12th INTERNATIONAL CONFERENCE ON OPERATIONS RESEARCH

La Habana, March 8th-11th, 2016

Organized by:

Universidad de La Habana.

SAMM, Université Paris I, Panthéon-Sorbonne.

Sponsors:

Asociación Latinoamericana de Investigación Operativa, (ALIO).

American Statistical Association, (ASA).

International Federation of Operations Research and Management Sciences, INFORMS.

Oficina del Historiador de la Ciudad.

Red Iberoamericana de Estudios Cuantitativos Aplicados, (RIDECA).

Sociedad Cubana de Matemática y Computación, Sección Investigación Operacional.

Universidad Técnica Particular de Loja, (UTPL).

COMMITTEES

Program Committee

S. Allende [Chair, Havana], L. Álvarez [Havana], A. Arcos [Granada], M.L. Baguer [Havana], C. Bouza [Havana], G. Bouza [Havana], R. Caballero [Málaga], J. Cochran (Alabama), B. Cornet [Paris 1-Kansas], M. Cortés [Cienfuegos], D. Covarrubias [Chilpancingo], F. Cucker [Hong Kong], M. Cottrell [Chair, Paris 1], J. Daduna [Berlin], M. Davidian [N. Carolina], A. Fernández [Havana], P. Gaubert [Paris 12], P. Gourdel [Paris 1], J.Guddat [Honor Chair, Berlin], C. Hardouin, [Paris Ouest Nanterre], S. Hernández[Xalapa], G. Joya [Malaga], A.M. B. López [Las Palmas], M. A. León [Pinar del Río], A. Marrero [Havana]], M. Negreiros [Fortaleza], M. Nicado [Havana], M. Olteanu [Paris 1], J. Otero [Havana], L. Pedreira [La Coruña], L. Pla [Lleida], M. Rodríguez [Havana], A. Ruiz [Havana], J. Ruckmann [Bergen], Ch.Tammer [Halle], L. Sandoval [Puebla], V. Sistachs [Havana], J.L. Verdegay [Granada], B.-A. Wickström [Budapest], A. Xavier [Rio de Janeiro].

Organizing Committee

Prof. Dr. Raúl Guinovart: Dean, Facultad de Matemática y Computación, Universidad de la Habana, Genry Pérez Rodríguez, Danai Pérez Arjona, Universidad de la Habana.

FOREWORDS

It is our pleasure to welcome you to the 12th International Conference on Operations Research. The Conference intends to serve as a forum for scientists related with Operations Research covering theoretical and practical results and experiences in applications of OR.

This edition is devoted to the 50th Anniversary of the journal Investigación Operacional and to the memory of Monique Florenzano. Investigación Operacional is strongly connected with the development of the Operations Research in our country. The journal has encouraged the development of the OR in Cuba and, in particular, the organization of the series of Conferences and Workshops on Operations Research. The journal publishes selected contributions presented in these scientific events in special numbers. A session of the Conference 12th Conference will be devoted to commemorate the 50th anniversary of the journal. Monique Florenzano was Associated Editor of our journal covering the area of Economic Sciences, area where she has had important contributions. She was also an enthusiastic member of the Program Committee of these events. A stream on Mathematical Economic and a session on Mathematical Economic will be held to rend honor to Monique Florenzano.

We are very glad that Prof. Dr. Charles Bouveyron, Prof. Dr. James Cochran, Prof. Dr. Paul Doukhan, Prof. Dr. Martin Grötschel, Prof. Dr. L. Robin Keller and Prof. Dr. José Luis Verdegay have accepted to read the Plenary Lectures of the Conference. Their expertise in their respective fields will allow a wide overview on the selected themes. We would like to thanks Prof. Dr. Dominique Haughton, Prof. Dr. Stephane Loisel, Prof. Dr. Christiane Tammer and Prof. Dr. José L. Verdegay for organizing special sessions. on economy and environment

Two pre-conference courses on topics of Probabilities were also held, by Prof. Madalina Oltenau and Prof. Julien Randon-Furling, professors of the University Paris 1, another sign of the long term cooperation of University Paris1 with Havana University as co-organizers of the Conference. This edition has also hosted a workshop on Economy and Environment, organized by Prof. Michael Ahlheim and Prof. Dr. Berng A. Wickström, whose goal is to identify common research interests on the theme between German and Cuban researchers. The Conference is supported by the number and level of contributions coming from Europe, Asia, Africa, USA and Latin America and Cuban researchers of different universities and centers of Cuba. The contributions have been organized in nine streams. In particular, we devoted to the memory of Monique Florenzano the stream on Mathematical Economic.

