EWG-MCDA
EURO Working Group on Multicriteria Decision Aiding
Groupe de Travail Européen Aide Multicritère à la Décision
NEWSLETTER
BULLETIN

Opinion Makers Section

Survey of Some Communities and Activities in the Field of MCDM

Kaisa Miettinen, President of the International Society on Multiple Criteria Decision Making, president@mcdmsociety.org

Department of Mathematical Information Technology, University of Jyväskylä, Finland and Department of Mathematics, Royal Institute of Technology, Stockholm, Sweden

http:// www.mit.jyu.fi/optgroup/

Introduction

We have many communities in the field of multiple criteria decision making (MCDM). These communities have more or less structured organizations and they work in different ways. In what follows, I survey some them and their main courses of action. The aim is to spread awareness of various activities in particular in the form of conferences and meetings.

Societies and Working Groups

The International Society on Multiple Criteria Decision Making was first a special interest group. It became formally a Society when its bylaws were accepted in 1998. The Society has currently about 1700 members in 97 countries and no membership fees. The main decisions are made by the executive committee. The members of the Society elect the members of the executive committee for four-year terms.

The main activity of the International Society on MCDM is organizing International Conferences on Multiple Criteria Decision Making every two years. The first conference of the series was organized in France in 1975 and the 22nd conference will take place in Malaga in June 2013 (http://www.uma.es/mcdm2013/). Proceedings of the conferences are published either as books or special issues of selected journals.

Further activities of the Society include an electronic newsletter published twice a year and an electronic discussion list MCDM-Discussion. The Society has presented awards at its international conferences since 1992. In 2011, also a new Doctoral dissertation award in MCDM was introduced. The website of the society is http://www.mcdmsociety.org.

A new Section devoted to MCDM was established in INFORMS in 2010. As the International Society on MCDM, the Section has a broad focus and is not, for example, devoted to some particular methods or problems. One of the motivations behind establishing this section was to increase the awareness of MCDM among INFORMS members and in INFORMS meetings. It is most encouraging that the INFORMS Annual Meeting in Charlotte in November 2011 (http://meetings2.informs.org/charlotte2011/) has a strong MCDM cluster with 16 sessions devoted to MCDM. This means that every slot of the conference has an MCDM session.

Elected officers and board members are elected in accordance with process operating concurrently with that of the INFORMS election process. In 2011, the membership due of the MCDM Section has been 5 USD for INFORMS members and 7 USD for others. For more information of this Section, see http://www.informs.org/Community/MCDM.

EURO, the Association of European Operational Research Societies (http://www.euro-online.org), has 30 member societies being national Operational Research Societies. Among many other activities, EURO has 28 working groups devoted to many research areas. Naturally, the Working Group on Multiple Criteria Decision Aiding is

most familiar to the readers of this newsletter! And the name suggests what the working group concentrates on.

EWG-MCDA was created at the first EURO Conference in 1975 and has currently over 350 members and no membership fees. As officers, the Working Group has three coordinators. It has meeting twice a year and the newsletter is also published twice a year. The 75th meeting will be organized in Tarragona, Spain, in April 2012. The website of the Working Group is http://www.cs.put.poznan.pl/ewgmcda/.

Naturally, many other working groups of EURO include interests in multiple criteria decision making. Among them are working groups devoted to decision support systems, group decision and negotiation support, advances in preference handling and continuous optimization, among others. For example, the latter, EUROPT with over 1100 members, has its next annual workshop in Siauliai, Lithuania in July 2012.

Conferences with a Special Focus

The conferences devoted to Evolutionary Multiobjective Optimization (EMO) and MultiObjective Programming and Goal Programming (MOPGP) are both organized every two years but they do not have any society behind them. Instead, the locations of EMO conferences are decided by a steering committee. The first conference was organized in Zurich, Switzerland in 2001 and the 7th conference will take place in Sheffield, UK in 2013. So far, the proceedings of the conferences have always been prepared as a book (published before the conference).

The first MOPGP conference was organized in Portsmouth in 1994 and they have been organized every two years since then with proceedings books. The 9th conference will take place in Niagara Falls, Canada, in June 2012. There is also a website devoted to MOPGP: http://www.mopgp.com/.

In addition to conference series mentioned so far, there are, for example IEEE Symposia on Computational Intelligence in Multicriteria Decision-Making in the field of computational intelligence applied to issues in multiple criteria decision making. They belong to the IEEE Symposium Series on Computational Intelligence. The next Symposium will take place in Singapore in April 2013 (http://www.ntu.edu.sg/home/epnsugan/index_files/SSCI2013/). In addition, International Workshops on Multiple Criteria Decision Making have been organized in Ustron, Poland, every year since 2005 with proceedings books.

There are more focused conferences like International Symposia on the Analytic Hierarchy Process (ISAHP) devoted to AHP and ANP taking place every two years since 1988. The 12th ISAHP symposium will be organized in Kuala Lumpur, Malaysia in 2013.

Collaboration Forums

Among examples of forms of existing collaboration are International Summer Schools on MCDM which have been organized every three years since 1983. Nowadays, they are jointly organized by the International Society on MCDM and the EURO Working Group on MCDA. It has been decided that the 11th International Summer School will be organized in Germany in 2013.

Fruitful collaboration has been established in Dagstuhl seminars (http://www.dagstuhl.de/) devoted to Practical Approaches to Multi-Objective Optimization (http://www.dagstuhl.de/04461, http://www.dagstuhl.de/06501) and Hybrid and Robust Approaches to Multiobjective Optimization (http://www.dagstuhl.de/09041) since 2004. The original objective was to bring together researchers of EMO and MCDM who typically attended different conferences and published in different journals. A lot of joint research has been done ever since and collaboration continues. One of the concrete outcomes is the book Multiobjective Optimization: Interactive and Evolutionary Approaches edited by J. Branke, K. Deb, K. Miettinen and R. Slowinksi, published in 2008 by Springer (http://www.springerlink.com/content/978-3-540-88907-6). The next seminar on Learning in Multiobjective Optimization (http://www.dagstuhl.de/12041) will take place in January 2012.

One of the activities aimed at fostering further development of the MCDM field is the recent restructuring of the editorial processes of the Journal of Multi-Criteria Decision Analysis (http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291099-1360). Nine topic areas were defined and area editors appointed. In addition, to broaden the focus of the journal, the subtitle Optimization, Learning and Decision Support was added to the title.

Experiences from MCDM2011

The 21st International Conference on Multiple Criteria Decision Making (MCDM2011, https://www.jyu.fi/mcdm2011) was held in Jyväskylä in June 2011. The future of the MCDM field looks promising because many young students and doctoral students did attend the conference. Besides, a record was made with over 300 participants in the series of MCDM conferences of the Society.

It was very positive that many researchers and practitioners of various fields applying MCDM methods and approaches did take part in the conference. This really shows that our methods are being needed and used in all sorts of applications. However, a challenge became evident. We should try to make it easier for practitioners applying our methods to enter the MCDM field. Summer Schools are mainly directed for students and doctoral students but we need compact tutorials as a part of our conferences so that people coming with different backgrounds can follow the presentations more easily.

Finally

Surveys like this are doomed to be incomplete and I apologize not being able to include all activities here. Naturally, there are for example many streams and sessions devoted to MCDM in various conferences, special issues and books published and their significance to the field should not be underestimated but they are out of the scope here.

My main objective has been here to spread awareness of various groups and communities. Overall, it would be desirable to find more ways to collaborate and build bridges between communities because we are all dealing with problems involving multiple conflicting criteria. Combining different points of view and approaches can produce valuable new tools to tackle practical problems with decision making. I am sure that we all find it important to further develop our field because there are always new challenges presented by real problems and intriguing applications where our methods can provide significant advantage. Increasing awareness of the potential of MCDM is our joint mission.

MCDA Research Groups

ITAKA

ITAKA (Intelligent Technologies for Advanced Knowledge Acquisition) is a research group of the Department of Computer Science and Mathematics at University Rovira i Virgili (Catalonia, Spain). This university is located in the south of Catalonia, having campus in different cities in this area. We are located at the city of Tarragona, which is the capital of the province.
ITAKA was created in January 2007 by Dr Antonio Moreno and Dr Aïda Valls, following the successful trail left by the Working Group on Multi-Agent Systems (GruSMA) from 2000 to 2006. We have several PhD students and Master students working in our group.
Our background is focused on research in the field of Artificial Intelligence. We have two main lines of research:

- Aggregation operators (Head: Dr. Aida Valls)
  - Multicriteria decision making.
  - Personalisation and recommendation (e.g. dynamic user profile management).
  - Statistical disclosure control.
- Distributed Systems (Head: Dr. Antonio Moreno):
  - Ontology engineering, especially automatic ontology learning.
  - Automated agent-based management of distributed processes, especially enactment of clinical guidelines.
  - Semantic Web knowledge.

A common feature of our research is the interest on the treatment of linguistic information. We are working with different models for the management of uncertainty in categorical and textual data, such as Fuzzy Sets or Ontologies. The results are mainly applied to eHealth, Tourism and Environment Protection. The following projects illustrate the lines of work of our group.

