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Dorien DeTombe, Cathal Brugha, Gerhard-Wilhelm Weber (Eds.)

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Satellite Event State of the Art Workshop 28th EURO Conference 2016

The goal of the State of the Art Workshop on Societal Complexity is to give the chairs of the Euro Operational Research Working Groups EURO MSC / EURO MCDA / EUROPT / EURO ORD / Ethics and OR the opportunity to meet and discuss with each other interesting subjects concerning the latest developments in their field. The chairs are doing research in overlapping fields of societal complexity such as in ethics, decision making and developing countries.
In the State of the Art Workshop top researchers have a platform to discuss the problematic and difficult issues in their research among each other. In the half a day workshop each researcher discuss the latest development in their research field and discus the future research questions with a special focus on problems, urgent societal issues and uncertainties.
In this multi-disciplined research group of highly scholar and experimented researchers, the researchers have the opportunity to discuss the questions and issues in the field of societal complexity that interest them most.

Prof. Dr. Dorien DeTombe
Prof. Dr. Cathal Brugha
Prof. Dr. Gerhard Wilhelm Weber

A workshop related to 28th EURO Conference is a co-operation of the Euro Working Groups:

EWG Methodology for Complex Societal Problems (MSC)
EURO MCDA
EWG EUROPT
EURO Continuous Optimization
OR for Development
EURO Working Group on Ethics and OR

Organized by

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1 The Need for a Global Moral Forum

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Abstract

The world is experiencing an unprecedented global threat in the complexity of the emerging problems, the health consequences of climate change, the fanaticism of political conflicts, the scale of refugee migrations, the power of finance corporations, and the rise of imbalances between rich and poor in the developed world. The response of global governance has been inadequate: the United Nations Organisation appears powerless, there is no corresponding "United Economies Organisation" to regulate global economic affairs, the United States is organising a Trans-Pacific Partnership that will give power in the courts to corporations to drive nations into debt, government bureaucracy is taking over as the main power in society, global banks are illegally colluding, and ever increasing printing of money and spiralling banking bubbles are leading to an unmanageable global debt to income ratio. There is a need for a Global Moral Forum, an international discussion group to consider how we should address these issues, and coordinate some kind of response. It would use LinkedIn and have a website at globalmoralforum.org

Keywords: Global Moral Forum, Complexity Problems

2 Analyzing and controlling the factors influencing the quality of primary education in developing countries

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Abstract

The system dynamics approach is a holistic way of solving problems in real-time scenarios. This is a powerful methodology and computer simulation modeling technique for framing, analyzing, and discussing complex issues and problems. System dynamics modeling and simulation is often the background of a systemic thinking approach and has become a management and organizational development paradigm. We present our experiences and thoughts on developing system thinking models to understand the important factors such as Facilities (includes infrastructure), Local and national political stability, Family migration from rural to urban localities, and Socio-economic status of the families on the quality of primary education system in developing nations. The research provides a high level view on the factors which need to be addressed for providing sustainable education experience to children living in developing nations. In this presentation, we discuss the situations in India, making an application of our method on data from the state of Gujarat, in Turkey and in Indonesia.

Keywords: Education, System Thinking, India, Turkey, Indonesia

3 Law and the Theory and Methodology of Societal Complexity

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Abstract

There are major real life problems in our society. Problems as poverty, violence against women and girls, war, terrorism, credit crisis, healthcare, sustainable development, cybercrime and many more. Citizens, governments, legal practitioners and legal scientists overstate law as a means to handle these real life problems. We introduce the Theory and Methodology of Societal Complexity into legal research and legal Practice. We state that we need to apply the Theory and Methodology of Societal Complexity in the legal curriculum, in local and general decision making and in designing legislation. On the other hand we think that state of the art in legal theory and legal methodology may contribute to the further development of the Theory and Methodology of Societal Complexity by adding legal theoretical viewpoints on democracy, rule of law, fundamental rights, state authority and 'the good life'.

