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MODELLING AND SIMULATION OF SOCIAL-BEHAVIOURAL PHENOMENA IN CREATIVE SOCIETIES

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Lithuanian Operational Research Society

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ABSTRACTS

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Vilnius, Lithuania

The International and EURO Mini Conference "Modelling and Simulation of Social-Behavioural Phenomena in Creative Societies" (MSBC-2019) was held in Vilnius, Lithuania on September 18-20, 2019 (http://www.msbc2019.mii.vu.lt).

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ABSTRACTS

MODELING DEVIANT CYBER BEHAVIORS: BOTS, TROLLS, AND INFORMATION OPERATIONS

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Social media platforms are widely used for sharing information. Although social media use is generally benign, such platforms can also be used for a variety of malicious activities, including the dissemination of propaganda, hoaxes, and fake news to influence the public. The availability of inexpensive and ubiquitous mass communication tools has made such malicious activity much more convenient and effective. This talk will touch upon various research efforts that demonstrate how such disinformation campaigns work, examine the critical link between blogs and other social media platforms (viz., YouTube, Twitter, Facebook, VKontakte, etc.), and the different media orchestration strategies. Using socio-computational models that leverage social network analysis and cyber forensic methodologies, prominent information actors and leading coordinators of disinformation campaigns are identified. These models are grounded in the fundamental social science theory of collective action. Further, the talk will highlight the tactics, techniques, and procedures used by the deviant groups to propagate disinformation. Of the several case studies the research methodology has been applied to, the talk will illustrate massive disinformation campaigns pertaining to the Baltic region and NATO's military exercises, conducted primarily through blogs but strategically linking to a variety of other social media platforms. The research has been transitioned into publicly available software programs, viz., Blogtrackers and YouTubeTracker that will be showcased during the talk.

MODELING AND SIMULATION OF IMPACT AND CONTROL IN SOCIAL NETWORKS

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The problems of analysis and prediction in social networks are interpreted for the domain of marketing (other applications are also possible, such as regional management, political choice and so on). Algorithms of determination of the strong subgroups and satellites for a network are implemented using the programming language R and tested on model examples. An original algorithm of calculation of the final opinions is proposed, implemented in R and also tested on the model examples. The main idea is that all control efforts in marketing (and other problem domains) should be directed only to the members of strong subgroups because they and only they determine the final opinions of all members of the network. Based on this idea, two problems of the opinions control on networks are studied. First, a static game in normal form where the players maximize the final opinions of all members of a target audience by means of the marketing impact to the initial opinions of some members of the strong subgroups. Second, a dynamic (difference) game in normal form where the players solve the problem of maximization of the sum of opinions of the members of a target audience by means of the closed-loop strategies of impact to the current opinions of the members of strong subgroups. In both cases we received the analytical solutions and conducted their comparative analysis. More complicated versions of the models are studied numerically on the base of the method of qualitatively representative scenarios in computer simulation.

Keywords: computer simulation, difference games, optimal control theory, social networks.

ECONOMETRIC MODELING OF THE ECONOMIC-POLITICAL SYSTEMS

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Economic-political system is unity of possibility complex actions, which provides all the basic public service needs satisfaction in every time moment from a given time interval. Society's production is mainly involved in the governance of the existing material and labor resources. In addition, the economic system depends on the essence of the current political system, which is constant at the given time interval. All of them received from the general economic-political system. Obviously, the economic-political have a cyclical nature and is conjugate with the time interval (cycle). Therefore, it provides information about the weaknesses of the economic-political system only at the end of the cycle.

The econometric model of the general economic-political system is discussed. We generate a specific regressive equation of the economic-political system, which envisages different conditions of the political system. Based on the generated regressive equation, we give an appropriate analysis.

Keywords: system, production, econometric modeling, regressive equation.

FINDING FAKE NEWS KEY SPREADERS IN COMPLEX SOCIAL NETWORKS BY USING BI-LEVEL DECOMPOSITION OPTIMIZATION METHOD

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Focal structure analysis explores the smallest possible sets of individuals can influence maximum number of users in social networks. These sets of individuals, when coordinating together, maximize information diffusing, influencing operations, or mobilizing crowds. Focal structure sets have enough resources at their disposal to regulate the flow of information in the network. Due to drawbacks in general Node-based and group-based community detection algorithms, these small influential sets are not discovered, and they remain hidden or forgotten in large communities. In this research, we propose a two-level decomposition opti-mization method to discover these intensive groups in complex social networks. We utilized a two-level decomposition problem maximizing the influencer nodes and the network's global sparsity/modularity measures, subjected to small real-world network metrics. Later, we demonstrate the efficacy of our model by ap-plying it to a YouTube network. The dataset was collected by identifying a YouTube channel that had more than 15 million views and was spreading fake news or conspiracy theory videos related to the conflict in the South China Sea. The dataset consisted of 47,265 comments on 5,095 videos by 8,477 comment-ers. We applied focal structure analysis to co-commenter network, where two commenters were connected if they commented on the same video, to identify the sets of individuals that are coordinating to manipulate YouTube's recommenda-tion algorithm to maximize the spread of fake news. The proposed method in this research identified the smallest entities that had high influence, interactions, and higher reachability for information dissemination. Also, a multi-criteria optimiza-tion problem is deployed to rank the identified sets for in-depth explorations.

Keywords: social network analysis, focal structure analysis, fake news spreaders, bi-level optimization, multi-criteria optimization method.

THE RESPONSIBILITY GAP IN ARTIFICIAL INTELLIGENCE

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One of the main challenges in the area of the ethics and law of artificial intelligence is an undefined status of responsibility. This issue arises mainly because an artificial agent can hardly be held responsible for its actions and motivations.

Even in the cases of highly sophisticated, therefore, artificially conscious robots, they are not being held completely conscious to be claimed liable. Liability, in this case, means moral and legal agency when an agent is able to be held responsible for its actions in a moral and legal way. This presupposes punishment or reward system if some sort of damage is done and if an agent is capable of learning from its past experience. Since robots' ability to learn is limited (in the case, for example, of deep learning), the punishment has little meaning, except for retributive justice. But before even starting to think about the retribution there is a need for ascribing responsibility in a just way, and in the case of a robot, the responsibility is shared.

The problem is defined as the "responsibility gap". This poses the question if autonomous systems can be designed to be held morally and legally responsible, so the responsibility gap can be avoided. Since robots (at least for now) are not treated as fully autonomous moral and legal agents, the agency is shared between different agents involved in the process. I argue that the notion of the distributed agency itself is a solution to the responsibility gap in the case of AI. Since it nudges all involved agents to behave responsibly, there is no need to require any sort of full responsibility from an artificial agent.

Keywords: artificial intelligence, the ethics of AI, responsibility, agency, algorithms.

RESILIENCE INSTRUMENTS FOR THE PROTECTION OF WATER RESOURCES

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The right to water, as a constitutionally protected value and as an essential common good to be guaranteed to every individual, is one of the fundamental problems of the 21st century.

According to the 2015 edition of the World Water Development of the United Nations, is expected by 2030 a 40% drop in water availability, unless it will be improved the management and use of this fundamental resource.

Water is a fundamental right and at the same time, a common good that belongs equally to everyone. Every man has the right to use it for what is necessary to satisfy his needs.

In this context, on the basis of the empirical analysis of the exploitation of the resource have emerged the market failures, consisting in a lack of private law in guaranteeing an effective protection of the environment and the defects of a public regulation based on planning.

This regulatory framework was not able to favor the introduction of new products or the use of more efficient and rational production techniques, penalizing investments in innovation in the water sector.

The planning acts, fundamental rationalization tools, have not in practice succeeded in generating good practices or protocols suitable for generating eco-sustainable mechanisms for exploiting the water resource.

In this context, it should be elaborated a legal system and the legislative instrument resilient to the changing society.

The present research project aims to evaluate how the creation of artificial markets, similarly to what happened in the electricity sector, powered by a request induced by the need to comply with legal obligations on companies and citizens, can generate a mechanism able to grant the efficiency and rationalization of private exploitation of the water resource (both industrial and domestic).