Research projects

We have participated in several Spanish and European research projects. Currently, we lead the Spanish project DAMASK (Data Mining Algorithms with Semantic Knowledge). This project focuses on one of the main limitations of traditional data mining methods: the lack of use of domain knowledge. This project proposes the use of semantic domain knowledge, represented in the form of ontologies, to define new methods for extracting and integrating information from heterogeneous Web resources with varying degrees of structure. On a second stage, we are developing new data mining tools that can perform an automatic clustering of a dataset using the knowledge provided in domain ontologies. Clustering is a useful tool to reduce the dimensionality of the set of alternatives for large data frameworks. The prototypes of the clusters (which must be obtained making a semantic interpretation of the clusters) can be used as representative alternatives. This smaller set of alternatives can then be treated using MCDA methods. The project will test the practical applicability of the developed tools in the strategic area of Tourism, with the construction (with the collaboration of 2 relevant entities in this domain) of a Web application for the personalized recommendation of touristic destinations.
In relation to the field of decision making in Tourism, Dr. Antonio Moreno and Dr. Aida Valls are scientific assessors of the projects SIGTur and EnoSIGTur, which are developed at the Scientific and Technological Research Park for Tourism (PCTTO in Vilaseca, Tarragona). Those projects are focused in providing personalized recommendations through the Web to the visitors of the province of Tarragona. New techniques for online adaptation of the user profile are being developed to achieve updated and accurate recommendations. Novel techniques both for numerical and linguistic values are being studied. The problem of dealing with large sets of

data is also present in these projects. Hybrid content-based and collaborative-based recommendation techniques are used to reduce the list of alternatives.

On another application domain, we collaborate in the Spanish project on Environmental Protection DROUGH, which is devoted to study the effects of the climate change on the services and ecosystems of small rivers (e.g. Francolí river in Tarragona). We have some previous experience in developing tools for environmental impact assessment. In particular, we are currently finishing the deployment of a software tool called SMES, which will be commercialized. SMES is a system that analyses the performance of the combination of sewage sludge on agricultural soils and provides an exhaustive evaluation of the impact of each combination in three dimensions: environmental, social and economical. A combination of fuzzy expert systems and fuzzy aggregation operators is used to solve this MCDA problem.

We participate also in the Decision Deck project. In particular, we intend to implement several aggregation operators as web services for DD. At the moment, a first module has been already constructed, which implements the classic OWA operator (Ordered Weighted Average). However, our aim is to extend this work by developing models for our own aggregation operators, such as the ULOWA and IULOWA operators (see references below). Those operators are based on the non-linear combination based on the order of the arguments, as proposed in OWA, but dealing with qualitative criteria that are evaluated with unbalanced linguistic scales (f.i. the academic grading scale {F,D,C,B,A}).

Finally, we also participate in an especially-distinguished project (distinguished as one of the most important research lines in Spain) which is focused on security and privacy related to computers (ARES-CONSOLIDER project). In this field we are studying new methods for anonymization of linguistic data, mainly using ontology-based intelligent techniques.

With respect to the line of research on Ontology Engineering and Semantic Web, we have a joint project with Manouba University in Tunis. In this project we study how to use the information stored in some ontology to filter and give a structure to the results of Web searches. Then, the results obtained from a certain search are analyzed and used to refine or enlarge the ontology automatically. With this retro-alimented system we are able to improve the quality of the results of the Web search at each step.

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We are currently busy organizing

In the forthcoming months we are organizing some research activities. We invite you to participate in these events.

- Workshop on Agents applied in Health Care. At 4th ICST International Conference on eHealth (e-health 2011) Málaga (Spain), 21-23 November 2011. http://electronic-health.org/

- Special session on Uncertainty in Profiling Systems and Applications. To be held in the International Conference on Information Processing and Management of Uncertainty (IPMU) in Catania, Italy (9 - 13 July 2012). http://www.ipmu2012.unict.it

- Special session on Uncertainty in Privacy and Security. To be held in the International Conference on Information Processing and Management of Uncertainty (IPMU) in Catania, Italy (9 - 13 July 2012). http://www.ipmu2012.unict.it

- 75th Meeting of the European Working Group on MCDA. Topic: MCDA and Artificial Intelligence: connections and challenges. This event will take place at our University in Tarragona. We cordially invite you all to participate and enjoy both the research and the Tarragona touristic city. April, 12-14th, 2012. http://deim.urv.cat/~itaka/CMS4/

- 10th Decision Deck Workshop will be also done in Tarragona, in coordination with the EWGMCDA meeting. It is expected to take place on April 11th, 2011.

Web links

ITAKA web page: http://deim.urv.cat/~itaka/CMS/
DAMASK project web page:
http://deim.urv.cat/~itaka/CMS2/

Forum

Robustness in Portfolio Decision Analysis

Ahti Salo
Aalto University School of Science
Deparment of Mathematics and Systems Analysis
P.O. Box 11100, 00076 Aalto
Finland

Introduction

Portfolio Decision Analysis (PDA) can be briefly defined as the application of decision analysis to the problem of selecting a subset – that is a *portfolio* – from a larger set of available alternatives, with the aim of contributing to the attainment of multiple objectives in the presence of relevant resource and other constraints. These kinds of problems are pervasive in firms and public administration (Kleinmuntz, 2007). For instance, industrial firms invest in research and development (R&D) projects in the expectation that the results allow them to launch new products. Municipalities undertake initiatives to improve the lives of their citizens by delivering educational and health care services. Even many individual decisions can be viewed analogously. All researchers, for instance, must decide which papers to read, realizing that time is a limited resource when seeking to take stock of the burgeoning literature.

PDA problems are often of considerable strategic importance and also more complex than problems where only one out of many alternatives is to be selected. These reasons, among others, have spurred the development of PDA methods that are now widely employed in public administration and industrial firms (see Salo, Keisler and Morton, 2011 for an extensive coverage).

One challenge in applying PDA is that it may be impossible or prohibitively costly to obtain complete information about the decision maker's preferences or the alternatives' performance with regard to multiple criteria. In the context of choose-one-out-of-many– problems, this challenge has been addressed in so-called preference programming methods which admit incomplete information by way of set inclusion. These methods synthesize this information through dominance concepts and decision rules into decision recommendations (see, e.g., Salo and Hämäläinen, 2010; Salo and Punkka, 2005).

2. Robust Portfolio Modelling

Robust Portfolio Modeling (RPM) (Liesiö, Mild and Salo, 2007, 2008) extends the principles of Preference Programming to portfolio problems. In RPM, incomplete information about the decision maker's preference is captured by examining sets of feasible criterion weights while information about the performance of alternatives is modelled through feasible score intervals, defined by lower and upper bounds on the alternatives' criterion-specific scores. The values of individual alternatives and even entire portfolios are modelled by using an additive weighting model.

RPM admits several kinds of constraints, such as (i) budget constraints, (ii) constraints on the availability of non-financial resources such as specialized skills, and (iii)

logical constraints (e.g., some alternatives can be selected only on condition that their enablers are also selected). The portfolios that satisfy all relevant constraints are feasible. The objective is to maximize the overall multicriteria value of the portfolio, subject to the constraints that apply.

However, in the presence of incomplete information, there may not exist a single feasible portfolio that would have the highest portfolio value for all combinations of feasible parameters. Thus, attention can be focused on *non-dominated portfolios*, i.e., portfolios such that there does not exist any other feasible portfolio which would yield (i) at least as much value for all combinations of feasible parameters and (ii) a strictly higher value for some combination of feasible parameters.

RPM features specialized algorithms for the determination of all non-dominated portfolios. It then examines the composition of these portfolios in order to provide decision recommendations. Specifically, the alternatives are categorized into three groups: *core alternatives* which are included in all non-dominated portfolios; *exterior alternatives* which are not included in any non-dominated portfolios; and *borderline alternatives* which are included in some but not in all non-dominated portfolios.

Based on this categorization, the decision maker can be advised to choose core alternatives, because these would belong to the optimum portfolio even if complete information were to be acquired by tightening bounds on score intervals or by choosing any one of the feasible weight vectors. In the save vein, no exterior alternative will enter the optimum portfolio. Thus, the explicit modelling of incomplete information can lead to useful decision recommendations, even if it does not necessarily establish a complete ranking of borderline alternatives.

3. Applications of Robust Portfolio Modelling

To-date, numerous applications have been carried out based on the RPM methdology:

- In a research project funded by the Finnish Road Administration (Finnra), RPM was used to guide the long-term allocation of funds among all road maintenance and road habilitation products (Mild and Salo, 2009). This case study was also one of the four finalists in the Practice Award competition of the INFORMS Decision Analysis Society in 2007.
- In the Foresight Forum of the Ministry of Trade and Industry in Finland, RPM helped screen innovation ideas proposed by more than one hundred leading experts from academia and industry. These ideas were evaluated with regard to three criteria (e.g., feasibility; novelty; societal impacts) to identify those that seemed worthy of further development. As a new feature, the conventional approach of deriving scores by using averages of the experts responses was complemented by using variances as well, in order to explore ideas about which the viewpoints differed most (Könnölä, Brummer and Salo, 2007).