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Keywords: Optimization, Good Governance, Complex Societal Problems, Handling Societal Complexity, Compram Methodology, Quality Of Life, Democracy, Rule Of Law, Fundamental Rights

4 Develop not only the economy

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Abstract

Developing countries concentrate their development often specifically on economic development demanded by the capitalist systems that dominate the world. This is stimulated by the way development is rated which is by the Gross National Product (GNP). However, as can be seen in many developing countries, often human and nature pay the price of the fast economic development. A better way to evaluate the rate of growth of a country is to use another concept of evaluation, such as the concept of National Quality of Life (NQL), which next to economic capital includes other aspects of life such as cultural, social, legal, educational and healthcare aspects which can be rated as capital too. These capitals give another value of development of countries. Rating a country this way, will encourage a more sustainable development of a country. For reaching a more sustainable development the focus of the policy of a country should be altered. This can be done using knowledge of societal complexity and the Compram methodology for policy making.

Keywords: Complexity, Society, Capitalism, Sustainable Development, Compram Methodology, GNP, National Quality Of Life (NQL)

DeTombe, D. (2015) *Handling Societal Complexity. A Study of the Theory of the Methodology of Societal Complexity and the COMPRAM Methodology.* Heidelberg: Springer.

5 The complexity of Human Communication: order out of chaos

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Abstract

We developed a model for feedback loops in the exchange of information between two actors, for example a GP and his patient, or a teacher and a student. Feedback loops were constructed in that model, according to hypotheses about positive and negative feedback between the actors. For the actors themselves we supposed entangled 'inner' feedback loops between the information task and related psycho-social and control processes. Those processes were modeled with non-linear differential equations of logistic growth. In a number of simulation studies, using STELLA and Madonna, we proved at face value that this complex model fit patterns we found in video observations of the interaction between a patient and his GP as it was put in SPSS data (Dijkum et al 2008). To explore the model in a more methodological and fundamental way we reprogrammed the model in Matlab as an extension of a model that was explored earlier by Savi (2007). We did some experiments with the model in which we explored the interaction between the different components of the model, being in states of order and chaos (Dijkum & Lam 2010). The leading questions of the exploration for this paper are: (1) can a system of which the components are all in a state of chaos produce order; (2) how can this be interpreted for our model of human communication?

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Keywords: Systems, Complexity, Matlab, Complex Societal Problems, Healthcare

6 Artificial Neural Networks vs. Multivariate Adaptive Regression Splines for Subpixel Snow Mapping from Satellite Data

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Abstract

Snow is an important land cover whose distribution over space and time plays a significant role in various environmental processes. Its high reflectance and low thermal reduce energy absorbed by the land surface, while snowpack stores water during the winter and releases it in the spring as snowmelt (Dobreva and Klein, 2011). During the winter period in the Northern hemisphere, snow can cover up to 40% of the earth's surface, which makes it not only a significant determinant of the earth's radiation budget, but also a vital source of irrigation and drinking water supply for many areas of the world (Hall et al., 1995). Thus, continuous monitoring of snow cover and accurate prediction of its areal extent are basically the key factors in order to deepen our understanding for present and future climate, water cycle, and ecological changes (Dobreva and Klein, 2011; Hall et al., 1995).

Remote sensing (RS) data available from various kinds of coarse and medium spatial resolution instruments is a powerful alternative, and has been employed to provide environmental data worldwide. Along with the parallel developments in the RS technologies, significant progress has been made in monitoring the snow cover since the mid-60s, when the first operational snow mapping was done by NOAA (Gafurov and Bárdossy, 2009).

The most frequently used instrument in snow cover mapping is probably the *Moderate Resolution Imaging Spectroradiometer* (MODIS) due to its high temporal frequency. MODIS has 36 spectral bands ranging in wavelength from 0.4 to 14.4 µm at varying spatial resolutions (bands 1-2: 250 m, bands 3-7: 500 m, and bands 8-36: 1000 m) (Qu et al., 2006a). Since its launch in 1999, data collected by MODIS on the Terra satellite have been extensively used for mapping global snow cover through the binary snow mapping algorithm, where each MODIS 500-m pixel is classified as snow or non-snow (Salomonson and Appel, 2006).

One frequently encountered challenge in snow mapping is the tradeoff between the temporal and spatial resolution of satellite imageries. Since high spatial resolution reduces the temporal resolution (i.e., Landsat 7 ETM+'s spatial resolution is 30 m; whereas its temporal resolution is 16 days), it eventually limits timely monitoring of the changes in snow cover (Moosavi et

al., 2014). On the other hand, high temporal resolution data reduces the precision of snow cover maps due to low spatial resolution.

