]
[1] LGI, Ecole Centrale Paris,
[2] MATHRO, Faculté Polytechnique, U-MONS
ELECTRE TRI is a sorting method used in multiple criteria decision analysis. It assigns each alternative, described by a performance vector, to a category selected in a set of pre-defined ordered categories. Consecutive categories are separated by a profile. In a simplified version proposed and studied by Bouyssou and Marchant and called MR-Sort, a majority rule is used for assigning the alternatives to categories. Each alternative a is assigned to the lowest category for which a is at least as good as the lower profile delimiting this category for a majority of weighted criteria. In this paper, a new algorithm is proposed for learning the parameters of this model on the basis of assignment examples. In contrast with previous work ([7]), the present algorithm is designed to deal with large learning sets. Experimental results are presented, which assess the algorithm performances with respect to issues like model retrieval, computational efficiency and tolerance for error.

– "*A piecewise linear approximation of PROMETHEE II's net flow scores*",
S. Eppe[1] and Y. De Smet[1]
[1] CoDE, Université Libre de Bruxelles
Promethee II is a prominent outranking method that builds a complete ranking on a set of actions by means of pairwise action comparisons. However, the number of comparisons increases quadratically with the number of actions, leading to computation times that may become prohibitive for large decision problems. Practitioners generally seem to alleviate this issue by down-sizing the problem, a solution that may not always be acceptable though. Therefore, as an alternative, we propose a piecewise linear model that approximates Promethee II's net ow scores without requiring costly pairwise comparisons : our model reduces the computational complexity (with respect to the number of actions) from quadratic to linear, at the cost of some misranked actions. Experimental results on artificial problem instances show a decreasing proportion of those misranked actions as the problem size increases. This observation leads us to provide empirical bounds above which the Promethee II-ranking of an action set is satisfyingly approximated by our piecewise linear model.

13h00 Lunch

14h30 Session 3

- Invited speaker : "*Principled Techniques for Utility-based Preference Elicitation in Conversational Systems*",
  Paolo Viappiani,

  CNRS-LIP6, Université Pierre et Marie Curie, Paris
  Preference elicitation is an important component of many applications, such as decision support systems and recommender systems. It is however a challenging task for a number of reasons. First, elicitation of user preferences is usually expensive (w.r.t. time, cognitive effort, etc.). Second, many decision problems have large outcome or decision spaces. Third, users are inherently "noisy" and inconsistent.
  Adaptive utility elicitation tackles these challenge by representing the system knowledge about the user in form of "beliefs" about the possible utility functions, that are updated following user responses ; elicitation queries can be chosen adaptively given the current belief. In this way, one can often make good (or even optimal) recommendations with sparse knowledge of the user's utility function.
  We analyze the connection between the problem of generating optimal recommendation sets and the problem of generating optimal choice queries, considering both Bayesian and regret-based elicitation. Our results show that, somewhat surprisingly, under very general circumstances, the optimal recommendation set coincides with the optimal query.

15h30 Coffee break

16h00 Session 4

- "*Using Choquet integral in Machine Learning : what can MCDA bring ?*",
  D. Bouyssou[1], M. Couceiro[1], C. Labreuche[2], J.-L. Marichal[3] and B. Mayag[1]
  [1] CNRS-Lamsade, Université Paris Dauphine,
  [2] Thales,
  [3] Université du Luxembourg.
  In this paper we discuss the Choquet integral model in the realm of Preference Learning, and point out advantages of learning simultaneously partial utility functions and capacities rather than sequentially, i.e., first utility functions and then capacities or vice-versa. Moreover, we present possible interpretations of the Choquet integral model in Preference Learning based on Shapley values and interaction indices.

- "*On the expressiveness of the additive value function and the Choquet integral models*",
  P. Meyer[1] and M. Pirlot[2]
  [1] Institut Télécom, Télécom Bretagne,
  [2] MATHRO, Faculté Polytechnique, U-MONS
  Recent - and less recent - work has been devoted to learning additive value functions or a Choquet capacity to represent the preference of a decision maker on a set of alternatives described by their performance on the relevant attributes. In this work we compare the ability of related models to represent rankings of such alternatives. Our experiments are designed as follows. We generate a number of alternatives by drawing at random a vector of evaluations for each of them. We then draw a random order on these alternatives and we examine whether this order is representable by a simple weighted sum, a Choquet integral with respect to a 2- or 3-additive capacity, an additive value function in general or a piecewise-linear additive value function with

2 or 3 pieces. We also generate non preferentially independent data in order to test to which extent 2- or 3-additive Choquet integrals allow to represent the given orders. The results explore how representability depends on varying the numbers of alternatives and criteria.

– "*Using set functions for multiple classifiers combination*",
F. Rico[1], A. Rolland[1],
[1] Laboratoire ERIC - Université Lumière Lyon
In machine learning, the multiple classifiers aggregation problems consist in using multiple classifiers to enhance the quality of a single classifier. Simple classifiers as mean or majority rules are already used, but the aggregation methods used in voting theory or multi-criteria decision making should increase the quality of the obtained results. Meanwhile, these methods should lead to better interpretable results for a human decision-maker. We present here the results of a first experiment based on the use of Choquet integral, decisive sets and rough sets based methods on four different datasets.