Our thanks to the Scientific Societies which have sponsored this edition. Their promotion to the Conference has been very important. In particular, the International Federation of Operations Research and Management Science and the American Statistic Association have play an important role for fostering links between the Operations Research Communities of Cuba and United States of America. In this sense, our special acknowledgment to Professor Robin Keller, past president of INFORMS and Prof. James Cochran. It is very important to wide and deep our scientific relations and we have the willness to do it.

Dear delegates, our material resources are limited. Some difficulties have to be sorted for coming to here, another ones could emerge yet. The organizers of the Conference will not spare efforts for doing your stay fruitful and nice. You are friendly welcome.

Contents

PLENARY LECTURES

MODEL-BASED CLUSTERING OF FUNCTIONAL DATA: APPLICATION TO THE ANALYSIS OF BIKE SHARING SYSTEMS

Charles Bouveyron

Université Paris Descartes, France

Bike sharing systems (BSSs) have become a means of sustainable intermodal transport and are now proposed in many cities worldwide. Most BSSs also provide open access to their data, particularly to real- time status reports on their bike stations. The analysis of the mass of data generated by such systems is of particular interest to BSS providers to update system structures and policies. This work was motivated by interest in analyzing and comparing several European BSSs to identify common operating patterns in BSSs and to propose practical solutions to avoid potential issues. Our approach relies on the identification of common patterns between and within systems. To this end, a model-based clustering method, called FunFEM, for time series (or more generally functional data) is developed. It is based on a functional mixture model that allows the clustering of the data in a discriminative functional subspace. This model presents the advantage in this context to be parsimonious and to allow the visual- ization of the clustered systems. Numerical experiments confirm the good behavior of FunFEM, particularly compared to state-of-the-art methods. The application of FunFEM to BSS data from JCDecaux and the Transport for London Initiative allows us to identify 10 gen- eral patterns, including pathological ones, and to propose practical improvement strategies based on the system comparison. The visual- ization of the clustered data within the discriminative subspace turns out to be particularly informative regarding the system efficiency. The proposed methodology is implemented in a package for the R soft- ware, named funFEM, which is available on the CRAN. The package also provides a subset of the data analyzed in this work.

THE IMPORTANCE OF COLLECTIVE SCIENCE

James J. Cochran

University of Alabama

The scientific method, which is embodied by statistical inference, is the heart of who we are and what we do as an academic community (which is why some, including me, argue that statistics is the purest of the sciences). Unfortunately, although we may individually think and act scientifically, collectively we often fail to do so. This has led in numerous instances to nonscientific collective behavior. In addition to dramatically retarding the progress of science, this collective behavior has led to misunderstanding of science by the non-scientific community, co-opting of science by the business community, and poor decision making by policy makers those who have relied on the results of our research efforts. In this talk I will address the lack of collective scientific behavior in research on the relative age effect and the ramifications that have resulted. Specifically, I will discuss the i) lack of appreciation for results that are not statistically significant, ii) disregard for conditions that are necessary for establishing a relationship between an antecedent event and a consequent event, and iii) failure to consider, establish, and test appropriate null and alternative hypotheses. I will also present what I believe are appropriate corrective measures.

A NEW VISION OF EXTREME VALUES THEORY UNDER DEPENDENCE

Paul Doukhan

University of Cergy Pontoise and French University Institute

The talk adresses some features of extreme values theory for time series. Classically clusters may appear for the extremes of time series. The theoretical behavior of such series is hard to capture theoretically so that

computational methods based upon resampling are sometimes preferable. In a joint paper with Prohl and Robert (2011) we improve on a paper by Bertail et al. (1999) allowing to consider weak dependence properties (Doukhan, Louhichi, 1999) and providing almost sure convergences. Cluster analysis asymptotics are provided in a paper by Drees and Rootzen (2010) and extented with Gomez. More recently with Jakubowski and Lang we prove simple sufficient conditions for the existence of a phantom distribution which means that extreme values theory under dependence may be seen to fit its independent analogue. We shall also explain the difficulties of our approach and our final aims to handle practical issues of extreme values theory.