The study also intends to exploit models of economic analysis of law to evaluate the impacts and the effects that can be determined in relation to the elaborating regulatory model, in order to develop reproducible methodologies in different contexts.

The creation of behavioral models of rational use of resources, induced by a public regulation, which foresees contingencies and controls on the operators' activities, represents a possible answer to the management of scarce resources, such as water.

Between an effective control and prompt management of the resource, we would have a rational and efficient use of the resource, respecting the principle of social utility of private initiative and social function of property.

The issue of the global protection of an indispensable natural resource through alternative regulatory models is the key point of the project.

In fact, to keep available the water resource in a way that could subtracted it from the game of particular interests, it is necessary to identify ways of regulation that guide the activities of the public and 'private' use, in compliance with the principle of social utility of private initiative and social function of property.

To achieve the objectives, I would compare and analyze the scientific literature on the theme, both European and not-European, to compare the legal experiences.

It is useful to compare the experiences and regulatory levels of other countries with similar legislative frameworks and the use of models of economic law analysis to assess the impacts and effects, in terms of development economic and distribution of resources, which can derive from the elaboration of a regulatory model.

Starting from the most recent doctrinal and jurisprudential approaches, matured in the Italian legal system and at Euro-Union level, I developed the research project through both the analysis of European legislation and jurisprudence, and through the study of literature and concrete regulatory models developed in developing countries and in countries with a high level of industrialization.

Keywords: environment, society, water, resource, management.

AN INTERNATIONAL COMPARATIVE ANALYSIS FOR AUTONOMOUS VEHICLES AND THEIR EFFECTS

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Recently, autonomous vehicles have been one of the hottest issues in the world. In the pasted one hundred years, automobile vehicles have changed human lives and social society. From now, autonomous vehicles will change the world for the second times. Therefore, the issue of autonomous vehicles calls us to focus its effects on the related social respects. In order to investigate the effects of these innovative technologies, an international comparative analysis between Japan and China, respectively No. 2 and No. 3 largest economic countries in the world, were conducted during 2016 and 2018. In this paper, we report on these two surveys. Through the comparative analysis, we can understand the differences between the two countries and reconsider what we should do in the coming years. The comparative analysis indicated that Japanese seemed more conservative than Chinese. In terms of the comparative results, we proposed that it was crucial for Japanese society to change this situation to promote autonomous vehicles.

Keywords: autonomous vehicles, innovative technology, international comparison, Japan, China.

COMPUTATIONAL MODELLING AND DATA ANALYTICS FOR THE STUDY OF HISTORIC CITIES

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The presentation will explore the potential of modelling and simulation tools for the study of the many different ways citizens engage bodily with the common resources of the city, such as heritage sites. In this effort we will use crowd simulation methods for mapping observational data in future planning scenarios for the city. Crowd simulation methods will be discussed as a computational technique that could help in the development of a digital practice for small-scale modelling (urban acupuncture). This approach was developed in response to the constraints that are typically imposed to the urban modelling process, and specifically methods that use simplified representations of human behaviour rules in their agent-based models. We will see how it builds on reactive agent-based models and uses virtual visitors' (observation) data in order to adapt the digital model of the city in the real conditions of the built environment – a flexibility that is much needed in the case of modelling the history-rich built environments of Mediterranean cities, where the palimpsest of the urban fabric is very complex. Contextualised in the broader research area of sustainable heritage, the talk will reflect on the applicability of an integrated approach to planning for heritage management, urban modelling, and computation (e.g., crowd simulation, VR) that will enable scholars, local authorities and stakeholders to better understand the diversity of users behaviour in historic public spaces. The talk will conclude by considering the importance of using digital tools for community participation in planning – an operation that is acknowledged to be necessary for enabling socially resilient cities.

WHY FRENCH HOSPITALS TEND TO MISS THE STAFF OPTIMIZATION PROCESS?

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In production systems, several decision steps are used to manage resources allocation and dimensioning. First, a strategic view is built to fix the amount of machines in regards to sales prevision, by considering an aggregated resources capacity. Then, tactical production plan dispatches fabrication orders on resources and periods, using more precisely estimated data on a smaller time-horizon. Finally, a completed schedule can be built on each resource, using detailed information on short-term horizon. Each of those steps are very useful to anticipate next ones using aggregation and introducing margin to absorb uncertainty. In workforce management, the same process can be followed, but margin often tend to be thinner to avoid overstaffed situation and unoccupied employees.

For several years, Health ministry has been trying to reduce global cost of hospitals. Dealing with staff allocation, margins, which were correct, now tend to decrease drastically. What could have been seen as process optimization actually leads to unstainable situations and French hospitals are now engaged in a deep crisis. The aim of this presentation is to highlight a possible cause of this crisis, showing that inappropriate hand-made decisions at a strategic level in a cost-reduction context can lead to very tense situations in the following levels, and to high additional costs. Through the case study of a team of nurses, we will demonstrate that bad aggregated requirements estimation at the strategic level may lead to make margins disappear. Thus, there exists neither acceptable tactical plan nor operational schedule, forcing the decision makers to increase the workload of the staff (violating legal limits, and exposing nurses to personal and professional risks) or to hire externals (increasing drastically final real costs of the service).

Keywords: operational research, staff scheduling, nurse rostering, lower bounds.

SMART CULTURE IN SMART CITIES – IMPACT PERSPECTIVES AND THE CASE STUDY SMARTSQUARE

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This presentation looks at impact perspectives for smart culture in the context of smart cities and deep dives into the case study of SmartSquare in Hamburg, Germany.

The federally funded project SmartSquare develops innovative service models for the revitalisation of a public space, which is currently used mainly as a transit zone, by means of digital cultural storytelling, data analytics, simulation and service scenarios. The focus is on Hamburg's Domplatz, the former location of Hammaburg castle and the intellectual and cultural centre of the city for centuries

Multiple stakeholders are relevant to our SmartSquare urban testbed project. The project partners are the eCultureLab and CityScienceLab of the HafenCity University, the Archaeological Museum Hamburg and Hamburg@Work, the cluster of digital economy in Hamburg. Added to this, at the SmartSquare itself the church, the civic foundation, retailers, the district municipality and the Archaeological Museum are relevant stakeholders. These stakeholders have different yet also overlapping cultural, social and economic impact perspectives that can enhance the project. It’s vital for us to understand these different impacts to ensure we continue to provide a service that makes a real difference to these stakeholders, and the city and people of Hamburg.

Our Impact assessment looks into the (potential) effect of cultural storytelling with digital signage (in shop windows for example), chatbots, audio tours, beacon paths etc. to increase the physical usage of the square, its relevance and the cultural awareness of people, as well as service scenarios that are developed.

We observe the square with analog and digital means in regard to the frequency of people, their pathways, their time spent, the interaction with the cultural installations (physical and digital) and the social media communication about the square and its cultural meaning.

MARKET MAKERS ACTIVITY – BEHAVIORAL AND AGENT BASED APPROACH

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The goal of the paper is to verify, how the behavioral and social features influence the decisions of the market makers and identify the consequences of these decisions for the price level, price volatility and bid-ask spreads observed in the market. Many microstructural models explain the rational behavior of market makers. Glosten and Milgrom (1985) present a model that emphasizes the role of the informational asymmetry between market maker and the informed traders. On the other hand, inventory models relate the market makers behavior to the current status of inventories. Garman, (1976) assumes, in the seminal paper on the inventory models, that the objective of the market maker is to avoid bankruptcy. Stoll (1978) assumes, in a more realistic way, that such the objective is only maintaining an inventory balance. It is however known, that not only rational factors influence the economic behavior, in particular the behavior of market makers, see. (Germain et al., 2014). Based on the literature, we stipulate that such personal traits as risk attitude, impulsivity, social behavior and sense of fairness may also influence the market makers behavior. In the paper we use agent based modeling approach to analyze the impact of the selected behavioral traits on the observed market prices and trading volume.

Keywords: agent based modelling, market maker, behavioral finance.