- The development of the Strategic Research Agenda for the Finnish forest industries was supported with a consultation process which involved some 150 leading experts from universities, research organizations, industrial firms and public administration. In each of the five value chains, some 30-40 prospective themes were proposed, whereafter these themes were evaluated with regard to three criteria in order to determine the core themes which seemed particularly promising (Könnölä, Salo and Brummer, 2011).
  - At an international level, RPM has been employed to support the development of research agendas for research programmes funded by agencies from several countries. In a consultation process for the WoodWisdom-Net ERA-NET, well over 300 proposals for prospective themes were submitted by more than 400 participants from 8 countries. These proposals were then evaluated from several complementary perspectives (academic, industrial) by using Internet-based tools. RPM was then employed to develop short-lists of attractive themes which were discussed by managers experts in a workshop setting. The process also helped identify new networks (Brummer, Salo, Nissinen and Liesiö, 2011).
  - At a major telecommunication company, the development of an RPM model guided the allocation of resources to standardization activities. In this model, the uncertainties in the development and standardization phases were explicitly captured, in order to shape adjustments through which the resulting portfolio would become best aligned with opportunities for

commercial success (Toppila, Liesiö and Salo, 2011).

4. Conclusion

Based on experiences from case studies such as those listed above, the identification of core and exterior projects has proven very useful in showing which alternatives should be selected or rejected. This has helped focus efforts towards the elicitation of additional information on alternatives where such information matters most. Seen from this perspective, RPM may reduce the overall costs of information acquisition while allowing the decision maker to exercise her subjective judgement when making choices among borderline projects.

Recently, we have developed RPM-like approaches for portfolio selection in situations where the alternatives' performance may vary across scenarios and where incomplete information about scenario probabilities can be captured through set inclusion (Liesiö and Salo, forthcoming; see also Gustafsson and Salo, 2005). In the context of group decision support, RPM has helped capture the preferences of different stakeholder groups, which in turn has made it possible to identify viable candidates for the portfolio solution (Vilkkumaa, Salo and Liesiö, forthcoming). All in all, there are many avenues for enriching the RPM methodology through new features and for leveraging such features in context of high-impact case studies.

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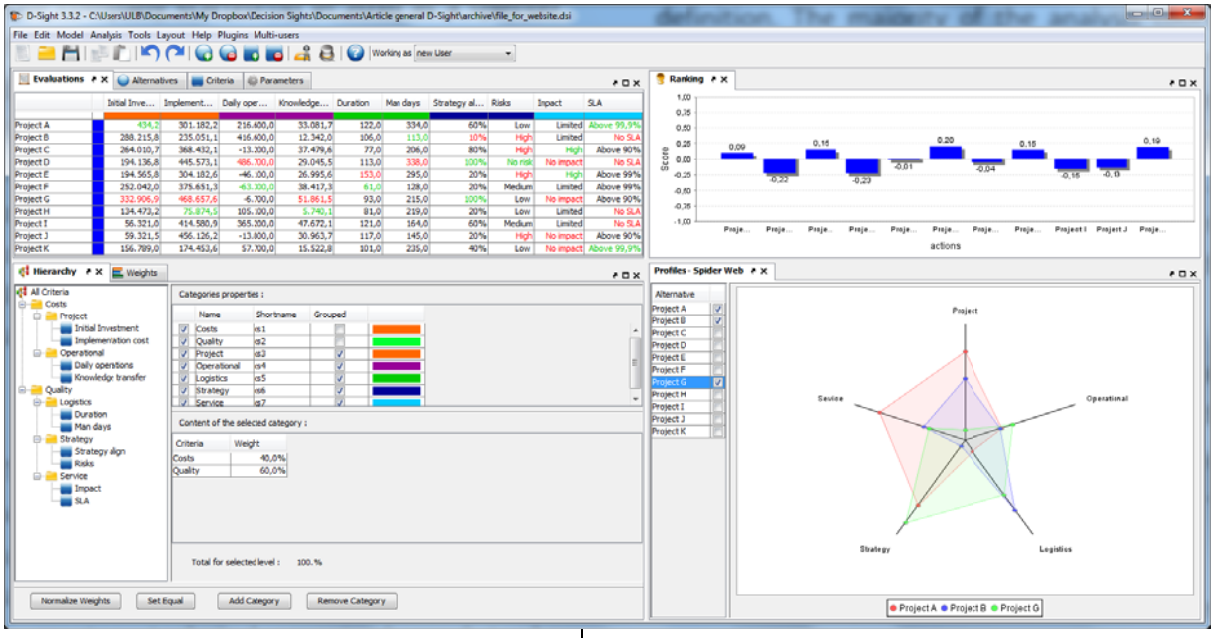
Consultancy Companies

D-Sight

www.d-sight.com

D-Sight is a company offering software and services to help companies and organization improve the way they decide. More particularly, D-Sight is specialized in multi-criteria decision aid. The main product of D-Sight is the D-Sight software. It is offered with different services such as support, training and tailor-made development. Consulting services are also provided by D-Sight in order to help organizations that need help to analyze complex multi-criteria evaluations problems.



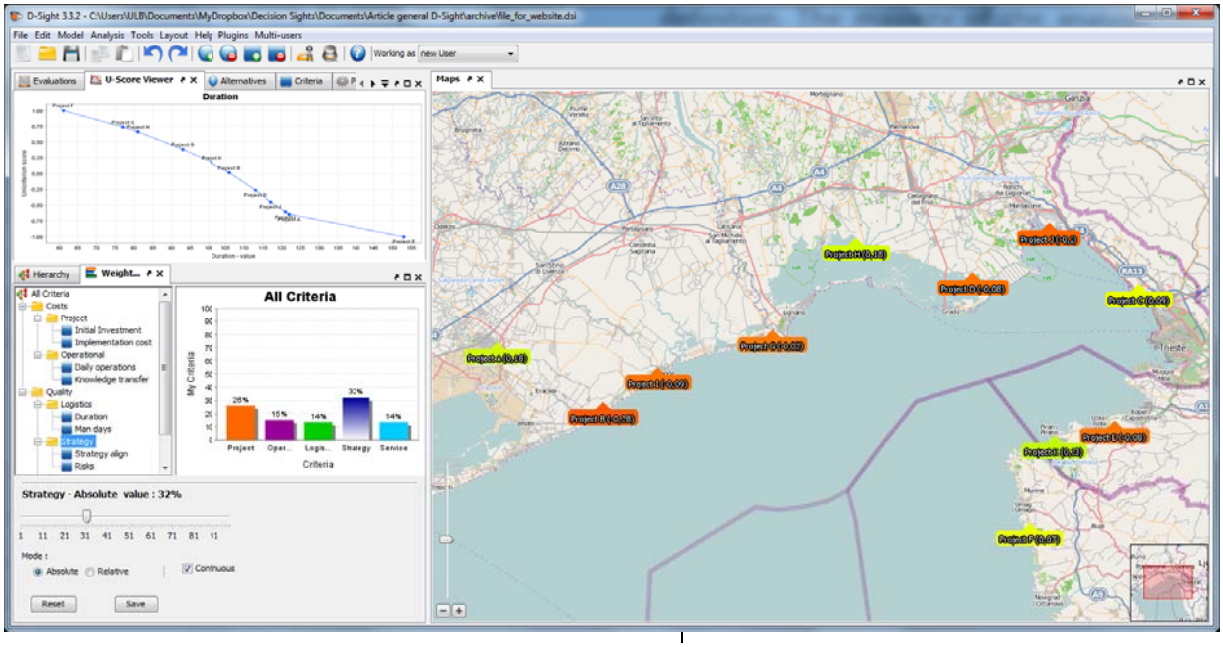
The company started-up in 2010 as a spin-off from the CoDE-SMG laboratory of the Engineering Faculty, in the Université Libre de Bruxelles (ULB), in Belgium. The software was initially developed in the research department. D-Sight is now an independent company but keeps strong connections with the laboratory and more generally, with the academic world.

The D-Sight software is used by companies for various types of applications. It is for instance used in the field of procurement, for tenders analysis when many criteria (financial aspects, guarantee, technical aspects…) need to be taken into account to find the best provider. We can also mention its use in engineering projects such as railway track design to find the best itinerary. Those are compared considering the investment costs, the impact on the population, the impact on the environment, etc. Finally, one last interesting example of utilization is the environmental studies that are made with the software.

D-Sight is also already used by many universities or research centers worldwide for research purposes in various fields. Finally, the software is used in classrooms for teaching multi-criteria decision making. It is important for the company to provide the teachers and their students with an up-to date tool that is used in the industry in real life cases. This is why the software is offered with special academic licenses.

D-Sight is based on the PROMETHEE GAIA methodology, as well as on a Utility based method. The decision maker can choose to work with the PROMETHEE method only or by using utility functions only. The two methods can also be combined in order to offer a large panel of possibilities in the evaluation process.

The software allows an easy problem definition. The majority of the analysis tools are based on visual representations. For instance, the ranking of the alternatives, their profiles, the uni-criterion scores are proposed in nice dynamic charts. Sensitivity analysis tools are also present in the software with for instance the so-called stability intervals.



The software can be enhanced thanks to a plugin system that allows the user to extend the functionalities. Those plugins can be easily installed through a plugin store available in D-Sight. Here are some of the available plugins:

- **The maps plugin** offers a complete interactive maps system that allows the user to localize his alternatives anywhere on a map. The results of the multi-criteria analysis can also be displayed in the maps.
- **The multi-actors (multi-scenarios) plugin** allows working with different stakeholders (scenarios) who are involved in the decision process. Each of them can have his own evaluations and his own analysis parameters. All the results can be computed for each of the participants (or scenarios). Furthermore, the global aggregated results can be obtained in order to analyze if there is a consensus solution and what is the final total ranking.
- **The subset optimization plugin** is based on the PROMETHEE V method and allows the decision maker to determine the best subset of alternatives (according to multi-criteria ranking) while taking into account different types of constraints.