DIGITAL HUMANITIES AND OPERATIONS RESEARCH
Martin Grötschel
Berlin-Brandenburg Academy of Sciences and Humanities, Germany.

The term Digital Humanities (briefly DH), coined about ten years ago, is used to describe efforts aimed at supporting research (and teaching) in the humanities (and the social sciences) by employing tools and methods from information technology, computer science and mathematics. DH is developing in many directions, but despite some hype and significant media coverage, DH is still in its infancy. The current DH situation resembles the early days of Operations Research, also a field in the interface of many other disciplines.

Standard statistical analysis has a long tradition in various branches of the humanities, and the usual IT-tools are frequently employed as well. In my lecture I will address the issue how OR tools can support DH, i.e., which modeling approaches and solution techniques of Operations Research can be successfully employed in Digital Humanities. I will describe, in particular, some of the efforts (still rudimentary) made in this direction at the Berlin-Brandenburg Academy of Sciences and Humanities with a special focus on linguistics, the edition of manuscripts (of famous scientists such as Leibniz, Alexander von Humboldt, Kant,) and archeology.

A MARKOV DECISION TREE MODEL TO EVALUATE COST-EFFECTIVENESS OF CERVICAL CANCER TREATMENTS
L.R. Keller and Jiaru Bai
University of California, Irvine, USA.

We evaluated the cost-effectiveness of adding the new drug bevacizumab to chemotherapy treatment of advanced cervical cancer. A Markov decision tree was created using recent clinical trial data. In the 5-year model, subjects transitioned through the following monthly states: response to the treatment, progression of the disease, minor complications, severe complications, and death. The 2013 US MediCare Services Drug Payment Table and Physician Fee Schedule provided costs, in US dollars. On average, patients survived 14.7 months at a US medical system cost of $5,938 with chemotherapy alone vs. 17.7 months at a cost of $79,097 with chemo plus bevacizumab. The estimated total cost of therapy with bevacizumab is approximately 13.3 times that for chemotherapy alone, adding $73,159 per 3.0 months of life gained. So the incremental cost effectiveness ratio (ICER) is $24,386 extra cost/extra month. Patients experienced a health quality level each month depending on the treatment effectiveness and on any complications, ranging from 0 for death to 1 for the baseline of 1 month responding to advanced cervical cancer treatment. Patients survived 11.2 quality adjusted life months (QALmonthscc) with chemo alone vs. 13.9 QALmonthscc with chemo plus bevacizumab. The ICER ratio increased to $27,096/QALmonthcc due to the smaller difference in QALmonths. Increased costs associated with bevacizumab therapy for advanced cervical cancer are primarily due to the cost of the drug and not the management of bevacizumab-induced complications. Possible future cost reduction.

FUZZY OPTIMIZATION: SINCE 1970 UNTIL TODAY AND BACK
José Luis Verdegay
Universidad de Granada, Spain.

The need for an optimal solution or the best solution among those available, in a properly proposed problem is the rationale behind studying the theories and proposing methodologies appropriate to the scientific field in which the problem arises. More specifically, although still a very broad area, there is an important type of problems, known as optimization problems, which are generally associated to finding the maximum or minimum value that a specific function can attain within a previously defined set. Everything related to such problems can be classified within the doctrinal field of Mathematical Programming, which covers a huge range of situations, whether they be linear cases, non-linear cases, randomness, single decision maker, several decision makers etc.