TOWARDS A HEALTHY BODY WEIGHT; THE PREVENTION OF OBESITY

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Obesity is a health problem for many people. Obesity, defined as having a BMI (body mass index) above 30, is frequently seen in both men and women of developed countries. Obesity may result in premature death by about seven years, and is also a complicating factor in a number of other diseases. Treating and curing obesity is very difficult. While people should change their habits towards a healthier way of eating, and doing more physical exercise, there are many factors that lead people away from healthier choices. The food industry wants to maximize its profit, and, therefore encourages people to maximize the purchases of their products in the shops and on the streets. Often, these products contain a much higher amount of fat, sugar and unhealthy artificial elements than is advisable. The so-called fast food industry produces food that is easy to buy and eat on the streets in the cities. Even for home, commercially produced food products are easier to eat than healthier fresh food which still have to be prepared. Although many people are aware of the negative effects of unhealthy food, they continue to eat these anyway. The busier lifestyles and longer working hours cause people to buy the quick and easy solutions to eating. As well easy access combined with tasty inexpensive products, create habits that are hard to change. In some cases, these habits may even mimic addiction. Although governments, as in the Netherlands, try to encourage their people to eat more healthy food and to do more physical exercises, these programs seem to be generally unsuccessful. Even when an intervention is benevolent, people do not want their government to interfere in their life in this way.

Obesity must be considered as a complex societal problem, because of the interaction of many different factors. These include economics, medical research, social and cultural habits, entertainments and changing work place habits. In addition, there are many emotional reactions and power relations involved in the handling of this problem. As well there are no easy changes to this problem. When the governments want to prevent their people from becoming obese, they should consider this problem as a complex societal problem and handle the problem according to the ideas of the Field of Societal Complexity and by applying the Compram Methodology, a methodology designed to handle societal complex problems. In this article the methodology will be explained through its application to the problem of obesity.

PROBABILISTIC MODEL OF CULTURAL PARTICIPATION IMPACT ON SOCIAL CAPITAL

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This study attempts to construct a computer-simulation based model of social impact of cultural events which may then be useful for simulation and measuring of social impact within a community context. The models and corresponding definitions of cultural processes that take place in communities or social groups, taking into account the opportunities to assess the perceptions of actors of events, are discussed. The changes in social capital are identified as the result of participation of actors-agents in cultural events assuming links between cultural participation and social capital measured with respect to the Organisation for Economic Co-operation and Development (OECD) methodology. A computer-based probabilistic model for assessment and simulation of social impact of a cultural event flow is developed and presented in the form of a finite difference model, single-layer perceptron and stochastic differential equation. Using data from Lithuania and the United Kingdom of participation in cultural processes and measurements of social capital, a case study is carried out by means of computer simulation. The methodology for assessment of social influence of cultural processes based on the created model and links for future research are discussed.

Keywords: social capital, cultural processes, agent-based modelling, computer simulation, stochastic-differential equation, statistical survey.

DEVELOPMENT OF INTELLIGENT MULTI-AGENT SYSTEM FOR ADAPTABLE DISTANCE LEARNING PROCESS

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The main problems of nowadays e-learning systems arise as: high time expenditure of lecturers in the processes of assessments and creation of materials; the level of interactions are not quite sufficient; the learning process does not ensure the required level of personalization. Some limitations of existing distance learning systems (DLS) can be extracted as inner language support only for creation of simple agents, and truly intelligent agents are difficult to integrate in working DLS environments. For the purpose to enable more effective learning personalization process, our aim concerns the finding of solutions for more adaptable and effective distance learning processes. The paper describes some possible ways to improve e-learning infrastructure and to increase its effectiveness. Our approach concerns the methods of integration of the domain ontology and making possible of the framework of intelligent multi-agents. The proposed solutions are related with technically development architecture of working agents based on the analysis and design of multi-layers of ontology, which tend to provide some automation and support for activities of artificial agents. The results show integration possibilities of multi agents in adaptable helping processes of e-learning.

Keywords: artificial agents, distance learning system, domain ontology, framework of multi-agents, adaptable learning methods.

EVALUATION POSSIBILITIES AND ISSUES OF GREEN BUSINESS DEVELOPMENT

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Our research area concerns the methods of evaluation of situations of business according to the sustainable requirements paying more attention for green business possibilities and risk evaluation. Requirements of Green business is corresponding to requirements of sustainable development and renewable energy possibilities. The countries which are considered as a developing countries comparing with other countries, has a lot of issues in developing of green enterprises. The countries which have important amount of natural resources, such as oil, gas, uranium and most entrepreneurs are interested in non-environmentally friendly spheres. But using these resources became causes of many problems regarding ecology of a country and a region. Our aim is to show possibilities of evaluation situations of environment protection by requirements of sustainable development using information infrastructure and applying some multi-criteria decision support methods. The approach provided by this research include some methods for multi-criteria decision support, and the main of them are TOPSIS and AHP methods. On the case of this study we demonstrate the evaluation of countries by levels of eco-efficiency of business. The TOPSIS method allows us to collect data about the most important fields of manufacturing enterprises and technologies and provide the structure of decision making which can help us to evaluate the situations according to effectiveness and ecology. Decision support can help us to say about the objects - are they proceed as green construction and green enterprises or not.

Keywords: decision support system, green business, sustainable development requirements, multi-criteria decision support methods.

POSSIBILITIES OF APPLICATION OF MULTICRITERIA DECISION MAKING METHODS FOR EVALUATION OF ICT USAGE IN BUSINESS

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Business management systems provide functionality for business enterprises, enabling maintain data about usage and manage of all types of resources. The statistical information helps us to reveal information about functioning of enterprises and implementing of ICT. Our research area concerns the methods for the evaluation of ICT usage in businesses and possibilities to evaluate the spectrum of different kinds of used systems. The ICT usage in businesses enterprises have differentiations. Countries have statistics about the level of ICT usage. The approach provided by this research include some methods for multicriteria decision support by applying TOPSIS and SAW methods. On the case study we demonstrate the evaluation of ICT usage in business in Lithuania with comparison of other countries. The TOPSIS method provide the structure of decision making, which can help us to evaluate the usage of ICT in business. Empirical research results show possibilities how to evaluate countries by ICT usage.

Keywords: ICT usage, decision support, business management systems, multi-criteria decision making methods, TOPSIS.

BIRTH-DEATH PROCESSES IN THE MODELING OF OPINION DYNAMICS OF SOCIAL SYSTEMS

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Models of the population or opinion dynamics often are introduced as the continuous-time Markov chains. A macroscopic dynamics in such models usually results in non-linear stochastic differential equations (SDEs) exhibiting power-law of first and second orders statistics and can be considered as a case of spurious long-range memory [1]. This category of agent-based models is as an alternative to the models built using fractional Brownian motion (fBm) and exhibiting real long-term memory property [2]. We investigate a general form for probability density function (PDF) of burst and interburst duration applicable to the continuous-time birth-death processes [3]. By the way, we propose new versions of birth-death processes exhibiting similar statistical properties of burst and interburst duration [4]. This consideration of burst and interburst duration statistical properties, from our point of view, might be used to discriminate between spurious memory and real long-range memory in various non-equilibrium systems [5].

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Keywords: agent-based models, birth-death process, opinion dynamics, Markov chains, spurious long-term memory.

INTEGRATED EXAMPLAR-BASED AND CASE-BASED REASONING APPROACHES FOR STUDENT'S LEARNING STYLE DIAGNOSIS PURPOSE

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In modelling, exemplar models explain real life events that are problematic for modelling that uses sets of rules. Exemplar models are appropriate in situations where it is necessary to take into account the frequency effect, the dynamical aspects and complexity. They use methods that generate model from data. Exemplar models aim to capture and store the detailed memory of the events over time and compare new observation against exemplars already stored. New exemplar of the event is classified according to its similarity to the exemplars already stored. Similarity might be computed in various ways: as the 'distance' between new exemplar and the exemplar already stored in the parameter space, assessing similarity by conditional probability, i.e. computing probability of an exemplar given the features of newly observed exemplar or using any loss function. Best known among examples of exemplar-based modelling are nearest neighbor method and case-based reasoning.