In order to tackle with this problem, sub-pixel classification methods have been applied to low or moderate resolution images (Foody and Cox, 1994). In contrast to binary classification approach where a pixel is labeled as either snow-covered or snow-free, the true class distribution can be well estimated in sub-pixel snow cover mapping even though the precise location of class fractions within each coarse resolution pixel still remains unknown (Moosavi et al., 2014). Sub-pixel snow cover mapping methods have evolved from various *spectral mixture analysis* (Painter et al., 2003; Painter et al., 2009) to latest machine learning-based *artificial neural network* (ANN) (Czyzowska-Wisniewski et al., 2015; Dobreva and Klein, 2011; Moosavi et al., 2014).

Nonparametric regression and classification techniques are mostly the key data mining tools in explaining real-life problems and natural phenomena where many effects often exhibit a nonlinear behavior. As a form of regression analysis, *multivariate adaptive regression splines* (MARS) is a nonparametric regression technique widely used in data mining and estimation theory in order to built flexible regression models for high-dimensional nonlinear data. In MARS model building, piecewise linear *basis functions* (BFs) are fitted in such a way that additive and interactive effects of the predictors are taken into account to determine the response variable (Kuter et al., 2015).

MARS uses two stages when building up regression model, namely, the *forward* and the *backward* step algorithms (Friedman, 1991). In the forward step, BFs are added up until the highest level of complexity is reached. Since the first step creates an over-fit model, preferred and eventual model is obtained by the elimination of BFs in the backward step. Selection of BFs is data-based and specific to the problem in MARS, which makes it an adaptive regression procedure suitable for solving high-dimensional problems.

In this study, the results of the first attempt for subpixel snow mapping in RS by MARS in European Alps were represented. Eight Landsat 7 ETM+ and MODIS image pairs in total were used in the study. All ETM+ images were selected for minimal cloud cover and were taken between February 2000 when MODIS became operational and May 2003 when ETM+ Scan Line Corrector failed which results in wedge-shape gaps degrading the image quality. ANN methodology which has recently been popular for subpixel snow mapping was also applied on the same data set, and the performances of both approaches were compared.

MODIS Level 1B product provides radiometrically calibrated and geometrically located Earth view data sets in scaled integer (SI) scientific data format. MOD02HKM Level 1B product contains *top-of-atmospheric* (TOA) radiometric information for the visible and near-infrared portion of the electromagnetic spectrum at 500 m spatial resolution in SI format, i.e., the first seven solar reflective bands of MODIS (Qu et al., 2006a). All MOD02HKM scenes were reprojected to a common UTM projection with a WGS84 datum to be compatible with the corresponding ETM+ scenes by using MODIS reprojection tool (Qu et al., 2006b). Then, SI values for bands 1-7 were converted to TOA reflectance values by using a MATLAB code. By using a mask generated from MODIS MOD09 quality assurance data (Vermote et al., 2015), pixels identified as cloud-covered, cloud shadow, water or bad-quality were excluded from further analysis.

All ETM+ scenes were converted to TOA reflectance values as described by Chander et al. (2009). At this point it is necessary to emphasize that it was not preferred to use atmospherically corrected surface reflectance instead of TOA reflectance due to unsuccessful attempts of atmospheric correction on Landsat TM/ETM+ alpine snow scenes reported in several studies (Czyzowska-Wisniewski et al., 2015; Masek et al., 2006; Vermote et al., 2006). Binary reference snow maps in which each pixel is labeled as snow or non-snow were produced from ETM+ images by adapting the original MODIS binary snow mapping algorithm proposed by (Hall et al., 1995). Then, snow fraction was calculated as the ratio of snow covered area to the total area within a 500 m radius of the center of a MODIS pixel. It was not preferred to calculate the snow cover fraction within an exact area delimited by a MODIS pixel in order to avoid MODIS geolocation uncertainties.

Five images were used for training and the remaining three were used for testing. After the exclusion of unsuitable pixels from the training set, 3% of the available pixels were selected by stratified random sampling. Stratification was carried out with respect to snow cover fraction from 0.0 to 1.0 with 0.1 intervals in order to prevent MARS and ANN models from being biased towards a certain snow cover fraction. TOA reflectance values of MODIS bands 1-7 were used as predictor variables, and the corresponding percentage snow cover fraction values were the response variable.