Among all of the models included in the Mathematical Programming field, the best and most studied is the single objective linear case (dealt with under Linear Programming), which has also been shown to have the greatest practical benefits. The methods and models of Linear Programming (LP) have useful applications in the areas of Engineering, Economy, Mathematics, Operations Research or Computational Intelligence as well as in other disciplines related to optimization to a greater or lesser degree. They constitute a more than suitable theoretical basis on which to tackle highly complex situations in an elegant and efficient manner. As occurs in the, let us say, conventional area of Mathematical Programming, also in the Fuzzy Sets and Systems area, the best and most studied problem of Fuzzy Mathematical Programming is that of Fuzzy Linear Programming (FLP). While FLP has its theoretical precedents in 1970 in the great and seminal work on Decision Theory by R. Bellman and L.A. Zadeh [1], FLP problems were formally born in 1974, the year in which two separate papers [2,3] proposed the same model to deal with LP problems, i.e. that the set of constraints be given by a fuzzy set. Despite the coincidence, the works approached the solution from different points of view, and thus employed different methods, which led to a solution constituted by a single point, which therefore can be considered as outside the fuzzy context of the calculation. It was subsequently shown [4] that these two methods are particular cases of a more general method which allowed a context-dependent fuzzy solution, and which encompassed the solutions put forward in [2,3]. From this perspective, and taking as a reference the recent paper [4], in this talk main highlights on the topic of FLP from the early 80s up to the current date will be described, paying special attention to current practical applications of FLP problems and possible future research areas that would deserve to be explored, as for instance may be the case of Fuzzy Sets based Metaheuristics.

References

1 R.E. Bellman, L.A. Zadeh: Decision Making in a Fuzzy Environment. Management Science 17 (B) 4 (1970) 141-164.

2 H. Tanaka, T. Okuda and K. Asai: On Fuzzy Mathematical Programming. Journal of Cybernetics 3, 4 (1974) 37-46.

3 H.J. Zimmermann: Optimization in fuzzy environments. Presented at XXI International TIMS and 46th ORSA Conference, San Juan, Puerto Rico, 1974.

4 J.L. Verdegay: Progress on Fuzzy Mathematical Programming: A personal perspective. Fuzzy Sets and Systems 281 (2015) 219-226.

PLENARY LECTURERS

Charles Bouveyron.

Charles Bouveyron (France) is Professor of Statistics and head of Department of Statistics at Université Paris Descartes, Paris, France. He received in 2006 the Ph.D. degree from Université Grenoble 1 (France) for his work on high-dimensional classification. In 2006-2007, he was a postdoctoral researcher in the Department of Mathematics and Statistics of Acadia University in Canada where he worked on the statistical analysis of networks. Then, he was Assistant Professor (2007-2012) and Associate Professor (2012-2013) at Université Paris 1 Panthéon-Sorbonne. His research interests include classification and clustering of high-dimensional data, classification under uncertainty and weak supervision, adaptive and online learning as well as network analysis. In this context, he has developed several innovative clustering and classification methods and applied them with success in medical imaging, mass spectrometry, aeronautics and chemometrics.

James Cochran.

James Cochran (USA) is Professor of Statistics and Rogers-Spivey Faculty Fellow at The University of Alabama. He earned a PhD in Statistics from the University of Cincinnati in 1997, and he has been a Visiting Scholar with Stanford University, the University of South Africa, the Universidad de Talca, and Pôle Universitaire Léonard De Vinci. Professor Cochran was a founding co-chair of Statistics Without Borders and a member of the founding committee for INFORMS Pro Bono Analytics initiative. He established INFORMS Teaching Effectiveness Colloquium series and annual case competition. In 2005 Professor Cochran established the International Education Workshop series, and in 2008 he organized the 2008 ORPA Conference on Using Operations Research to Address Urban Transport and Water Resource Management Issues in Africa. He is founding Editor-in-Chief of the Wiley Encyclopedia of Operations Research and the Management Sciences and the Wiley Series in Operations Research and Management Science. He served as Editor-in-Chief of INFORMS Transactions on Education and serves on the boards of several journals. In 2006 Professor Cochran was elected to the International Statistics Institute, in 2008 he received the INFORMS Prize for the Teaching of OR/MS Practice, in 2010 he received the Mu Sigma Rho Statistical Education Award, and in 2011 he was named a Fellow of the American Statistical Association. In 2014 he became the 86th recipient of the American Statistical Association's Founders Award, and in 2015 he received the Karl E. Peace Award for outstanding statistical contributions for the betterment of society.

Paul Doukhan.