Plugins are also developed on-demand when a customized version of the software is required for a specific application.
Supporting the customer is a very important value for the D-Sight company. This is why all the users, whether they are academic or industrial, can benefit from a complete help during their learning of D-Sight. This is made by providing phone or e-mail support or even with a complete training focused not only on the software itself but also on the multi-criteria methodology. Furthermore, as D-Sight is involved in different decision projects, the software permanently evolves to better answer the needs of the users.
A free trial of D-Sight is available on www.d-sight.com. For more information, please contact Quantin Hayez: qhayez@d-sight.com.

Software

1000Minds MCDA software – implementing the PAPRIKA method

Paul Hansen
Department of Economics, University of Otago
paul.hansen@otago.ac.nz

Franz Ombler
1000Minds, www.1000minds.com
franz@1000minds.com

1000Minds is MCDA software that implements the PAPRIKA method for 'scoring' multi-attribute value models, that is, for determining their point values, based on decision-makers' preferences as expressed using pairwise rankings of alternatives. PAPRIKA is an acronym for '**P**otentially **A**ll **P**airwise **R**an**K**ings of all possible **A**lternatives' [1]. 1000Minds and PAPRIKA were invented by the authors. We briefly describe the software and then, in more detail, explain the essence of the method.

1. 1000Minds software

1000Minds is internet-based software available from www.1000minds.com. 1000Minds enables users to:

discover decision-makers' preferences with respect to the relative importance of decision criteria, prioritise or rank alternatives in one-off or repeated applications, and consider 'value for money' when allocating resources. Depending on the application, users can create their own customised processes involving a variety of decision-making activities involving 10s or 100s (even 1000s!) of participants working individually or together in groups.

1000Minds has been used in published studies in the areas of clinical research and treatment decision-making [1-6], health technology prioritisation [7], corporate strategic management [8], plant and animal breeding [9,10], and environmental management [11]. The software won an IBM- and Microsoft-sponsored *Consensus Software Award* and was a finalist for The Wall Street Journal Asia's *Global Entrepolis@Singapore Award*.

1000Minds is free to academic and student users for research and study that is not funded commercially or from research grants; otherwise, including for government and business users, license fees can be negotiated. Trial access can be easily obtained from www.1000minds.com. Rather than discussing the software's features here, interested readers can experience 1000Minds directly by availing themselves of a trial. The remainder of this article is devoted to explaining the PAPRIKA method underpinning 1000Minds.

2. The PAPRIKA method

The PAPRIKA method is for determining the point values of multi-attribute value models, based on decision-makers' preferences. As for other MCDA methods, PAPRIKA specifically applies to *additive* multi-attribute value models with performance categories – also commonly known as 'points', 'scoring', 'point-count' or 'linear' systems or models. Such models – hereinafter referred to simply as 'value models' – consist of multiple criteria where each criterion is demarcated in to two or more categories. Each category is worth a certain number of points that is intended to reflect both the relative importance ('weight') of the criterion and its degree of achievement. For each alternative the point values are summed across the criteria to get a total score, by which the alternatives are ranked. This representation is equivalent to the more traditional approach involving normalised criterion weights and 'single-criterion value functions'; we employ the unweighted representation because it simplifies our explication.

Overview of PAPRIKA

The PAPRIKA method pertains both to value models for ranking particular alternatives that are known to decision-makers (e.g. investment projects) and to models for ranking potentially all hypothetically possible alternatives in a pool that is changing over time (e.g. patients presenting for medical care). Our explanation is centred on this second type of application because it is more general.

PAPRIKA is based on the fundamental principle that an *overall* ranking of all possible alternatives representable by a given value model – i.e. all possible combinations of the categories on the criteria – is defined when all *pairwise* rankings of the alternatives vis-à-vis each other are known (provided the rankings are consistent).

However, depending on the number of criteria and categories, the number of pairwise rankings of all possible alternatives is potentially in the millions or even billions. Of course, though, many of these pairwise rankings are automatically resolved due to one alternative in the pair having a higher category for at least one criterion and none lower for the other criteria than for the other alternative – known as 'dominated pairs'. But this still leaves potentially millions or billions of '*un*dominated pairs' – pairs of alternatives where one has a higher ranked category for at least one criterion and a lower ranked category for at least one other criterion than the other alternative, and hence a judgement is required for the alternatives to be pairwise ranked.

For example, for a value model with eight criteria and four categories within each criterion, and hence 4^8 = 65,536 (n) possible alternatives, there are $n(n-1)/2$ = 2,147,450,880 pairwise rankings. Even after eliminating the 99,934,464 dominated pairs, there are still 2,047,516,416 undominated pairs to be ranked. Clearly, performing anywhere near this number of pairwise rankings is impossible without a special method.

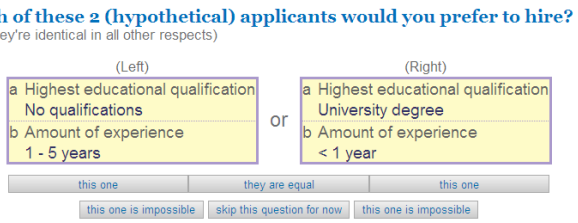
PAPRIKA solves this problem by ensuring that the number of pairwise rankings that decision-makers need to perform is kept to a minimum – only a small fraction of the potentially millions or billions of undominated pairs – so that the method is practicable. It does this by, for each undominated pair explicitly ranked by decision-makers, identifying (and eliminating) *all* undominated pairs implicitly ranked as corollaries of this and other explicitly ranked pairs (via the transitivity property of *additive* value models, as illustrated in the simple demonstration later below).

The method begins with the decision-maker pairwise ranking undominated pairs defined on just two criteria at-a-time (where, in effect, all other criteria's categories are pairwise identical). An illustration of such a question appears in Figure 1 (for the example of ranking job applicants). This is followed, if the decision-maker chooses to continue (she can stop at any time), by pairs with successively more criteria, until potentially *all* undominated pairs are ranked. Thus, ***P**otentially **A**ll **P**airwise **R**an**K**ings of all possible **A**lternatives* (hence the PAPRIKA acronym) are identified: as either dominated pairs (given) or undominated pairs explicitly ranked by the decision-maker or implicitly ranked as corollaries. From the explicitly ranked pairs, point values are obtained via linear programming; although multiple solutions to the linear program are possible, the resulting point values all reproduce the same overall ranking of alternatives.

Simulations of PAPRIKA's use reveal that if the decision-maker stops after having ranked undominated

pairs defined on just two criteria at-a-time, the resulting overall ranking of all possible alternatives is very highly correlated with the decision-maker's 'true' overall ranking obtained if all undominated pairs (involving more than two criteria) were ranked [1]. Therefore, for most practical purposes decision-makers are unlikely to need to rank pairs defined on more than two criteria, thereby reducing the elicitation burden. For example, approximately 95 pairwise rankings are required for the value model with eight criteria and four categories each referred to above; 25 pairwise rankings for a model with five criteria and three categories each; and so on. The real-world applications of PAPRIKA (via 1000Minds software) referred to in Section 1 suggest that decision-makers are able to rank comfortably more than 50 and up to at least 100 pairs, and relatively quickly, and that this is sufficient for most applications.

Figure 1: Example of a pairwise-ranking question (1000Minds screenshot)



Theoretical antecedents

PAPRIKA closest theoretical antecedent is Pairwise Trade-off Analysis [12], a precursor to Adaptive Conjoint Analysis in marketing research [13]. Like PAPRIKA, Pairwise Trade-off Analysis is based on the idea that undominated pairs that are explicitly ranked by the decision-maker can be used to implicitly rank other undominated pairs. Pairwise Trade-off Analysis was abandoned in the late 1970s, however, because it lacked a method for systematically identifying implicitly ranked pairs. Also proposed was the ZAPROS method [14]; however, with respect to ranking undominated pairs defined on two criteria "it is not efficient to try to obtain *full* information" [15]. PAPRIKA overcomes this efficiency problem.

A simple demonstration of the PAPRIKA method

PAPRIKA can be easily demonstrated via the simple example of determining the point values for a value model with just three criteria – denoted by '*a*', '*b*' and '*c*' – and two categories within each criterion – '1' and '2', where 2 is the higher ranked category [1].

This value model's six point values (two for each criterion) can be represented by the variables $a1$, $a2$, $b1$, $b2$, $c1$, $c2$ ($a2 > a1$, $b2 > b1$, $c2 > c1$), and the eight possible alternatives as ordered triples of the categories on the criteria (*abc*): 222, 221, 212, 122, 211, 121, 112, 111. The total scores for alternatives 121 and 112, for example, are $a1 + b2 + c1$ and $a1 + b1 + c2$; and undominated pairs are represented as '121 *vs* (versus) 112' or '$a1 + b2 + c1$ *vs* $a1 + b1 + c2$', etc. Scoring this model involves determining the values of the six point value variables so that the decision-maker's preferred ranking of the eight alternatives is realised.

Identifying undominated pairs

PAPRIKA's first step is to identify the undominated pairs. With just eight alternatives this can be done by pairwise comparing all of them vis-à-vis each other and discarding dominated pairs. As summarised in Figure 2, there are nine undominated pairs (labelled with Roman numerals). However, three are duplicates after any variables common to a pair are 'cancelled'. Thus, there are six *unique* undominated pairs (sans asterisks in Figure 2).