In MARS model training, 70% of the pixels was used for training, and 30% of the pixels was used for validation. As in all nonparametric regression methods, MARS has also certain basic *model-tuning* parameters. The first one is the *maximum allowed number of BFs in the forward model* (maxBF), increasing of which gives a rise in the amount of flexibility, i.e., complexity of the resulting model. The second parameter is the *maximum allowed degree of interactions between variables* (maxINT). By increasing maxINT, MARS gain more ability to model nonlinearities and statistical dependencies between response variables. In order to decide the optimal MARS model building parameters, a basic *grid-search* method was applied. First, the value of maxINT was fixed, and then the values of maxBF was varied taking the values $\{20, 40, \ldots, 200\}$. The value of maxINT was set as taking the values $\{1, 2, 3\}$. The trained model for each setting was applied on the validation set, and its training and validation performance were evaluated in terms of root-mean-square error (RMSE) and the square of the Pearson correlation coefficient (r^2) values.

ANNs generate an information processing model that mimics the knowledge acquisition mechanism of the brain from the environment. This knowledge is stored in the form of interneuron connection strengths (Haykin, 2009). In this study, the chosen ANN for subpixel snow mapping was a feed-forward network with one hidden layer trained via backpropagation learning rule with 7 nodes in the input layer and 1 node in the output layer. Since there is no unique theory to determine the optimal values of an ANN's internal variables (Moosavi et al., 2014), the number of nodes in the input and output layers were set equal to the number of predictor (i.e., input) and response (i.e., output or target) variables. The gradient-based Levenberg-Marquardt backpropagation was used during the ANN training. The tangent sigmoid function and the log-sigmoid function were assigned to the hidden and the output layers, respectively. Log-sigmoid function was preferred as the transfer function between the hidden layer and the output layer since it scales its outputs within the range of snow fraction values, i.e., [0, 1]. Several methods have been proposed to determine the optimum number of neurons in the hidden layer such as $2n + 1$, $2n$ and n, where n is the number of nodes in the input layer (Moosavi et al., 2014); however, trial-and-error approach is an appropriate way as indicated by Mishra and Desai (2006), and Shirmohammadi et al. (2013). Therefore, 4-22 nodes with increment of 3 were tested for the hidden layer. The ANN training data was split into three parts by random sampling: 70% for training, 15% validation, and 15% for testing. As in modeling with MARS, training, validation and testing performance of ANN models were evaluated in terms of RMSE and r^2 values.

The independent test data sets were undoubtedly the most valuable source to analyze the performances of the ANN and MARS models trained with optimal settings. With MARS, r^2 values of 0.96, 0.67, 0.95 and 0.93 were obtained for the 1st, 2nd, 3rd and combined test data sets, respectively; whereas the corresponding r^2 values for ANN were 0.95, 0.62, 0.85 and 0.89. The average RMSE of MARS and ANN on all test data sets were 0.166 and 0.387, respectively.

These results indicated that use of MARS provided a significant increase in the accuracy for percentage snow cover estimation when compared to ANN. ANNs are often considered as "black box" since they do not give explicit information about the functional relationship between predictor and response variables, which reduces their explanatory capability to provide insight into the characteristics of the data set. Additionally, ANNs, in general, are hard to implement in point of choosing the suitable network structure and determining the optimal model training parameters. This study proved that with its elaborately designed mathematical structure and simplicity in model building, MARS provides a better alternative to estimate percentage snow cover area than ANNs.

Keywords: Remote Sensing, Snow Cover, MARS, Neural Networks, MODIS, Landsat

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7 A Survey on Transportation Interval Games

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What is a Transportation Situation?

Many systems, such as transportation, assignment, linear production problems among many others, are usually studied from the perspective of Operations Research (OR). With this approach, it is frequently thought that there is only one decision maker involved and the objective is to optimize the system, usually, by using an objective function (single-valued or multi-valued) representing the performance of the system. At many occasions the objective can be reduced to maximize the benefit or to minimize the cost. In such situations, producers and retailers aim to minimize their costs or maximize their profits. Producers and retailers can form coalitions in order to obtain/save as much as possible. Constitutively, a transportation situation consists of two sets of agents called producers and retailers which produce/demand goods, respectively. The transport of the goods from the producers to the retailers has to be profitable. Therefore, the main objective is to transport the goods from the producers to the retailers at maximum profit. Such a cooperation can occur in transportation situations (Sánchez-Soriano, 2006;Sánchez-Soriano et al., 2001). However, when the agents involved agree on a coalition, the question of distributing the obtained profit or costs among the agents arises, then cooperative game theory is widely used on interesting sharing cost/profit problems in many areas of Operational Research such as connection, network planning, routing, scheduling, production, inventory, transportation, etc. (see Borm et al., 2001).