In this paper, first, case-based reasoning (CBR) method that uses old experiences and adapts them for finding a solution to new problems is described. Then graphical representation called Plate notation is briefly introduced. It is used to describe statistical models, including template models for graphical Bayesian network (BN) modelling. Second, a systematic review of literature on modelling approaches combining CBR and Bayes network is done, trying to identify current status of the development of the framework for Bayesian case-based reasoning. Literature review focuses on exemplar-based approaches, exploring possibilities of combining BN and CBR and seeking for niches for improvement of the overall BN-CBR approach. In the paper, comparative analysis of existing CBR-BN models is done. Attention is paid to feedback issues. Finally, after discussion and weighting the pros and cons of application of combined BN-CBR approach for student's learning style diagnosis, conclusions are made and future research trends are presented.

Keywords: exemplar-based model, case-based reasoning, nearest neighbors, learning style, Bayes network, similarity.

CO-CREATING FOR CULTURAL COMMONS: SCENARIOS FOR CROSS-SECTORAL COLLABORATION

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In the present context of old infrastructures being disrupted and of political divides and global challenges accelerating societal fragmentation, culture and creativity provides opportunities for a human-scale digital transition into future commons. How may cultural, creative actors and citizen communities co-create for such a digital transition of our cultural infrastructures? What opportunities does cross-sectoral collaboration and sharing open data, provided by municipalities and governments, open up?

The digital archival holdings of cultural institutions provide traces of cultural memory and intangible heritage, which are in focus for audience development and for building new cultural commons or ecosystems. Also born digital cultural data are generated by cultural and creative organizations and the communities and environments we live in and by. The focus on open and sharable data within the cultural creative field (and sectors) are growing, and gap analysis of cultural creative statistics (cf. KEA Feasibility study on data collection and analysis in the cultural and creative sectors in the EU, September 2015) recommend supplementing existing statistics (EUROSTAT) with semi structured (monitoring) data and data collection of unstructured data, for new insight into how multilayered value - including artists' interventions and citizens engagement – is created in and through cultural creative institutions, events and productions.

The talk will include cases of cultural creative collaborations e.g. from community-centered smart city-projects and from Aarhus 2017 European Capital of Culture, and will present lessons learned from citizens' engagement with open data, experimental design processes, and cross-sectoral collaboration in a quadruple helix-model.

SOCIAL DISINTEGRATION INDEX AND ITS APPLICATIONS

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This article presents the calculation methodology of the social disintegration index (SDIx) and an analysis of its applications. Social disintegration is interpreted as a lack of integration, and the Social Disintegration Index is calculated as a value supplementing the average of various social integration indicators to the figure of one. This index allows comparison of societies according to the elasticity of relations between their members and can be compared to Social Network Index (SNI) or Social, Cultural and Civic Integration Index (SCCII). Another application of SDIx is in suicide analysis. In this case, Social Disintegration Index may be used to validate Emile Durkheim's theory of suicides. And, finally, the SDIx may be applied to the construction of certain models of human behaviour. In this case, we presume that social disintegration means behavioural changes which, in their turn, are determined by the changes in stimuli (typical situations) and mentalities.

Keywords: social disintegration index, social integration, behaviour, suicides, stimulus-reaction model, mentalities.

EXPERIMENTAL ANALYSIS OF ALGEBRAIC MODELING LANGUAGES FOR SOCIAL BEHAVIOR MODELING

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One of the ways to model social behavior is to formalize the problem as a mathematical model (e.g., social network analysis problems [1, 2]) using algebraic modeling language (AML) and attempt to solve it using mathematical tools (see [3], and references therein). However, this requires a researcher to be skilled in defining the problem using the terms of some AML. Moreoever, choosing an AML is not that trivial, since nowadays multiple competing AMLs exist.

In this work, we investigate the current state of optimization modeling systems by selecting most prominent AMLs (AMPL, AIMMS, GAMS, Pyomo) and modeling systems supporting them in order to perform an extensive theoretical and experimental analysis of their characteristics.

In theoretical comparison, we evaluate how the features of reviewed languages match with requirements for modern AMLs. While in the experimental analysis, we create automated tools to generate a test model library and tools to perform extensive benchmarks using the library created.

We determine the best performing AMLs by comparing the time needed to create a model instance for a specific type of optimization problem and analyze the impact presolving done by AML has on the actual problem-solving. Lastly, we provide insights on which AMLs performed best and what features are relevant in the current landscape of mathematical optimization and mathematical sociology.

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Keywords: algebraic modeling languages, mathematical optimization, presolving, AMPL, AIMMS, GAMS, Pyomo.

EXPERIMENTAL EXPLORATION OF THE KRIGING PREDICTOR FOR FACIAL EMOTION RECOGNITION

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There is a fast growth in emotion recognition research in various types of communication such as text, speech, gestures, and facial expressions. Two models are used to recognize emotions: the categorical model and the dimensional one. In the first model, emotions are described with a discrete number of classes, affective adjectives, and, in the second model, emotions are identified by axes, i.e. by defining where they lie in a two, three or higher dimensional space. In this research, a two-dimensional circumplex space model is used for facial emotion recognition. Warsaw set of emotional facial expression pictures (WSEFEP) (Olszanowski et al., 2015) is used in the experiments. The kriging predictor has been employed for emotion recognition from facial expression and explored experimentally. It has been ascertained that the kriging method is suitable for facial emotion recognition.

Keywords: facial emotion recognition, categorical model, dimensional model, kriging predictor.

AN INVESTIGATION OF SOCIAL-BEHAVIORAL PHENOMENA IN THE PEER-REVIEW PROCESSES OF SCIENTIFIC FOUNDATIONS

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A huge amount of the issues in the realm of scientific endeavor are decided by members of expert communities in various fields. Decisions that sanction the funding of project proposals are based on a voting process. Such decision-making is particularly applied in the evaluation of applications to publicly-funded initiatives, which include the awarding of higher academic degrees and titles, in competitions to fill personnel vacancies and other similar areas.

In such situations, experts (electors) individually decide in favor of a particular applicant based on specific objective criteria, as well by subjective consideration of their decision's repercussion in the professional field and the impact of the decisions on the experts' reputation. The result of such choices may depend on the psychological qualities and the current mood of the expert. The selection of the experts and their assignation to particular evaluation projects is often random. As a result, the collective adjudication on such projects is comprised of the interweaving of several objective and subjective factors.

In this paper, the authors examine the competitive selection process for scientific projects in applications for funding from scientific foundations. A simulated "peer review" model is utilized, designed to analyze a number of experts' economic and psychological characteristics and their group affiliation in the form of scientific schools.

The authors use qualitative analysis concerning the impact of changes reputations of experts on their decisions in the scientific community. Thus, the research results herein show the dynamics of the scientific and expert community structure. The model is agent-oriented and is a convenient tool for modeling the process of competitive selection in project funding applications.

Keywords: public choice, alternative choice, science experts, psychological characteristics, agent-oriented modeling, multi-stage choice, reputation, scientific school.

VOTER MODEL FOR ELECTORAL AND CENSUS DATA

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Voter model is rather well-known model of opinion dynamics. While the original premise of the model is rather simple, agents imitate their random neighbors, modifications of varying complexity are numerous. Model was extended to support multilayer networks, zealotry, agents with multiple states and many other extensions. From physicist's perspective Voter model is interesting, because it belongs to the same universality class as zero temperature Glauber dynamics for the Ising model. Here we use less known interpretation, Kawasaki interpretation, of the Ising model. What makes Kawasaki interpretation very different from other interpretations of Ising model is that global magnetization is fixed, while the dynamics are localized as particles swap places. We apply this idea to Voter model by assuming that: (1) agents have fixed opinions, (2) agents reside in compartments, (3) which they can change according to the rules based on the original Voter model. We examine a few of possible implementations of these rules and show the impact of the slight differences between them. We also provide an empirical context to these theoretical developments by using Lithuanian electoral data and UK census data [1-4].