The cancellation of variables common to undominated pairs can be illustrated as follows. When comparing alternatives 121 and 112, for example, $a1$ can be subtracted from both sides of $a1 + b2 + c1$ *vs* $a1 + b1 + c2$. Similarly, when comparing 221 and 212, $a2$ can be subtracted from both sides of $a2 + b2 + c1$ *vs* $a2 + b1 + c2$. For both pairs this leaves the same 'cancelled' form: $b2 + c1$ *vs* $b1 + c2$. Formally, these subtractions reflect the 'joint-factor' independence property of additive value models [16]: the ranking of undominated pairs (in uncancelled form) is independent of their tied rankings on one or more criteria. Notationally, undominated pairs in their cancelled forms, like $b2 + c1$ *vs* $b1 + c2$, are also representable as _21 *vs* _12 – i.e. where '_' signifies identical categories for the identified criterion.

Figure 2: Undominated pairs identified by pairwise comparing the eight possible alternatives

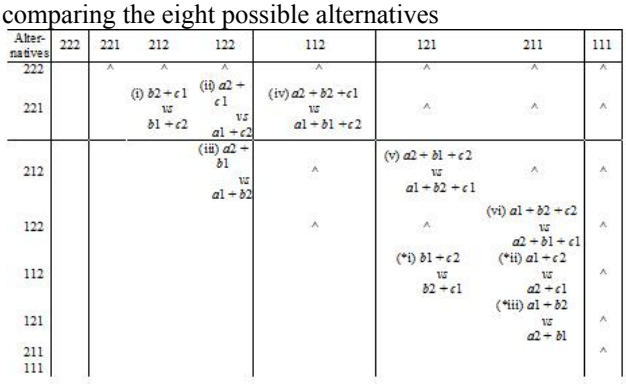


Figure notes: ^ denotes dominated pairs. The undominated pairs are labelled with Roman numerals; the three with asterisks are duplicates of pairs (i)-(iii).

Ranking undominated pairs and identifying implicitly ranked pairs

Undominated pairs with just two criteria are intrinsically the least cognitively difficult for the decision-maker to pairwise rank relative to pairs with more criteria. Thus, arbitrarily beginning here with pair (i) $b2 + c1$ *vs* $b1 + c2$, the decision-maker is asked: "Which alternative do you prefer, _21 or _12 (i.e. given they're identical on criterion *a*), or are you indifferent between them?" Suppose the decision-maker answers: "I prefer _21 to _12". This preference can be represented by '_21 $\succ$ _12', which

corresponds in terms of total score equations to $b2 + c1 > b1 + c2$ (where '$\succ$' and '$\sim$' denote strict preference and indifference respectively, corresponding to the usual relations '>' and '=' for the total score equations).

Central to the PAPRIKA method is the identification of *all* undominated pairs implicitly ranked as corollaries of the explicitly ranked pairs. Thus, given $a2 > a1$, it is clear that (i) $b2 + c1 > b1 + c2$ (as above) implies pair (iv) (see Figure 2) is ranked as $a2 + b2 + c1 > a1 + b1 + c2$. This reflects the transitivity property of (*additive*) value models. Specifically, $221 \succ 121$ (by dominance) and $121 \succ 112$ (i.e. pair i $\_21 \succ \_12$, as above) implies (iv) $221 \succ 112$; equivalently, $212 \succ 112$ and $221 \succ 212$ implies $221 \succ 112$.

Next, suppose the decision-maker ranks pair (ii) as $a1 + c2 > a2 + c1$. Given $b2 > b1$, this implies pair (vi) is ranked as $a1 + b2 + c2 > a2 + b1 + c1$. Furthermore, the two explicitly ranked pairs (i) $b2 + c1 > b1 + c2$ and (ii) $a1 + c2 > a2 + c1$ imply pair (iii) is ranked as $a1 + b2 > a2 + b1$. This can easily be seen by adding the corresponding sides of the inequalities for pairs (i) and (ii) and cancelling common variables. Again, this reflects the transitivity property: (i) $121 \succ 112$ and (ii) $112 \succ 211$ implies (iii) $121 \succ 211$; equivalently, $122 \succ 221$ and $221 \succ 212$ implies $122 \succ 212$.

As a result of two explicit pairwise comparisons – i.e. *explicitly* performed by the decision-maker – five of the six undominated pairs have been ranked. The decision-maker may cease ranking whenever she likes (before all undominated pairs are ranked), but let's suppose she continues and ranks the remaining pair (v) as $a2 + b1 + c2 > a1 + b2 + c1$.

The overall ranking of alternatives and point values

Thus, all six undominated pairs have been ranked as a result of the decision-maker explicitly ranking just three: (i) $b2 + c1 > b1 + c2$, (ii) $a1 + c2 > a2 + c1$, and (v) $a2 + b1 + c2 > a1 + b2 + c1$. Because these three pairwise rankings are consistent – and *all* $n(n-1)/2 = 28$ pairwise rankings ($n = 8$) for this simple value model are known – a complete overall ranking of all eight possible alternatives is defined (1^{st} to 8^{th}): 222, 122, 221, 212, 121, 112, 211, 111.

Simultaneously solving the three inequalities above, subject to $a2 > a1$, $b2 > b1$ and $c2 > c1$, gives the point values (i.e. the 'points system'), reflecting the relative importance of the criteria to the decision-maker; for example, one solution is: $a1 = 0$, $a2 = 2$, $b1 = 0$, $b2 = 4$, $c1 = 0$, $c2 = 3$.

Other things worthwhile noting

First, the decision-maker may decline to explicitly rank any given undominated pair (thereby excluding it) on the grounds that at least one of the alternatives considered corresponds to an impossible combination of the categories on the criteria. Also, if the decision-maker cannot decide how to explicitly rank a given pair, she may skip it – and the pair may eventually be implicitly ranked as a corollary of other explicitly ranked pairs.

Second, in order for all undominated pairs to be ranked, the decision-maker will usually be required to perform fewer pairwise ranking if some indicate indifference rather than strict preference. On the whole, indifferently ranked pairs generate more corollaries with respect to implicitly ranked pairs than pairs that are strictly ranked.

Finally, the order in which the decision-maker ranks the undominated pairs affects the number of rankings required. For example, if the decision-maker had ranked pair (iii) *before* pairs (i) and (ii) then it is easy to show that all three would have had to be explicitly ranked, as well as pair (v) (i.e. four explicitly ranked pairs in total). However, determining the optimal order is problematical as it depends on the rankings themselves, which are unknown beforehand.

Applying PAPRIKA to 'larger' value models

Of course, most real-world value models have more criteria and categories than the simple example above, which means they have many more undominated pairs. The value model referred to earlier with eight criteria and four categories each has 2,047,516,416 undominated pairs (analogous to the nine identified in Figure 2), of which, excluding replicas, 402,100,560 are unique (analogous to the six in the example above) [1]. (As mentioned earlier, for a model of this size the decision-maker is required to explicitly rank approximately 95 pairs defined on two criteria at-a-time, which most decision-makers are likely to be comfortable with.)

For such real-world value models, the simple pairwise-comparisons approach to identifying undominated pairs used in the simple example (represented in Figure 2) is impractical. Likewise, identifying all pairs implicitly ranked as corollaries of the explicitly ranked pairs becomes increasingly intractable as the numbers of criteria and categories increase. The PAPRIKA method, as implemented in 1000Minds, relies on computationally efficient processes for identifying unique undominated pairs and implicitly ranked pairs respectively. The details of these processes are available in our article [1].

How does PAPRIKA compare with traditional scoring methods?

PAPRIKA entails a greater number of judgments (but typically <100 and often <50 [1]) than most 'traditional' scoring methods, such as direct rating [17], SMART [18], SMARTER [19] and the Analytic Hierarchy Process [20]. Clearly, though, different types of judgments are involved. For PAPRIKA, the judgements entail pairwise comparisons of undominated pairs (usually defined on just two criteria at-a-time), whereas most traditional methods involve interval scale or ratio scale measurements of the decision-maker's preferences with respect to the relative importance of criteria and categories respectively. Arguably, the judgments for PAPRIKA are simpler and more natural, and therefore they might reasonably be

expected to reflect decision-makers' preferences more accurately. This is so, in our experience.

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About the 74th Meeting

Dominique Bollinger, HEIG-VD, Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud, 1401 Yverdon-les-Bains, Switzerland
Dominique.bollinger@heig-vd.ch

From 1983 to 1995 it appeared that EWG MCDA meetings in Switzerland followed a perfect arithmetic progression on 6 years step, alternating spring and fall (March 1983 in Basel, October 1989 in Fribourg, March 1995 in Lausanne).
But suddenly we realize that this perfect progression suffered a gap of 10 years ! Was it due to the Millenium bug ? Some sort of standard deviation in this progression or simply someone who turned the calendar wheel once too much on the decades ?
In fact, we do not really care, since we were all delighted to welcome the EWG MCDA after all these years back in Switzerland for its 74th Meeting (MCDA'74) on October 6-8 at the Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud (HEIG-VD) in Yverdon-les-Bains (Switzerland).

The chosen topic for this meeting , "Geographic Information System (GIS), Planning and Environment", was linked with the previous one in Corte (France), emphasizing the great experience of GIS, territorial planning and environmental engineering of both our EC+G Departement (Environnement Construit et Géomatique) and our G2C applied research and development Institute (Géomatique, Gestion de l'environnement, Construction et surveillance d'ouvrages).