Keywords: Transportation, Cooperative Interval Games

Cooperative Interval Games

Uncertainty is a daily presence in the real world. It affects our decision-making and may have influence on cooperation. At many occasions, uncertainty is so severe that we can only predict some upper and lower bounds for the outcome of our actions, i.e., payoffs lie in some intervals. A suitable game theoretic model to support decision making in collaborative situations with interval data is that of cooperative interval games. Cooperative interval games have been proved useful for solving reward or cost sharing problems in situations with interval data in a cooperative environment. A natural way to incorporate the uncertainty of coalition values into the solution of such reward/cost sharing problems is by using interval solution concepts. An interval solution concept on the class of cooperative interval games is a map assigning to each interval game a set of n-dimensional vectors whose components belong to the set of closed intervals of real numbers.

Further, cooperative interval games and interval solution concepts have had broad applicability in Operations Research, economy, modern finance, climate negotiations and policy, environmental management and pollution control, etc. In such situations, decisions regarding whether (or not) to cooperate within the grand coalition rely on estimations of

individual benefits or costs, between two bounds. Some existing and potential applications of cooperative interval games are sequencing situations, bankruptcy situations and airport situations.
In the classical approach to the problem under uncertainty, the parameters are exactly known. In this case, the problem is fully solved using the results of Sánchez-Soriano et al. (2001). However, in real-life transportation situations, problem parameters are not known exactly. Agents considering cooperation can rather forecast lower and upper bounds on the outcome of their cooperation. Thus, we have a transportation interval situation and to solve the related sharing profit problems, we need suitable sets of solutions.
To handle transportation situations, where the indivisible units of good and the profit are giving by using interval data, the theory of cooperative interval games is very suitable (see Alparslan Gök et al., 2008,2009a, 2009b).

Transportation Situations and the Related Games

In a transportation situation the set of players is partitioned into two disjoint subsets P and Q containing n and m players, respectively. The members of P will be called producers, whereas the members of Q will be the retailers. Each origin player $i \in P$ has a positive integer number of units of a certain indivisible good, p_i, and each destination player $j \in Q$ demands a positive integer number of units of this good, q_j. The shipping of one unit from origin player i to destination player j produces a nonnegative real profit b_{ij}. A transportation situation like this is characterized by a 5-tuple (P,Q,B,p,q), where B is the $n \times m$ matrix of profits, p is the *n*-dimensional vector of available units at the origins, and q is the *m*-dimensional vector of demands.
For every transportation situation (P,Q,B,p,q) and every coalition $S \subset N := P \cup Q$, with producers $S_P := S \cap P$ and retailers $S_Q := S \cap Q$, and assuming that these sets are both non-empty, we can define the maximization problem by:

$$\begin{aligned} T(S):\ \text{maximize} \quad & \sum_{i \in S_P} \sum_{j \in S_Q} b_{ij} x_{ij} \\ \text{such that} \quad & \sum_{j \in S_Q} x_{ij} \le p_i, \quad i \in S_P, \\ & \sum_{i \in S_P} x_{ij} \le q_j, \quad j \in S_Q, \\ & x_{ij} \ge 0, \quad (i,j) \in S_P \times S_Q. \end{aligned}$$

If we denote by $\vartheta(T(S))$ the optimal value of the problem $T(S)$, we can define a cooperative game associated with every transportation situation (P,Q,B,p,q) in the following way:

- The set of players $N = P \cup Q$;
- The so-called characteristic function v is given by:

$$v(S) = \begin{cases} 0, & \text{if } S = \emptyset \text{ or } S \text{ is contained in } P \text{ or in } Q, \\ \vartheta(T(S)), & \text{in any other case,} \end{cases}$$

Formally, a cooperative game is defined by an ordered pair $\langle N, v \rangle$, where $N = \{1, \dots, n\}$ is the set of players, and $v : 2^N \to \mathbb{R}$ is the characteristic function such that $v(\emptyset) = 0$.

A transportation game is any cooperative game v arising from a transportation situation (P,Q,B,p,q).