Paul Doukhan (France) received his Ph.D. in 1980 from Orsay and since then he has served in various places including Orsay, Wuhan University, University Cergy-Pontoise and ENSAE. In 2011 he was elected as a senior member of Universitary institute of France (as 3% of French Academics). He has directed 18 Ph.D theses and he is the author/c-author of about 90 papers, 10 lecture notes volumes and 10 textbooks. He has served as an associate editor for the journals Stochastic Processes and their Applications, Statistics, Strapro online encyclopedia, Theory of Stochastic processes, Research Bulletin of NTII (Kiev), Journal of Time series analysis, and Statistics. His lecture notes on mixing is among the most cited references of the subject. He is the leader of a French group on dependence structures.

Martin Grötschel.

Martin Grötschel (Germany)Martin Grötschel, born in 1948, studied mathematics at U Bochum, he received his PhD in economics and habilitation in Operations Research at U Bonn. He has been mathematics professor at TU Berlin and president of the Zuse Institute for Information Technology Berlin until September 2015. Grötschel was the Secretary of the International Mathematical Union from 2007 to 2014 and chaired the DFG Research Center MATHEON Mathematics for Key Technologies from 2002 to 2008. Since October 2015 he has been President of the Berlin Brandenburg Academy of Sciences and Humanities. Grötschels main areas of research are discrete mathematics, optimization and operations research with a special focus on the design of practically efficient algorithms for hard combinatorial optimization problems appearing in practice. The application areas include telecommunications, chip design, energy, production planning and control, logistics, and public transport. He has recently begun investigating mathematical and IT aspects of digital humanities. Grötschels scientific achievements were honored with several distinctions including the Leibniz, the Beckurts, the Dantzig, the Fulkerson, and the John von Neumann Theory Prize. He holds four honorary degrees and is a member of five scientific academies.

L. Robin Keller.

L. Robin Keller (USA) is the 2016 Past President of the Institute for Operations Research and the Management Sciences (INFORMS, www.informs.org). Prof. Kellers research focuses on developing techniques for analyzing decisions. Her decision analysis research spans the areas of multiple attribute decision making, fairness, perceived risk, and planning protection against terrorism, environmental, health, and safety risks (www.merage.uci.edu/go/Keller; personal site: http://faculty.sites.uci.edu/lrkeller/). She is a Full Professor of Operations and Decision Technologies in the Paul Merage School of Business at the University of California, Irvine, USA (http://www.merage.uci.edu/Faculty/AcademicAreas/ODT.aspx). She teaches management science to Health Care Executive MBAs, decision analysis to MBAs, and decision theory to doctoral students. She

joined UCI in 1982 after earning her M.B.A. and Ph.D. in management science from UCLA. She has served as the Doctoral Program Director and Associate Dean (for the Full-time MBA Program and for Research). She was Program Director for the US NSF Decision, Risk, and Management Science Program. Dr. Keller was the Editor-in-Chief of Decision Analysis from 2007-2012, a founding Director-at-large of INFORMS, TIMS Vice President-Finance and Council member, and Decision Analysis Society Chair. She received the Ramsey Medal in 2015, for lifetime contributions to decision analysis from the Decision Analysis Society of INFORMS, and is an INFORMS Fellow (2004) and 2006 INFORMS Kimball Medalist.

José Luis Verdegay.

José Luis Verdegay (Spain) received the M.S. degree in mathematics and the Ph.D. degree in sciences from the University of Granada, Spain, in 1975 and 1981, respectively. He is a full Professor at Department of Computer Science and Artificial Intelligence (DECSAI), University of Granada, Spain, member of the Models of Decision and Optimization (MODO) Research Group, Coordinator of the Master on Soft Computing and Intelligent Systems between University of Granada and University of Computer Sciences (Cuba) and Regional Director of the Asociación Universitaria Iberoamericana de Postgrado (AUIP). As research is concerned, he has published 23 books and more than 325 scientific and technical papers in leading scientific journals and books and has been Advisor of 19 Ph.D. dissertations. He has served on many international program committees and has attended numerous national and international conferences, congresses, and workshops. He has been Principal Researcher in a variety of national and international research and educational projects, and currently is leading a research project on Models of Optimization and Decision: Applications and Solutions based on Soft Computing at 3 Different Environments. Professor Verdegay is an IFSA fellow, IEEE Senior member, and Honorary Member of the Cuban Academy of Mathematics and Computation. Besides he has the Featured Possition of Invited Professor at the High Technical Institute José Antonio Echevarría (Havana, Cuba), Central University of las Villas (Santa Clara, Cuba) and University of Holguín (Holguín, Cuba).