The recent arrival of Dominique Bollinger as Professor in environmental engineering who coordinated the

organization of this meeting, is not a coincidence. The wish and aim for our Department and Institute is to develop an MCDA Skill Center in our school. Professor Florent Joerin who joined the HEIG-VD team lately is also bringing his valuable expertise in GIS-MCDA approaches. It was thus a great opportunity to start these MCDA activities in our school by hosting the 74th EWG MCDA meeting and showing that Switzerland is still on the track for MCDA expertise.

MDCA'74 was attended by 57 participants from 14 countries: Algeria, Belgium, Canada, France, Germany, Greece, Italy, Luxembourg, Morocco, Poland, Spain, Switzerland, Tunisia and United Kingdom. Overall, 32 proposals had been submitted, out of which 16 communications were presented, 16 papers were included for discussion and 4 posters presented by young MCDA researchers.

A round table on the theme "Could GIS and MCDA methods put up with predefined softwares in the field of territorial and environmental management ?" ("Les SIG et les méthodes multicritères peuvent-ils se contenter de logiciels prédéfinis dans les problématiques environnement et gestion du territoire ?") was introduced by Dominique Bollinger and held by a panel of GIS, territorial and MCDA experts, Francis Grin (HEIG-VD), Roland Prélaz-Droux (HEIG-VD) and Marc Pirlot (Université de Mons). Although this question wouldn't be answered in a clear way, a lot of elements were highlighted, showing interesting points of views as well from the side of GIS experts as from the side of MCDA experts. A passionate debate on the question of "how clear a decision should be" showed the difference of sensibility of both worlds, which may be able to converge for a better and more reliable decision.

A broad and active participation of all members in the discussions around the presented contributions led to interesting proposals, improvement in the works in progress and really brought new ideas and ways of development, really enriching the meeting.

Social events were also the highlights of this meeting, with a special gala dinner at the Pro Natura Center offering excellent and unusual bio meals, a visit at the famous Cailler Chocolate House and factory, the discovery of the Gruyères castle after a well-deserved cheese-fondue/raclette meal. Last but not least, a rock concert especially organized for the occasion where group members discovered the other side of their host, Dominique Bollinger as "DOM" on stage, brought the "rock'n'roll" attitude into this meeting … all these events have of course and as usual contributed to a great atmosphere and friendship between group members and gave the final touch to this wonderful scientific meeting.

Dominique Bollinger wants, in the name of HEIG-VD, to thank all group members who participated greatly as well in the scientific program as in all other event during these three days. We really hope this meeting will be the start of great collaboration for our school with all members of the group, and marks the beginning of MCDA activities at the HEIG-VD.

Full papers, abstracts and posters are available on the MCDA'74 website http://mcda74.heig-vd.ch developed by Romain Feuz with the help of our software and web cell.

From 4 to 6 of submitted papers from MCDA'73 and MCDA'74 will undergo a two-fold blind review to be selected for publication in a special issue of the International Journal of Multicriteria Decision Making (IJMCDM), a new journal published by Inderscience (http://www.inderscience.com/browse/index.php?journalID=350).

We wish to thank you all for the big success and enthusiasm for this 74th meeting and hope that we will soon welcome you again in Switzerland for any kind of purpose: meeting, scientific collaboration, tourism or music … who knows …

Organizing and Scientific Committee:
Dominique Bollinger,
HEIG-VD
Jacques Pictet,
Independent MCDA consultant
Romain Feuz,
HEIG-VD

The MCDA 74th meeting program is presented below.

Jeudi 6 octobre / Thursday 6th October

Jeune Chercheur / *Young Researchers Meeting*
Inscription / *Registration*
10h30-12h00
Akhrouf Mohamed:
Contribution au développement de systèmes d'aide à la décision multicritères :
Application à la problématique de choix d'investissements publics en Algérie
Ceppi Claudia:
Integration between the multicriteria decision analysis and the GIS to
obtain a map of risk in the city of Tuzla (BH)
Sarrazin Renaud: Méthode d'analyse multicritère appliquée à l'évaluation de la performance de projets routiers en matière de sécurité routière durable
Tilio Lucia: Resilience as an urban tool to mitigate seismic risk
Marc Vuillet: Application des méthodes d'aide multicritère à la décision pour l'évaluation de la performance des digues de protection contre les inondations

12h00-13h30

Inscription et diner / *Registration and lunch*

Session d'ouverture / *Opening Session*
13h30-14h00
C. Kunze, Directeur Haute Ecole d'Ingénierie et de Gestion du canton de Vaud (HEIG-VD)
D. Bollinger, organisateur des 74èmes journées du Groupe de travail européen AMCD

Session I: SIG, Territoire et environnement
14h00-14h30
***Florent Joerin*, Christelle Legay, Annie Lebel, Geneviève Cloutier, Salem Chakhar, Manuel Rodriguez :** Evaluer les risques liés aux changements climatiques: exemple pour le cas de l'eau potable
14h30-15h30
***Francis Macary*, Juscelino Almeida Dias, Odile Leccia, José Miguel Sanchez-Perez :** Risques agroenvironnementaux : de l'évaluation par modélisation multicritère spatialisée sur un petit territoire, à l'usage de la télédétection au niveau du grand bassin versant englobant

Papiers soumis à discussion / *Papers submitted to discussion*

Valentina Ferretti, Silvia Pomarico: Integrating Multicriteria Analysis and Geographic Information Systems for studying ecological corridors in the Piedmont Region
Willem Karel M. Brauers, Romualdas Ginevicius, Valentinas Podvezko: Multi-objective geographic information system on the Lithuanian regions
Pierre L. Kunsch, Mathieu Vander Straeten: Fis Tool, a Fuzzy Inference System for dealing with very uncertain criteria in environmental management

15h30-16h00

Pause café / *Coffee break*

Table ronde
16h00-17h00
Roland Prelaz-Drouz, Doyen département EC+G, Professeur en Gestion du Territoire, HEIG-VD
Francis Grin, Professeur en Système d'Information Géographique, HEIG-VD
Marc Pirlot, Université de Mons

Papiers soumis à discussion / *Papers submitted to discussion*

Valentina Ferretti: Integrating Multicriteria Analysis and Geographic Information Systems: a survey and classification of the literature

Andrzej M.J. Skulimowski: Multicriteria Decision Support for Flood Management Based on Digital Maps

Session II: Contribution théorique
17h00-17h30
Valérie Brison, Marc Pirlot : Comparaison de cartes décisionnelles
17h30-18h00
Salvatore Greco, Johannes Siebert, Roman Slowinski: Modelling interactions on bipolar scales using robust ordinal regression: the UTAGSS method
18h00-18h30
***Alexandru-Liviu Olteanu*, Raymond Bisdorff, Patrick Meyer:** A Contribution to the Multiple Criteria Preordering Problematic

Papiers soumis à discussion / *Papers submitted to discussion*
Salvatore Greco, Yannis Siskos, Roman Slowinski: Controlling robustness in ordinal regression
Thomas Veneziano, Raymond Bisdorff, Patrick Meyer : Etude de la stabilité du graphe de surclassement coupé médian

20h00

Banquet, Château de Champ-Pittet / *Banquet, Castle Champ-Pittet*

Vendredi 7 octobre / Friday 7th October

Session III: SIG, Territoire et environnement
9h00-9h30
Francesca Baiocco, *Elisa Costa, Silvio Andrea Garavoglia, Maria Franca Norese*: Applying PROMETHEE and ELECTRE methods in selection of storage sites of soil/rock excavation: case study of the Messina Strait Bridge project
9h30-10h30
***Mathieu Ehinger, Dominique Bollinger*, Alexandre Repetti, Christine Leu**: Analyse multicritère participative pour ajuster un projet de développement d'un milieu rural au plus près de l'identité régionale tout en respectant les contraintes locales d'aménagement du territoire

Papiers soumis à discussion / *Papers submitted to discussion*
Céline Ohresser, Nathalie Gartiser, Emanuelle Caillaud, A. Ghenaim, Jean Renaud : Conception portuaire en milieu écologiquement sensible : Un exemple d'analyse multicritères pour agir sur le système de projet

10h30-11h00

Pause café / *Coffee break*

Session IV: Contribution théorique
11h00-11h30
Vivien Kana, *Alexis Tsoukiàs*: Poverty Measurement and Policy Making
11h30-12h00
Marta Bottero, Valentina Ferretti, Giulio Mondini: Towards an integration in sustainability assessment: the application of the Choquet integral for siting a waste incinerator
12h00-12h30
Milosz Kadzinski, Salvatore Greco, Roman Slowinski: RUTA: a framework for assessing and selecting additive value functions on the basis of rank related requirements

Papiers soumis à discussion / *Papers submitted to discussion*
Lucas Marin, David Iserin, Antonio Noreno, Aïda Valls: Automatic Adaptation Of Linguistic Preferences
Maria De Vicente Y Oliva, Jaime Manera Bassa, Rocio Guede Cid: Some ideas from DEA useful for MCDA

12h30-14h00

Diner / *Lunch*

Vie du groupe
14h00-14h30
R. Slowinski: Vie du groupe et prochaines réunions / *Working group matters and next meetings*