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Keywords: voter model, opinion dynamics, electoral data, census data.

AGENT-BASED-MODEL OF STUDENTS' SOCIOCOGNITIVE LEARNING PROCESS IN ACQUIRING TIERED KNOWLEDGE

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The cognitive and social aspects of students' learning process in acquiring scientific, tiered system of knowledge are explored by using an agent-based-model. Cognitive aspects of learning are described as foraging for the best explanations on epistemic landscapes, whose tiered structures are set by instructional design. The sociodynamic aspects of learning are described as an agent-based model, where agents compare and adjust their proficiency through peer-to-peer comparisons. The results show that even in cases where social learning is unbiased, social learning has a substantial effect on learning outcomes.

Keywords: sociocognitive learning, agent-based-model, epistemic landscape.

SOCIOCOGNITIVE ASPECTS IN LEARNING AND TEACHING: AN AGENT-BASED MODELLING APPROACH

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The agent-based modelling of complex social phenomena such as opinion formation, the formation of collaborative groups, and even progress in science has proved its usefulness as a new tool for conceptualisation and reasoning in fields traditionally found in the human sciences. In educational sciences, however, the adoption of agent-based modelling has advanced slower, though already nearly two decades ago a few seminal studies began using computational modelling to study the sociodynamics of collaborative learning in science education. One reason for the slow progress may be that the educational sciences need to address both cognitive and social aspects at the same time, which requires the computational model of an educational phenomenon to integrate cognitive and social factors. In the present talk I will discuss the possibilities of agent-based-modelling in advancing our understanding of the social and cognitive aspects of teaching-learning, referred here briefly as sociocognitive aspects of learning. The viewpoint here is that cognitive and social aspects must be treated as interconnected sociocognitive components of teaching-learning process. Moreover, the notion of "teaching" must be explicitly considered through the structured training sequence that guides learning (i.e. teaching should be seen as designed to reach a certain target). The basic assumptions in modelling such a teaching-learning process are that the process is affected by: 1) the context of learning and its design (i.e. teaching is structured and supervised), 2) students' cognitive abilities and proficiencies, and 3) social interactions. I will discuss how such an approach provides first steps in a direction which attempts to combine cognitive and sociodynamics aspects of learning which encourage the use of computational approaches in theoretical descriptions of learning and in guiding empirical research settings.

MODELING THE BEHAVIOR OF ECONOMIC AGENTS AS A RESPONSE TO INFORMATION ON TAX AUDITS

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In the modern world, the absence or availability of a certain information leads an individual to make a decision regarding the choice of her/his behavior strategy. The current study investigates the impact of the information on possible tax audits on individuals' decisions to evade taxation or not.

Recent studies on tax control have shown that the auditing probabilities, which guarantee the absence of evasions among risk-neutral taxpayers, can be considered as the optimal strategies of the tax authority.

However, the implementation of such a strategy is excessively expensive for tax authorities and practically impossible due to the limited state budget. By virtue of the latter, a searching for additional methods to stimulate taxpayers for fair payment of taxes is needed. The dissemination of information on future tax audits among the taxable population can be offered as one of such tools. We set that the process of information spreading resembles evolutionary dynamics in nature, thus we design it as an imitation dynamics over the structured population of interacted economic agents.

In contrast to previous research, where the assumption of the risk-neutrality of taxpayers also significantly reduces the quality of the model, keeping it away from reality, in the current study, we assume that the behavior of an agent depends both on the information she/he receives and on her/his propensity to risk. By using this assumption we construct evolutionary dynamics based on classic bimatrix games and various rules for choosing taxpayer's behavior.

To analyze possible economic scenarios we conducted a series of numerical simulations with visualization of the information dissemination process for the populations represented by networks of various structures. The results of simulations confirmed the presence of influence of information on the final distribution of tax payments among the population with different level of the risk propensity.

Keywords: tax evasions, tax control, information dissemination, evolutionary games, behavioural models, networks.

ON SOME PROBLEMS OF TEACHING IN THEORETICAL MECHANICS

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This research is devoted to the specific problems of Mechanics Foundations. The actual questions are considered, that are connected with the level and quality of fundamental knowledge on Theoretical Mechanics in training-teaching of specialists (Engineers-Mechanists) both in general and aviation engineering domain. The principles of subject teaching are discussed, that are led to the activating and governing methods of learning in High Engineering Education. In regard to this statement the general aspects of the peculiarities, inherent to the Theoretical Mechanics subject, that are distinguishing it from another basic disciplines of Engineering Education, are studied. Also of the special difficulties in the understanding and the education, that are generated by these peculiarities, are analyzed. The objective causes, having systematic character, are selected and discovered.

It is stipulating the necessity in special long process of the adaptation for right understanding and skilled using of Mechanics basic, fundamental laws. The main "sources of hindrance" in the understanding of Mechanics laws (Newtonian laws) are revealed. It is discussed the ways and methods for overcoming intuitional theories and models in Mechanics; it is worked out the necessary recommendations for teaching with the psychological-methodological aspects consideration. The general tenets are illustrated on the examples from the experience of our Education System in the Mechanical Engineering domain.

Keywords: modelling, system dynamics, complex systems, education, system thinking and methods.

TOWARDS CONCEPTUALLY NOVEL OSCILLATING AGENT-BASED SIMULATION OF THE RELATIONSHIP BETWEEN CULTURAL PARTICIPATION AND SOCIAL CAPITAL

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Effective simulation and prediction of the social impact of culture is one of the most important questions in contemporary social science and formative cultural policy. After a comprehensive review of the current simulation approaches, we found an evident lack of systematic conceptual models, however. It gave an impetus to investigate some novel conceptual approaches. In general, we admit that cultural events take part in the formation of social capital via the ability to communicate behavioral information in social networks. Following the bottom-up approach, implications of the social impact of cultural events are taking place on the individual (agent or actor) level first. Consequently, the aggregated effect can be simulated and predicted for the group or society (multiagent) level as well. For several reasons, we used CIDOC-CRM cultural ontology, which gives a structured framework of main cultural entities. We discovered that relations between them are not trivial and require fundamentally different viewpoints and simulation frameworks, which would better conform to the emergent complexity of social networks. For this reason, we analyzed in more detail Youri Lotman‘s semiosphere concept and OSIMAS (an oscillations-based multiagent system) paradigm. Consequently, in the proposed agent-based conceptual model, there is employed not only classical pair-to-pair based Axelrod’s neighborhood interaction model but also a one-to-many information broadcasting model. Such conceptual approach is able to provide simulation models for the complex emergent relations between cultural participation and social capital.

Keywords: cultural participation, social capital, OSIMAS, CIDOC-CRM, conceptual model.

SCIENCE, EDUCATION AND KNOWLEDGE IN SUSTAINABLE DEVELOPMENT PROBLEM AND THE WAY FOR THEIR MODELLING

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The development of science and education are the key factors for sustainable development. Modeling and simulation of social phenomena are very important for understanding such phenomena. Operational research supplis the tools for such goals. OR of large social systems and processes in them and taking into account their interactions with the environment usually require the use of either appropriate models or at least more or less formalized concepts. Currently, accounting for physical, natural and technical factors in OR studies is relatively well developed. An example is research on sustained development. Far less developed (although also numerous) are OR studies that adequately take into account the inner nature of individuals as intelligent beings and their interaction in society. This paper proposes the consideration of such human qualities as mentality, anticipation, the acquisition and generation of knowledge, especially when considering interacting individuals. Considerations are based on models of society in the form of networks with associative memory with elements that also take into account the internal mental representations of individuals. As the main examples, the tasks of supported development and transformation of society are considered. Global and local educational problems are considered as the examples. Also shown are examples of ethics accounting in such schemes of consideration of society.

Keywords: sustainable development, science, education, modeling, associative memory, mentality.