– "*Preference Learning using the Choquet Integral*",
E. Hüllermeier[1]
[1] Department of Mathematics and Computer Science, Philipps-Universität Marburg, Germany
abstract to come

Friday November 16th, 2012

9h Session 5

– Invited speaker : "*Ranking Problems, Task Losses and their Surrogates*",
Krzysztof Dembczynski,
Laboratory of Intelligent Decision Support Systems, Poznan University of Technology

From the learning perspective, the goal of the ranking problem is to train a model that is able to order a set of objects according to the preferences of a subject. Depending on the preference structure and training information, one can distinguish several types of ranking problems, like bipartite ranking, label ranking, or a general problem of conditional rankings, to mention a few. To measure the performance in the ranking problems one uses many different evaluation metrics, with the most popular being Pairwise Disagreement (also referred to as rank loss), Discounted Cumulative Gain, Average Precision, and Expected Reciprocal Rank. These measures are usually neither convex nor differentiable, so it is, in general, infeasible to optimize them directly. Therefore they are sometimes referred to as task losses, and in the learning algorithms one rather employs surrogate losses to facilitate the optimization problem. The question, however, arises whether we can design for a given ranking problem a surrogate loss that will provide a near-optimal solution with respect to a given task loss. For simple ranking problems and some task losses the answer is positive, but it seems that in general the answer is rather negative. During the talk we will discuss several results obtained so far, with the emphasis on the bipartite and multilabel ranking problem and the pairwise disagreement loss, in which case very simple surrogate losses lead to the optimal solution.

10h00 Coffee break + Poster session

– "*Preference Learning to Rank : An Experimental Case Study*", M. Abbas, USTHB, Alger, Algerie

– "*From preferences elicitation to values, opinions and verisimilitudes elicitation*", I. Crevits, M. Labour, Université de Valenciennes,
– "*Group Decision Making for selection of an Information System in a Business Context*", T. Pereira, D.B.M.M Fonte's, Porto, Portugal
– "*Ontology-based management of uncertain preferences in user profiles*", J. Borras, A. Valls, A. Moreno, D. Isern, Universitat Rovira i Virgili, Tarragona
– "*Optimizing on the efficient set. New results*", D. Chaabane, USTHB, Alger, Algerie

11h00 Session 6

– Roundtable : "*From Multiple Criteria Decision Analysis to Preference Learning*"
Participants : E. Hüllermeier, P. Viapianni, K. Dembczynski

12h00 Lunch

13h30 Session 7

– Invited speaker : "*Learning GAI networks*",
Yann Chevaleyre,
LIPN, Université Paris 13

Generalized Additive Independence (GAI) models have been widely used to represent utility functions. In this talk, we will address the problem of learning GAI networks from pairwise preferences. First, we will consider the case where the structure of the GAI network is known of bounded from above. We will see how this problem can be reduced to a kernel learning problem. Then, we will investigate the structure learning problem. After presenting the computational of algorithms can be used to solve this problem.

14h30 Coffee break

15h00 Session 8

– "*On measuring and testing the ordinal correlation between valued outranking relations*",
R. Bisdorff[1],
[1] University of Luxembourg
We generalize Kendall's rank correlation measure to valued relations. Motivation for this work comes from the need to measure the level of ap- proximation that is required when replacing a given valued outranking with a convenient weak ordering recommendation.

– "*Elicitation of decision parameters for thermal comfort on the trains*",
L. Mammeri[1,2], D. Bouyssou[1], C. Galais[2], M. Ozturk[1], S. Segretain[2] and C. Talotte[2]
[1] CNRS-Lamsade, Université Paris-Dauphine, [2] SNCF
We present in this paper a real world application for the elicitation of decision parameters used in the evaluation of thermal comfort in high speed trains. The model representing the thermal comfort is a hierarchical one and we propose to use different aggregation methods for different levels of the model. The methods used are rule-based aggregation, Electre Tri and 2-additive Choquet. We show in this paper the reasons of the choice of such methods and detail the approach used for the elicitation of the parameters of these methods.

– "*Dynamic managing and learning of user preferences in a content-based recommender system*",
L. Marín[1], A. Moreno[1], D. Isern[1] and A. Valls[1]
[2] Universitat Rovira i Virgili, Tarragona

The main objective of the work described in this paper is to design techniques of profile learning to enable a Recommender System to automatic and dynamically adapt preferences stored about the users in order to increase the accuracy of the recommendations. The alternatives (or set of possible solutions to the recommendation problem) are defined by multiple criteria that can be either numerical or categorical. A study of the performance of the whole designed techniques so far is also included.

– "*An algorithm for active learning of lexicographic preferences*",
F. Delecroix[1], M. Morge[1], J.-Chr. Routier[1]
[1] Université Lille 1
At the crossroad of preference learning and multicriteria decision aiding, recent research on preference elicitation provide useful methods for recommendation systems. In this paper, we consider (partial) lexicographic preferences. In this way, we can consider dilemmas and we show that these situations have a minor impact in practical cases. Based on this observation, we propose an algorithm for active learning of preferences. This algorithm solve the dilemmas by suggesting concrete alternatives which must be ranked by the user.

17h00 Closing session