Transportation Interval Situations and Related Interval Games

We introduce the transportation interval situations inspired by Sánchez-Soriano et al. (2001). In a transportation interval situation, the set of players is partitioned into two disjoint subsets P and Q, containing n and m players, respectively. The members of P will be called producers, whereas the members of Q will be the retailers. Each origin player $i \in P$ has a positive integer interval number of units of a certain indivisible good p'_i, and each destination player $j \in Q$ demands a positive integer interval number of units of this good, q'_j. The shipping of one unit from origin player i to destination player j produces a nonnegative interval real profit b'_{ij}. Here, $p'_i := \left[\underline{p'_i}, \overline{p'_i}\right]$, $q'_j := \left[\underline{q'_j}, \overline{q'_j}\right]$ and $b'_{ij} := \left[\underline{b'_{ij}}, \overline{b'_{ij}}\right] \in I(\mathbb{R})$.

A transportation interval situation like this is characterized by a 5-tuple (P,Q,B',p',q'), where B' is the $n \times m$ matrix of interval profits, p' is the n-dimensional vector of available interval units at the origins, and q' is the m-dimensional vector of interval demands.

For every transportation interval situation (P,Q,B',p',q') and every coalition $S \subset N : P \cup Q,$ with producers $S_P := S \cap P$ and retailers $S_Q := S \cap Q,$ and assuming that these sets are both nonempty, we can define the maximization problem of the pessimistic scenario by

$$\underline{T}(S): \text{ maximize } \sum_{i \in S_P} \sum_{j \in S_Q} \underline{b'_{ij}} x_{ij}$$

$$\text{such that } \sum_{j \in S_Q} x_{ij} \le \underline{p'_i}, \quad i \in S_P,$$

$$\sum_{i \in S_P} x_{ij} \le \underline{q'_j}, \quad j \in S_Q,$$

$$x_{ij} \ge 0, \quad (i,j) \in S_P \times S_Q.$$

and the maximization problem of the optimistic scenario is stated as

$$\overline{T}(S): \text{ maximize } \sum_{i \in S_P} \sum_{j \in S_Q} \overline{b'_{ij}} x_{ij}$$

$$\text{such that } \sum_{j \in S_Q} x_{ij} \le \overline{p'_i}, \quad i \in S_P,$$

$$\sum_{i \in S_P} x_{ij} \le \overline{q'_j}, \quad j \in S_Q,$$

$$x_{ij} \ge 0, \quad (i,j) \in S_P \times S_Q.$$

Then, we can define a cooperative interval game associated with every transportation interval situation (P,Q,B',p',q') in the following way:

- The set of players $N = P \cup Q$;
- The characteristic function v' is given by

$$v'(S) = \begin{cases} [0,0], & \text{if } S = \varnothing \text{ or } S \text{ is contained in } P \text{ or in } Q, \\ \left[\vartheta\left(\underline{T}(S)\right), \vartheta\left(\overline{T}(S)\right)\right], & \text{in any other case.} \end{cases}$$

A transportation interval game is any cooperative interval game v' arising from a transportation situation (P, Q, B', p', q').

We note that "pessimistic" and "optimistic" scenarios could be used referred to with relation to robust optimization, behavioral OR, behavioral game theory and economics with an emphasis on the role of the environment and of the human factor.

In the sequel, behavioral game theory analyzes interactive strategic decisions and behavior using the methods of game theory, experimental economics, and experimental psychology. Among examples of games used in behavioral game theory research ought to be cooperative game under uncertainty more and more.

Discussion and Conclusion

Basically, uncertainty is present in almost every real-world situation influencing and questioning our decisions. Here, we survey transportation interval games corresponding to transportation interval situations. In those situations, it may affect the optimal amount of goods and consequently whether and how much of a product is transported from a producer to a retailer.

The research areas of Game Theory and Operations Research are both extensively studied fields with many problems and solutions.In the sequel, this tutorial surveys the research area of cooperative games associated with transportation problems in which various decision makers (players) are involved under uncertainty.

The interrelation between transportation situations and cooperative interval games is of a more recent date and a pioneering work (see Palanci et al., 2016a).Additionally, several talks are given which highlights the importance of the study (see Özceylan and Weber, 2010; Palanci et al., 2015, 2016b; Tuydes and Weber, 2015).

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