NEGATIVE DIALECTICS ON SUSTAINABILITY AND CREATIVE DISRUPTIONS

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The purpose of the article is to present Negative dialectics was developed by Theodor Adorno; however, the paper considers dialectics rather in the horizon of contemporary nihilism and becoming diversity than in the sense of Critical theory of Adorno. In any way some features of negative dialectics of Adorno will be presented in the opposition to the Hegelian dialectics. Nihilism empowers politics and praxis of making and crossing of borders and so supports the politics of weak minorities, becoming the other. What does mean a political in this context? I am far away to support K. Schmidt idea that a political is continuous conflict between ours and enemies. It is oversimplification. H. Arendt™s understanding of the political is more subtle and is based on the fundamental question of the personal freedom and political liberty. The development of social and cultural forms, diversity of them and conflicts between them creates needs of political competition, wars and negotiations. All such forms of conflicts of social and cultural becoming of minor could be translated and considered in the language of negative dialectics. What it could to give us? Dialectics tells that the wars, conflicts and even deep dialogues transform us in some irreversible way. The dialectical contradictions work only in the moment of real conflict, in the drama of dialogue and put the seal of the new condition of the Being. The article considers the conflict between intention of sustainability and disruption, negation of alienation and producing of new aliens; between intention of social groups for inter-trust and rebellions against communicative agreement. This is a possible adornian thesis against Jurgen Habermas rational communicative action: negative dialectics forecasts irrational action of disruption in all the most perfect sustainability.

OPTIMIZATION OF DATA PROCESSING AND PRESENTATION IN SOCIAL SURVEYS: FROM LIKERTMEANS TO “YES PERCENTAGE”

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The article presents a replication study of a significant empirical study carried out earlier. Borg & Gabler (2002) showed that there is an extremely high correlation between the Means of Likert Scale Items and the percentage of agreement (Yes%). On this basis, they suggested to use not traditional Likert mean, but Yes % in survey reports. The latter are easier to interpret and do not have the same problem as Equidistance of Likert-type scales. It was decided, based on the big date (N≈9000), to carry out the replication study in another historical time, in another culture and measuring another construct. If the statistical regularity detected by Borg & Gabler is repeated, it is universal, then it is really appropriate to move to a wider use of Yes% when preparing the survey report. The replication study showed that there is an extremely high correlation (R2 = 0.948) between the primary Likert items means and Yes% of items, approximating to the linear function. Used the classic 5-grade Likert scale. The verification is carried out only at the level of single items without passing to the level of analysis of additive indexes. It also turned out that the Likert items-mean correlation with the No% is lower (R2 = 0.865), which negates the postulate of symmetry of the scale. In addition, the Likert means correlation with "neutral category%" is even lower - R2 = 0.340. When preparing Survey studies reports, give priority to “yes %” instead of Likert items means.

Keywords: likert scale, equidistance, agreement percentage, correlation, reports of social survey.

BEHAVIOUR PATTERNS IN EXPERT RECOGNITION BY MEANS OF STRUCTURED EXPERT JUDGMENT IN PRICE ESTIMATION IN CUSTOMIZED FURNITURE MANUFACTURING

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The furniture manufacturing sector of the Baltics is facing serious challenges common in all European countries, namely, the growing global competition for customized solutions. New standards to be followed in the industry tend to in-crease production costs, extend manufacturing time and cause frequent errors in the product quality. To maintain sustainability, companies need decision support instruments, allowing an immediate reaction to customized orders and proper evaluation of manufacturing procedures, costs and deadlines. The complex prob-lem of cost estimation at an early stage could be solved partly by strengthening operational research in decision support systems supplemented with machine learning techniques. Additional reliability could be acquired complementing an in-telligent system with a human knowledge intervention and applying outcomes of behavioural operational research. Scientific and methodological issues of how to integrate the output of structured expert judgement into an intelligent cost estima-tion system is a pressing problem. The goal of the present research is to look into the cultural pattern of competence recognition within furniture industry with the purpose to adjust the structural expert judgement strategy as an instrument to val-idate expert input into the decision support tool for cost estimation. The research is based on mix method strategy (a qualitative study, a quantitative study and a structured expert judgement experiment). The findings clearly highlighted that a well-composed group of experts could be a possible solution in assessing uncer-tain aspects of cost estimation. Although the cultural model of the furniture sector would recommend a slightly different approach: the top executives and the best engineers in this sector are seen as experts. This should be taken into account when developing methodological recommendations for the implementation of the structured expert judgement.

Keywords: behavioural operations research, structural expert judgement, customise manufacturing, cost estimation.

SOCIAL CAPITAL EFFECTS ON MIGRATION FLOWS IN A MODERN GLOBAL SOCIETY

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As the world moves towards a more global society, people are increasingly migrating and settling in different countries. This has caused an array of social and political turmoil that has created social and cultural tensions, radicalization and even hostility. To address these concerns and predict behavior, policy makers must turn to quantitative measurements and simulations to understand the causes and effects of emigration and immigration dynamics. In that regard, this paper presents the current quantifiable social factors most critical to predicting emigration and immigration flow. In particular, the focus will be on understanding the connection and predicting societal migration behavior based on individual social capital. Our research primarily targets the less investigated effects of social-behavioral phenomenon, which account not only for economic opportunities but also other social factors that cause migration flows. The predictive analysis is achieved by identifying which social capital metrics are most pertinent to migration flows. This study additionally investigates the effects from both sides by determining how migration flows affect the individual social capital. To culminate, an agent-based simulation connecting social capital with migration flows is proposed as a potential avenue for further research.

Keywords: migration dynamics, social capital, radicalization, agent-based simulation.

SPILLOVERS, OR WHAT IS CULTURE GOOD FOR

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Being a theatre scholar by training and trade I have sometimes had this question: for whatever reason people leave the comfort of their homes and invest their money to spend several hours in dark crowded halls watching other people speaking and doing things on stage? Same goes for museums that attract hundreds and thousands eager to cast an eye on "La Gioconda" or the art spaces that are subject of vast public investments such as Centre-Pompidou Metz. Our quick assumptions – the artefacts are there to witness the past and to cultivate the present generations of humankind thus contributing to development of bigger and greater future – in post-Richard Florida times have become somewhat problematic. The advocate of the creative class himself admits that cities with dense populations of young, successful creatives exhibit "the harshest levels of economic inequality and economic segregation" (Florida, 2017). The aim of my address is to discuss "the spillovers", i. e. unexpected outcomes that are created by cultural initiatives and span across artistic, social, cultural, economic, and political fields.

AGENT-BASED SIMULATION MODEL OF THE RELATION BETWEEN PARTICIPATION IN CULTURAL EVENTS AND SOCIAL CAPITAL DYNAMICS

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Using simulation modeling, we investigate how cultural participation can contribute to the clustering patterns of social capital (cohesion, polarization, radicalization). In the presented agent-based simulation model agent's have static demographic features, cultural preferences, and dynamic social capital characteristics. Transformations of cultural and social capital features' follow Axelrod's model. However, due to the additional extensions, our simulation model is capable to examine not only pair-to-pair based neighborhood interaction, but also cultural events' broadcasting effect. Simulation results show how particular demographic and cultural setup conditions contribute to the different clustering patterns of social capital.

Keywords: agent-based simulation, Axelrod model, social capital, cultural participation.

NON-LINEAR ANALYSIS METHODS APPLICATION IN OCCUPATIONAL FATIGUE MONITORING

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Human fatigue manifesting as temporary physical and psychological work capacity reduction is important factor associated with occupational injuries and quality of life of workers. Relationship between working time and fatigue is very individual and non-monotonic so sensitive and not disturbing work process methods of fatigue monitoring is the issue. [1] The aim of EUREKA project „Non-intrusive Human Fatigue Assessment“ is to develop platform with complex passive multi-level fatigue monitoring system and workability evaluation system designed in order to provide an integrated service in professional safety and health area. Methods of fatigue evaluation based on approach that human body as complex system adapts to an ever-changes with the help of integrated responses from three primary holistic systems, execution or performance (skeletal-muscle system), supplying (cardiovascular system) and regulatory (neurohumoral system) [2]. For the purpose to characterize the nonlinear complexity of signals the power spectrum, fractal dimensions, wavelet transformation, phase portrait, correlation dimension, the largest Lyapunov exponent, time-dependent divergence exponent, mass exponent spectrum and complexity measure can be used [3]. These methods verify the fact that ECG dynamics are dominated by an underlying multi-dimensional non-linear chaotic system, whose complexity measure is about 0.7 (in scale from 0 to 1). Second order coherence matrices the internal links of dynamical systems, i.e. relations between two synchronous data sequences can be described by mathematical expression Then the features of matrix sequence sufficiently reflect the interdependence of two data sequences. It shows the variation of discriminates sequence. During the optimal workload discriminant values goes closer to zero, showing higher complexity and optimal mobilization of body functions. The sudden change of discriminant values indicate about the essential changes in body, during fatigue conditions discriminant values increases showing that interaction between body functions are worsening. Conclusions: An important challenge is to process multi-sensor data in real time and create the appropriate data mining models that allow to analyze the inter dependencies of parameters and complex estimation of the functional state. Non-linear vital signals analysis methods allows more sensitive evaluate phenomenon of occupational fatigue and are suitable for real time fatigue monitoring systems.