Session V: Logiciel
14h30-15h00
Olivier Sobrie, Marc Pirlot: Intégration d'outils d'aide à la décision dans un système d'information géographique
15h00-15h30
***Antonio Boggia, Salvatore Greco*, Gianluca Massei:** Implementation of multicriteria modules in a geographic information system
15h30-16h00
Karim Lidouh: Intégration d'outils multicritères dans les systèmes d'information géographique

Papiers soumis à discussion / *Papers submitted to discussion*
Salvatore Corrente, Salvatore Greco, Roman Slowinski: Extending ELECTRE and PROMETHEE methods to Hierarchical Structure of Criteria and Imprecise Evaluations
Nabil Belacel: Intelligent decision support system-based biomarker discovery

16h00-16h30

Pause café / *Coffee break*

Session VI: Application, autre
16h30-17h00
Chiara Novello, Maria Franca Norese: An integration of decision aiding tools to support problem formulation in innovation processes
17h00-17h30
Lamia Berrah, *Vincent Clivillé*, Gilles Mauris: Decision aiding in manufacturing improvement approaches
17h30-18h00
***Salvatore Greco*, Vincent Mousseau, *Roman Slowinski*:** Parsimonious preference model for robust ordinal regression

Papiers soumis à discussion / *Papers submitted to discussion*
Jasmin Tremblay, Irène Abi-Zeid : Décision multicritère et argumentation : le processus d'évaluation de projets
Silvia Angilella, Salvatore Corrente, Salvatore Greco, Roman Slowinski: Multicriteria customer satisfaction analysis with interacting criteria

Stefan Wegener: Drawing conclusions from facilitated MCDA interventions in a public policy context
Francesca Abastante, Marta Bottero, Salvatore Greco, Isabella M. Lami: The role of Analytic Network Process and Dominance-based Rough Set Approach in strategic decisions for territorial transformations

Clôture des Journées / *Closing of the meeting*
18h00-18h15
D. Bollinger: Clôture des travaux scientifiques / *Closing Speech*

Concert Rock au « Citrons Masqués » / *Rock concert at « Citrons Masqués »*
21h00
Une opportunité de voir votre hôte sur scène / *An opportunity to see your host on stage*
DOM concert 12.- CHF

Samedi 8 octobre / Saturday 8th October
Journée consacrée à des échanges informels devant permettre aux participants de mieux se connaître et d'organiser leur coopération. *Day dedicated to informal exchanges aiming the participants to better know themselves and to organize their cooperation.*
8h45
Départ d'Yverdon-les-Bains / *Departure from Yverdon-les-Bains*
10h30
Visite Maison Cailler / *Visit the Maison Cailler*
12h30
Repas typiquement Suisse / *Typical Swiss dinner*
14h30
Château de la Gruyère / *Castle of Gruyères*
17h30
Retour à Yverdon-les-Bains / *Back to Yverdon-les-Bains*

Forthcoming meetings

Decision Sciences Institute Annual Meeting;
November 19-22, 2011; Boston, USA;
https://www.decisionsciences.org/annualmeeting/

IEEE IEEM 2011 - 2011 IEEE International Conference on Industrial Engineering and Engineering Management;
December 6-9, 2011; Singapore;
http://www.ieem.org

1st International Conference on Operations Research and Enterprise Systems (ICORES);
February 4-6, 2012; Vilamoura, Algarve, Portugal;
http://www.icores.org/

APMOD 2012 - International Conference on Applied Mathematical Optimization and Modelling
March 28-30, 2012; Heinz-Nixdorf-Forum, Germany;
http://www.apmod.org/

Evostar 2012;
April 11-13, 2012; Malaga, Spain;
http://www.evostar.org

MCDA'75, 75th Meeting of the EWG on MCDA;
April, 2012; Tarragona, Spain;
Organizer: Universitat Rovira i Virgili, Contact: Aida Valls http://deim.urv.cat/~itaka/CMS4**.**

2012 INFORMS Conference on Business Analytics & Operations Research;
April 15-17, 2012; Huntington Beach, California, USA;
http://meetings.informs.org/Analytics2012

25th Conference of the European Chapter on Combinatorial Optimization;
April 26-28, 2012; Antalya,Turkey;
http://www.eccoxxv.org

Group Decision and Negotiation - GDN 2012
May 20-24, 2012; Recife, Brazil;
http://www.cdsid.org.br/gdn2012/

IEEE World Congress on Computational Intelligence;
June 10-15, 2012; Brisbane, Australia;
http://www.ieee-wcci2012.org/

INFORMS 2012 International Beijing;
June 24-27, 2012; Beijing, China;
http://meetings.informs.org/beijing2012

The 54th Annual conference of the Canadian Operational Research Society and the 12th International Conference on Multiple Objective Programming and Goal Programming;
June 11-13, 2012; **Sheraton on falls, Niagara Falls, Canada; www.cors.ca/cors2012/**

IPMU 2012-14th International Conference on Information Processing and Management of Uncertainty in knowledge based-systems; July 9-13, 2012; Catania, Italy.
http://www.ipmu2012.unict.it

Euro 2012 - 25th European Conference on Operational Research; July 8-11, 2012; Vilnius, Lithuania; http://www.euro-2012.lt

The Sixth Global Conference on Power Control and Optimization PCO 2012, which will be held in Mount Carlo hotel, Las Vegas, Unites States of America , August, 6 – 8, 2012.

ISMP 2012 - 21st International Symposium on Mathematical Programming;
August 19-24, 2012; Berlin, Germany;

http://www.ismp2012.org

76th Meeting of the EWG on MCDA.
September, 2012; Portsmouth, Great Britain;
Organizer: University of Portsmouth - A. Ishizaka;
Topic: "MCDA in maritime, land and air transport management".

OR 2012 - - International Annual Conference of the German OR Society;
September 4-7, 2012; Leibniz Universität Hannover, Germany;
http://www.OR2012.de

ANTS 2012 - Eighth International Conference on Swarm Intelligence;
September 12-14, 2012; Brussels, Belgium;
http://iridia.ulb.ac.be/ants2012

Matheuristics'2012;
September 16-21, 2012; Angra dos Reis, Rio de Janeiro, Brazil;
http://www.ic.uff.br/matheuristics2012/

INFORMS Annual Meeting 2012 Phoenix;
October 14-17, 2012; Phoenix, Arizona, USA;
http://www.informs.org/

EURO / INFORMS Joint International Conference 2013;
July 1-4, 2013; Rome, Italy;
http://www.euro2013.org

Announcements and Call for Papers

*** CFP Special Session on Hybrid Artificial Intelligent Systems ***

Scope

Ordinal regression (so called ranking, sorting or ordinal classification) is a relatively new learning problem, where the objective is to learn a rule to predict labels in an ordinal scale, the labels being discrete but being possible to establish a natural order among them. Consider, for example, a teacher who rates student performance using A, B, C, D and E and we know that A>B>C>D>E.

Many real problems require the classification of items into naturally ordered classes, e.g. Multi- criteria decision making, Medicine, Risk analysis, University ranking, Information retrieval and filtering, and, in general, problems involving humans participating
in the data generation process.

Ordinal regression has been commonly tackled as standard multinomial classification, ignoring ordering information, and penalising equally all mistakes. Others have considered ordinal regression as standard regression problems, assigning a numerical value for each class, what is difficult and very problem-dependent. Alternatively, some specific solutions have been recently proposed in Machine Learning and Pattern Recognition literature, ordinal regression being a very active and interesting field. Hybrid Artificial Intelligent Systems are becoming popular due to their capabilities of handling many real world complex problems, involving imprecision, uncertainty, vagueness and high-dimensionality. They provide us with the opportunity to use both, our knowledge, and raw data to solve problems in more complex problems in a more interesting and promising way. This multidisciplinary research field is in continuous expansion in the artificial intelligence research community. This special session aims to cover a wide range of works and recent advances on Hybrid Artificial Intelligent Systems applied to ordinal regression. We hope that this session can provide a common forum for researchers and practitioners to exchange their ideas and report their latest finding in the area.

The special session will be organized within the "7th International
Conference on Hybrid Artificial Intelligence Systems (HAIS'12)"
(http://hais.usal.es/). HAIS'12 will be held in Salamanca, Spain, in March of 2012.

Topics

Original contributions are solicited in the following topics (but are
not limited to):
Goodness-of-fit Tests for Ordinal Response Regression Models.
* Evaluation Measures for Ordinal Regression.
* Imbalanced Ordinal Regression Problems.
* Ordinal regressión by extreme learning machines.
* Latent variable model for categorical data.
* Generalized linear models with ordered predictors.
* Multivariate Analysis of Ordinal Measures.
* Threshold models for ordinal discrete data.
* Proportional odd logistic regression analysis of ordinal score data.
* ROC analysis in ordinal regression learning.
* Modelling ordinal relations with SVMs.
* Information entropy for Ordinal Regression.
* Adding monotonicity to learning algorithms.
* Distribution-based models for the classification of ordinal data.
* Ordinal versus nominal classification.
* Probabilistic kernel approach to ordinal regression based on
Gaussian processes.
* Ranking, reranking, and ordinal regression algorithms.

* Replicating data for ordinal regression.
* Kernel Discriminant Learning for Ordinal Regression.
* Conditional risk models for ordinal response data.
* Soft Computing for ordinal regression.
* Bioinspired algorithms for ordinal regression.
* Data Mining algorithms for ordinal regression.
* Evolutionary algorithms for ordinal regression.
* Ensemble learning for ordinal regression.
* Preference learning.
* Applications in Medicine, Information Retrieval, Risk Analysis...

and any other real problems involving a set of ordered labels.

