Master Thesis Proposal

How decision making tools based on outranking relations can handle semantic data

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Introduction

The ITAKA research group is focused on the study and development of new methods and applications of multi-criteria decision aid systems (MCDA). We are currently working on the extension of some classical MCDA methods based on outranking relations [1,2]. In particular, the method ELECTRE is being adapted to the treatment of non-numerical variables.

MCDA methods have as input a data matrix with a set of objects in the rows and a set of attributes (or variables) in the columns. Additionally a model of the user preferences is known so that we can evaluate the suitability of the values in the data matrix with respect to the goals (interests, preferences) of the user.

In this Master Thesis we want to study the case of semantic multi-valued attributes, as in the following table. In this case we show 3 different activities for tourists. The activities may be described with different attributes, being one of them the “Type of activity”. Each activity has a list of concepts (tags) that define the kind of activity.

<table>
<thead>
<tr>
<th>Touristic Activities</th>
<th>Type of activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaudi museum</td>
<td>Art, museum, Architecture</td>
</tr>
<tr>
<td>Gaia river</td>
<td>Natural, space, Rural, route, Biking</td>
</tr>
<tr>
<td>Montblanc Cellar</td>
<td>Vineyards, Rural, route, WineTasting</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

When the list of available activities is large (we have catalogued more than a thousand different activities in the Tarragona province) we need tools to automatically analyse these data from a certain user’s perspective in order to recommend him only the subset of activities of his interest.

In this work we will use semantic techniques that are based on ontologies. An ontology is a knowledge structure that defines concepts and their relations. A specific touristic ontology is available for this work. The concepts of the ontology will correspond to the tags that can be used in the data matrix. Therefore, by exploiting the relations in the ontology we can know the similarity between tags. Ontologies can also be used to store the user’s preferences, by associating some numerical scores to the concepts [3].
Up to now, MCDA methods are usually applied to numerical or categorical data. To deal with this new kind of semantic data we need to modify some steps of the classical algorithms. In this work we will study the ELECTRE method, which is based on the definition of so called *outranking* relations [4,5].

The study of this kind of techniques is crucial in the development of a new generation of intelligent recommender systems, based on the interpretation of semantic data, as well as in the improvement of decision support tools in general.

This work is related to the course MCDSS (Multi-Criteria Decision Support Systems) given in the second semester at URV. Students from this course will have a better background to tackle this work, although it is not necessary to take the course to do this thesis.

**Objectives of the master thesis:**

The goal of this master thesis is to use the information about the user preferences and the relationships between the concepts in an ontology to compare the different objects in a data matrix and be able to construct an order between the objects. The method used for comparison and ranking will be ELECTRE.

**Tasks:**

- Study the outranking methods, focusing on ELECTRE.
- Study the characteristics of ontologies and define a way of storing the user preferences in the ontology (on the basis of previous work done at the ITAKA group).
- Define new measures of concordance and discordance to construct outranking relations with semantic attributes.
- Implement these measures in Java and integrate them into a software that is being developed at ITAKA.
- Test the system with real data in collaboration with the Scientific and Technological Research Park in Tourism and Leisure (partner of URV).
- Write a deliverable with the methods developed and the results for the SHADE project.

**References**