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WORLD MODELING AND ITS OUTCOMES

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Worldmodeling is a typical subject of O.R. (Opations Research) and offspring of its system-holistic thinking. The model-object necessarely implies World system Analysis, Syntesis and Administration with very far reaching limits to human knowledge and wisdom, understandig this term as efficacious and efficient application of knowledge.

Jay Forrester´s 1970 - offer (Worldmodel 3) to the Club of Rome´s concern about an scientific approach to the "the Predicament of Mankind" which plagues the hole nature, resulted in the "The Limits To Growth" statements (MIT, Dennis Meadows, et all. 1972), its decennial actualization and an overwhelming information flow about an statistical "almost sure" decay or even destruction of, what is now, our civilization, culture and environment.

Almost every scientific prediction about population development, resource availability, nutrition, pollution and other essencial social functions, until 2100, is so menacing that a complete and profound analysis of causes is indispensable. But this is not what happens:

All "allowed" preocupation is directed to Climatechange, Migration, Warfare, Terror, Hunger, Poverty, loss of Health, Pollution, Scrapdisposal, etc., which, so terrible its burden our lives and consciences, are only SECUNDARY OUTCOMES in a due description of our Social System. Its punctual, momentary mitigation brings relief only, also punctual and momentary, to cynic "political correctness" or insignificant individual conscience who´s good intention "pave the road to hell".

I think that the way out of the created dilemma begins by the recognition that MANKIND CAN be modelled as an ARTIFICIAL SYSTEM and so it can be ADMINISTRATED as such. AND THIS HAS TO BE DONE AT EVERY HIERARCHICAL NATIONAL AND INTERNATIONAL GOVERNAMENTAL AS WELL AS INSTITUTIONAL LEVEL.

Applying our OR knowledge, affect, concepts, terms and methods, guided by the scientific and ethical Princple of Objectivity, A UNIC PERIODICALLY ADAPTIVE WORLDMODEL can be concieved and applyed to whom every and each national government would have proportionally contributed, INCLUDING the respect of THE ETHICAL IMPERATIVE OF INDIVIDUAL SUBJECT LIBERTY AS CONDITION FOR SOCIAL WELFARE.

BUT THE MEANING OF BOTH TERMS, WELFARE AND INDIVIDUAL LIBERTY, HAVE TO BE DEFINED, ADJUSTED TO THEIR MEANING WHITHIN THE OPTIMAL SYSTEM MODEL

Above mentioned intent (LTG, etc.) gives us a starting point. But a solution can only be found if welfare and liberty are choosen as multi-variables of the Artificial Human System to be optimized and other factors such as market, property, growth, etc. are conditioned by this optimization taking place in a NATURAL ENVIRONMENTAL SYSTEM with input-output ultrastable equilibrium.

Necessarely, a new social relation system must emerge and new definitions of liberty and welfare would be needed, as mentioned.

So, the task is given. But, can it be entrusted to our proffessional community? My answer is that it must, that our debt to our cultural heritage is so great that a denial seems an ethical resignation.

After worldwar 2, the era of neutral science has ended. Data and Informationflow and availability of every knowledge-subject and of individual as well as collective responsability became so great that a teleonomic-predictive statement of our possible future became, correspondently to our specific skill, a moral commandment.

Therefore, I call 1) to start the disigne of an admissable Worldmodel, such that it meets the necessary “Required Variety” and programmed periodic adaptation, which, I fear, present models have not, and 2) to found, whithin our institutional limits, the administrative. Subsystem to handle this Worldmodel.

MINIMIZING THE NUMBER OF DEPOT CHARGING POINTS FOR ELECTRIC BUSES OF SEVERAL ROUTES

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A mathematical model and a method for minimizing the number of depot charging points for a fleet of electric buses (e-buses) serving a given set of urban routes have been developed. The model is based on simulating discharge processes of e-buses according to their schedules of the most representative day and on optimizing the use of the depot parallel recharge points over time. It is assumed that e-buses are equipped with high-capacity batteries (hundreds of kWh) which keep sufficient energy for executing the daily schedule and are recharged in the depot. The batteries are slow charging (2-8 hours). The constraints include the requirement to fully restore the charge of the batteries and to address the available dynamic power supply provided by the city power grid. The input data are departure and arrival times of e-buses from/to the depot, the charge levels of the batteries when the e-buses return to the depot, the functions of batteries charge depending on the current charge level and the charging time, and lower and upper bounds on the number of the depot charging points. A two-level decomposition scheme for solving the formulated problem is developed. At the lower level, for a fixed number of charging points, optimal allocation of the charging points between e-buses over time is sought with the objective of minimizing the total unsatisfied charging time of all e-buses, which is required to fully restore their batteries by the beginning of the next day. At the upper level, a bisection search over a given range of the optimal number of charging points is performed. The results are obtained within the project PLATON of Electric Mobility Europe Cofund.

Keywords: electric bus, depot charging station, optimal planning.

MANY-SIDED GLOBALIZATION AND CULTURAL IDENTITY QUESTION

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Globalization is perceived as a multidimensional process that binds and rebinds the world at many levels. Different aspects of globalization have formed their own fields of research. The economic, technological and cultural dimensions of globalization are most clearly distinguished, paying attention to the various "twists and turns" of the postmodern era -- informational, visual, ecological. The political dimension of globalization is the supranational, effective international institutions whose purpose is to promote the process of globalization by ensuring the free flow of capital, goods and people as "labor force" and “human resources”, while submitting all other "freedoms" to capital. This movement inevitably changes the national and social relations, civilizational and cultural interaction. Changes are defined as cultural and social hybridization, diasporation and ghettoization processes that are of increasing interest to researchers of various fields. It is worth pointing out that globalizational socio-cultural change is increasingly influenced by technological virtualization and mediaization processes, which promote the isolation from particular locations, social strata, nations and states and the engagement in virtual anonymous social relationships. Explaining the impact of globalization on people, nations and cultures raises the question of cultural and ethno-cultural identity and human selfness. This issue has been exacerbated by the current phase of globalization, which is now dominated not by homogenizing but by heterogenizing processes, leading to global power races, the spread of regional military conflicts and areas of instability, ethnic and religious cleansing, and the "return" of geopolitics, civilizational and cultural imagery to strengthen national and cultural identities.

The narrow exploration of certain processes and factors of globalization does not allow us to understand the subtle and all-encompassing impact of globalization on man, and so far we lack the theoretical "image" of the interactions of various identities -- individual, group, national, etc. Such an image requires a cultural theory that would describe the relationship between culture and identities, the basic cultural features of identities and the functioning of cultural memory. People always live as communities, thus, in a more general sense, the primary purpose of culture is to ensure the vitality of a community by maintaining and reinforcing its identity in its mother tongue. Primary cultural expediency manifests itself in several dimensions of co-existence or co-habitation – co-existence with natural environment, homeland, co-existence with one's neighbors and others, co-existence with one's history and historical experience. All dimensions of co-existence include active cultural memory, which is the vital power of cultural action. Such an understanding of culture helps to explain why contemporary globalization is accelerating the erosion of various identities, and at the same time provides an insight into cultural identity strengthening tools, which are increasingly embedded in the contemporary geopolitical power relations.