Paper Submission

Authors are invited to submit papers through HAIS 2012 web site
(http://hais.usal.es/). Papers are up to 12 pages and must be formatted according to the LNCS-LNAI style template format.

Organizers
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* César Hervás Martínez and Pedro Antonio Gutiérrez
Department of Computer Science and Numerical Analysis, University of Córdoba, Spain.

Important Dates
Deadline for paper submission (Extended!)October 30th, 2011
Notification of acceptanceDecember 9th, 2011
Camera-ready manuscript submissionJanuary 9th, 2011
HAIS2010 ConferenceMarch 28th-30th, 2012

In April 2012 the Research Training Group 1703 **“Resource Efficiency in Corporate Networks** – Methods for Enterprise and Corporate Level Planning to Utilize Renewable Resources” is going to start at Goettingen University, Germany.
More information can be found at the website
www.resource-efficiency.uni-goettingen.de

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Tel qu'évoqué lors de notre dernière rencontre à Yverdon, les participants aux 73ième et 74ième rencontre du groupe MCDA sont invités à soumettre leur contribution à deux revues intéressées par les recherches et applications abordant la décision spatiale et multicritères.

Or, nous avons pensé que l'article :
Problèmes multicritères pour la définition de zonages territoriaux: méthodes, algorithmes et applications
intéresserait grandement la Revue Internationale de Géomatique.

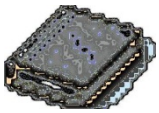
Cette revue privilégie les contributions donnant une grande importance à la dimension spatiale par son application, mais aussi par les outils utilisés. Les articles peuvent être publiés en anglais ou en français.

Les délais de publications sont :

CALENDRIER
Date limite de remise des articles : 31 décembre 2011
Réponses aux auteurs : 15 février 2012
Remise version finale : 15 avril 2012
Remise à l'éditeur : 31 mai 2012
Parution du numéro spécial : septembre 2012

Pour plus d'information, Revue Internationale de Géomatique : http://geo.e-revues.com/acceuil.jsp

Web site for Annpoucements and Call for Papers:
www.cs.put.poznan.pl/ewgmcda



Books

OPTIMALITY CONDITIONS IN VECTOR OPTIMIZATION
By Manuel Arana Jiménez, Gabriel Ruiz Garzòn, Antonio Rufiàn Lizana

eISBN: 978-1-60805-110-6

http://benthamscience.com/ebooks/9781608051106/index.htm

Vector optimization is continuously needed in several science fields, particularly in economy, business, engineering, physics and mathematics. The evolution of these fields depends, in part, on the improvements in vector optimization in mathematical programming. The aim of this Ebook is to present the latest developments in vector optimization. The contributions have been written by some of the most eminent researchers in this field of mathematical programming. The Ebook is considered essential for researchers and students in this field.

Multi-Criteria Decision Analysis: Environmental Applications and Case Studies
By Igor Linkov, *US Army Engineer Research and Development, Brookline, Massachusetts, USA*; Emily Moberg, *Massachusetts Institute of*

Technology, *USA*
Series: Environmental Assessment and Management

ISBN: 9781439853184
http://www.crcpress.com

Environmental management is often complicated and multidisciplinary and the issues that arise can be difficult to solve analytically. Often, decision makers take ad hoc approaches, which may result in the ignoring of important stakeholder opinions or decision criteria. Multi-criteria decision analysis (MCDA) provides a framework by which these types of decisions can be made but, despite being used effectively in many fields, it is not often used in environmental management.

Given the novelty and inherent applicability of this decision making framework to the environmental field, there is a need for more teaching tools for MCDA. In particular, there is a need for a case study based approach to help readers navigate the many MCDA methods and decide how to apply them to a specific case.

Through a collection of case studies, **Multi-Criteria Decision Analysis: Environmental Applications and Case Studies** gives readers the tools to apply cutting-edge MCDA methods to their own environmental projects. It offers an overview of the types of MCDA available and a conceptual framework of how it is applied, with the focus on its applicability for environmental science.

Taking an in-depth look at the case of sediment management, the book introduces different steps of MCDA processes—from problem formulation and model development to criteria weighing and alternative scoring. The authors then explore the case using various MCDA methods, which allows readers to see clearly how the methodologies differ and gain a better understanding of the mechanistic operation of the analysis.

A series of case studies in nanotechnology collectively demonstrate the application of MCDA in situations of high variability and uncertainty that require the integration of technical information and expert judgment—an area where MCDA clearly shines. The authors describe multiple decisions—from risk classification to value of information analysis to the assessment of potential research and funding investments—that readers may face in dealing with emerging environmental threats.

Demonstrating the broad applicability of MCDA methods for different types of cases, the book presents a series of case studies ranging from oyster restoration to oil spill response. In conjunction with these cases, the book also provides corresponding decision models that are implemented by the DECERNS software and allow users to examine the same case using multiple MCDA tools. The DECERNS software and models are available for download at www.crcpress.com.

Intended both as a research and teaching tool, this book inspires creative thinking when applying MCDA to complicated environmental issues.

Articles Harvest

(This section is prepared by Salvatore CORRENTE, salvatore.corrente@unict.it)

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H.-M. Cho, S.-J. Bae, J. Kim, and I.-J. Jeong (2011). Bi-objective scheduling for reentrant hybrid flow shop using Pareto genetic algorithm. *Computers and Industrial Engineering*, 61 (3), 529-541.

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S. Sitarz (2012). Mean value and volume-based sensitivity analysis for Olympic rankings. *European Journal of Operational Research*, 216 (1), 232-238.

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M. Tzur, and E. Drezner (2011). A lookahead partitioning heuristic for a new assignment and scheduling problem in a distribution system. *European Journal of Operational Research*, 215 (2), 325-336.

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T. Yang, Y.-F. Wen, and F.-F. Wang (2011). Evaluation of robustness of supply chain information-sharing strategies using a hybrid Taguchi and multiple criteria decision-making method. *International Journal of Production Economics*, 134(2), 458-466.

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Seminars

SÉMINAIRE «MODÉLISATION DES PRÉFÉRENCES ET AIDE MULTICRITÈRE À LA DÉCISION»
Responsables : Bernard ROY, Daniel VANDERPOOTEN
(le mardi à 14:00)
Prochaines réunions
15 novembre 2011 Conférence de **Brice Mayag** (Lamsade Université Dauphine)
Représentation des préférences ordinales par l'intégrale de Choquet 2-additive
résumé (voir pièce jointe).
13 décembre 2011 Conférence de **Bernard Roy** (Lamsade Université Dauphine), **José Figueira** (Université technique de Lisbonne) et **Juscelino Almeida Dias** (Lamsade Université Dauphine)
Electre Tri NC : une nouvelle méthode de tri
10 janvier 2012 Conférence de **Myriam Merad** (INERIS)
Processus d'aide à la décision en gestion des risques : De la conduite du processus d'expertise à sa gouvernance
31 janvier 2012 Présentation des travaux d'**Olivier Cailloux, Jun Zheng** et **Vincent Mousseau** (Ecole Centrale de Paris)
Application d'une méthode de tri multicritère à la sélection de portefeuilles
résumé (voir pièce jointe).
21 février 2012 Conférence de **Roman Slowinski** (Institut Polytechnique de Poznan)
Régression Ordinale Robuste - à la poursuite d'un modèle compatible le plus simple possible, pourtant permettant la prise en compte de l'interaction entre critères
13 mars 2012 Conférence de **Fioravante Patrone** (DIPTEM Université de Genova)
Preference aggregation and strategic behavior: a game theoretic perspective
27 mars 2012 Conférence de **Thierry Marchant** (Ghent University, Belgique), **Denis Bouyssou** (Lamsade Université Dauphine) et **Marc Pirlot** (Université de Mons, Belgique).
Gestion de la diversité : considérations axiomatiques
résumé (voir pièce jointe).

Announcement:

The "Useful links" section of the group's homepage

(www.cs.put.poznan.pl/ewgmcda)

is being enlarged. Contributions of URL links to societies, research groups and other links of interest are welcome.

A membership directory of the European Working Group on "Multiple Criteria Decision Aiding" is available at the same site. If you would like to be listed in this directory please send us your data (see examples already in the directory).

Contact: José Rui Figueira (figueira@ist.utl.pt)

Web site for the EURO Working Group "Multicriteria Aid for Decisions"

A World Wide Web site for the EURO Working Group on "Multicriteria Aid for Decisions" is already available at the URL:

http://www.cs.put.poznan.pl/ewgmcda/

Web site Editor: Milosz Kadzinski
(Milosz.Kadzinski@cs.put.poznan.pl)

This WWW site is aimed not just at making available the most relevant information contained in the Newsletter sections, but it also intends to become an online discussion forum, where other information and opinion articles could appear in order to create a more lively atmosphere within the group.

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EURO Working Group on Multicriteria Decision Aiding
Groupe de Travail Européen Aide Multicritère à la Décision
NEWSLETTER
BULLETIN

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Contributions should be sent to:
José Rui Figueira (figueira@ist.utl.pt)

José Rui Figueira
Instituto Superior Tecnico
Departamento de Engenharia e Gestao
Campus da Alameda
Av. Rovisco Pais
1049-001 Lisboa, Portugal
E-mail: figueira@ist.utl.pt