IMPORTANCE OF OPTIMIZATION TECHNIQUES FOR THE SOCIAL SCIENCES

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Many of nowadays social sciences branches could hardly manage without the help of mathematics, which is an integral part of contemporary sciences. In some sense, one can hardly properly solve problems of modern social behavior without applying mathematics. Most of such problems can be modeled and solved using optimization techniques.

Such computational social science branch widely has been used to represent the relationships between individuals of a population in online social networks [6] or modeling other network flow optimization problems [1, 3]. Some of those problems have been shown to be difficult to solve by sequential algorithms, thus there is great importance in developing parallel algorithms for optimization.

Due to its simplicity and efficiency, derivative-free global-search DIRECT (DIvide a hyperRECTangle) [2] algorithm is one of the most popular optimization algorithms in past two decades and has received considerable attention from the optimization community, and various novel ideas and extensions have been proposed, including for general global optimization problems. Unfortunately, the efficiency of the many DIRECT-type algorithms become worse solving multimodal problems and when the solution with high accuracy is required. To overcome such difficulties, we have introduced and incorporated into our algorithms [4, 6] a new scheme for the selection of potentially optimal hyper-rectangles. An extensive experimental investigation revealed the potential and competitiveness of the added enhancements in our recent proposals, especially for more challenging (higher dimensional) and multimodal problems. Moreover, since the set of potentially optimal hyper-rectangles is larger (compared to DIRECT), this scheme looks more promising (compared to original DIRECT) for parallelization.

However, the nature of the DIRECT algorithm presents difficulties for efficient parallel implementation, and it is known only a few parallel DIRECT implementations. Thus, in this talk, we introduce first parallel implementation to our recently proposed generally constrained DIRECT-type algorithm [4, 5] and experimentally investigate the potential of our proposal for mathematical optimization and challenging mathematical sociology problems.

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Keywords: derivative-free global optimization, DIRECT-type constraint handling, parallel algorithm.

WHY WE NEED THE THEORY OF SOCIAL COMPLEXITY: OPPOSITION TO VACCINATIONS, A MODEL OF A SOCIETAL COMPLEXITY

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Humanity seems to be on the brink of facing issues threatening our very survival. Environmental and social problems are intertwined and plague every continent. Modern communication technologies, transportation, and trade have brought about a global level of society, and more widespread and complicated problems. Yet human thinking and small ideas prevent us from finding solutions. The theory of societal complexity and the COMPRAM methodology provide a way to study and look for better ways to deal with such problems. In relatively recent times, small groups of people have opposed mass vaccination programs for their children. Suddenly, in 2019 there is a measles epidemic spreading across continents. This is a serious childhood disease which had almost been eliminated by mass vaccinations. This phenomenon has many intertwined factors: the biological aspect and the reality of a serious illness, with serious consequences, including possible death; the social aspect that encouraged mass vaccination before children entered school; the recent rise of resistance to authority of any kind; the denigration of expertise, and the rise of phony research and fake news; the distrust of the big pharmaceutical companies, to name a few. This paper will demonstrate how this issue can be used as a model of a complex societal problem, and how the COMPRAM methodology may be used to establish a way of handling this problem.

Keywords: societal complexity, antivaxers, health.

AN INTEGRATED MODEL FOR ASSESSING THE EFFICIENT USE OF PUBLIC/CULTURAL BUILDINGS

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State enterprises and municipalities concern about the performance use of public buildings. The optimisation of their efficient management by ensuring the rational use of resources and protecting societal needs are complex tasks. Therefore, stakeholders need knowledge-based decisions. The article proposes a novel management model, an original set of criteria to assess and select the most efficient use scenarios of public buildings. The hybrid fuzzy multi-criteria decision model consists of four different approaches. The challenge's solution starts with setting up a team of qualified experts. Later, the team creates original qualitative and quantitative criteria set to assess the efficiency of the use of cultural buildings at the specific local conditions. Then decision-makers determine criteria weights based on the Delphic AHP model. The basis of criteria values is statistical data, calculations, and data from expert judgement. At the following step, the decision-makers solve the task using three different MCDM methods and integrate obtained results for the final ranking. The proposed model will expand the possibilities for impartial decision-making and evaluate the efficiency of end-use of buildings concerning social benefit criteria. The results are essential to public sector organisations, especially for municipalities with particular problems associated with the management of a large number of public assets.

Keywords: public buildings, use efficiency criteria, multiple criteria decision-making, fuzzy model, social benefits, expert systems.

BRAIN AND CULTURE; SOME IMPORTANT INCLUSIONS

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The main message of this presentation, consciousness cannot exist without its external body (obviously not reducible to the brain as purely physical substance) – culture. It does not only provides consciousness with some external raw product for further processing, but also represents means for evaluating, and attaches importance to the activity of consciousness; because what we are evaluating, we are respectively signifying. The situation with current fashion in the Consciousness Studies can be briefly expressed in 2 points. (a) consciousness - either processes or the state of material reality. (b) Reliability of results in this field necessarily requires an independent (and preferably qualified) observer or third-party perspective. Nevertheless, consciousness in its original meaning (syneidós) inevitably needs both the Other (firstly, as a teacher and then as a necessary co-subject for the realization of their potencies) and an appropriately prepared Self, possessing a conscience.

In the words of Kant, the conscious human being is the one who received the moral law (das sittliche Gesetz) through cultural formation. A person without a cultural core is not a human. It is possible to put forward a more rigorous thesis that the same cultural core determines both the content of the concept of a person and the entire configuration that we first fitting them to ourselves. Within these frameworks the brain takes part in both cognitive and cultural and even social activities. It is a nucleus of the mega system of culture. From this set or thoroughly mixed soup we do not only get the sophisticated thoughts endlessly but also simple recipes and advice like how to cook. However, it is this adherence to one or another style of culture forms some external consciousness, which if we are talking about the brain, or rather, and the brains, is exclusively the product of this large consortium of primarily biological objects.

BEHAVIORAL OPERATIONS RESEARCH: REACHING A FAIR COMPROMISE AGREEMENT ON PIECE-RATE COMPENSATION SYSTEM

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The efficient piece-rate compensation system is usually the result of the compromise agreement between employees and the employer. This study is mainly focusing on the process of reaching a fair compromise agreement on piece-rate compensation system. The discussed problem relates to the issues of behavioral operations and behavioral operations management. Designing and developing an effective and efficient piece-rate compensation system could have a significant impact on enterprise efficiency. The presented results are based on the ideas contained in rational choice theory, implicit contract theory, and human resource management theory. We assume that employers know and accept the requirements that employees expect from piece-rate compensation system. Otherwise, the employer will not be able to ensure adequate and competent personnel for his enterprise. Reaching a fair compromise agreement can ensure effective compromise piece-rate compensation system.

Keywords: behavioral operations research, behavioral operations management, effective compensation system, employees and employer expectations, reaching a compromise agreement.

EFFECTIVENESS AND EFFICIENCY AT NATIONAL LEVEL ESTIMATION FOR EUROPEAN COUNTRIES BY MEANS OF DEA

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The terms of economic efficiency and productivity are gradually being embedded in the daily vocabulary of education policy makers around the world. Quantification of education done right promises higher quality with less resources. The studies on education efficiency are focused exclusively on primary, secondary or tertiary educational stages. However, this type of assessments only provides partial views of the education system. For the estimation of efficiency and effectiveness we included the input and output indicators of each education level in the models. As a result we obtain a more wide-ranging assessment of national educational systems. In the analysis we use publicly available year 2015 data collected from EUROSTAT, OECD and IEA. Full data set is available for 12 European countries. We apply data envelopment analysis for effectiveness and efficiency estimation. No prior assumptions are made or expert judgement included. The calculated effectiveness/efficiency ratio is above 1 for all countries which indicate that better outcomes can be achieved with the given resources.

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Keywords: data envelopment analysis, education systems, effectiveness/efficiency ratio.

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