PRE-CONFERENCE ACTIVITIES

Pre- Conference Courses
March 1st- March, 7th, 2016.

Course: **Time series: change-point detection and regime switching models.**
Prof. Madalina Olteanu (Ph.D.).
SAMOS-CES, Université Paris I Panthéon Sorbonne, France.

Course: **Out and About with Brownian Motion: a mini-course on extreme-value statistics and applications**
Prof. Julien Randon-Furling (PhD). Université Paris1, Paris I Panthéon Sorbonne, France.

Pre-Conference Workshop for the initiation of research partnerships
March, 7th, 2016.

9:00-16:00: Salon Unesco, Universidad de La Habana.
The workshop has been organized for promoting research partnerships between Cuban and German researchers working on on environmental problems and its economic impact.
Participants:

- Professor Andreas Löschel: Energy and Resource Economics, University of Muenster, Germany.

- Professor Alfonso Sousa-Poza: Household and Consumer Economics, University of Hohenheim, Germany.

- Professor Andreas Pyka: Innovation Economics, University of Hohenheim, Germany.

- Professor Bengt-Arne Wickström: Public Finance, Andr assy-Universität Budapest,Germany.

- Professor Michael Ahlheim: Environmental Economics, University of Hohenheim, Germany.

- MSc. Ute Siepmann: Environmental Economics University of Hohenheim, Germany.

- Dr. Jos e Somoza Cabrera: Centro de Investigaciones Marinas, Universidad de La Habana, Cuba.

- Dr. Juan Llanes Regueiro: Centro de Investigaciones Marinas, Universidad de La Habana, Cuba.

- Dr. Pedro Álvarez Mederos: Instituto Superior de Relaciones Internacionales, Cuba.

- MSc. Raúl Rangel Cura: Instituto de Geografa Tropical, CITMA, Cuba.

- Dra. Yeniley Allegue Losada: Facultad de Economía, Universidad de La Habana, Cuba.

GENERAL TIME-TABLE

Abbrv.	Activities	Abbrv.	Activities	Abbrv.	Activities
Ac	Actuarial and related topics	AD	Analytics across the Disciplines	AE	Applications in Economy
CM	Computational Methods Models	DOM	Decision and Optimization	ME	Mathematical Economics
OT	Optimization Theory	SPM	Statistical and Probability Models	TOR	Teaching OR

Tuesday, 8th

Hotel Habana Riviera.

09:00-10:00: Opening Session, Salón Internacional.

10:00-11:00: Opening Plenary Lecture, Salón Internacional.

11:00-11:30: Coffee Break.

11:00-14:00: Registration.

11:30-12:30: Special Session 50th Anniversary of the Journal Revista Investigación Operacional, Salón Internacional.

17:00-18:30: Posters Session 1 & 2, Hall, Hotel Habana Riviera.

18:30-19:15: Tour: "Hotel Habana Riviera and its History".

19:30-23:00: Welcome party, Salón Copa Room, Hotel Habana Riviera.

Wednesday, 9th

Hotel Habana Riviera.

09:00-10:00: Plenary Lecture, Salón Gelabert.

10:00-10:30: Coffee Break.

10:30-12:50 Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
DOM1	TOR	CM1	OT1

12:50-14:30: Lunch Break.

14:30-15:30: Plenary Lecture, Salón Gelabert.

15:30-16:30: Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
DOM2	SPM1	AE1	OT2

16:30-16:50: Coffee Break.

16:50-18:30 Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
DOM3	SPM2	AE2	OT3

Thursday, 10th

Hotel Habana Riviera.

09:00-10:00: Plenary Lecture, Salón Gelabert.
10:00-10:30: Coffee Break.
10:30-12:50 Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
SPM3	ME1	CM2	AE3

12:50-14:30: Lunch Break.
14:30-15:30: Plenary Lecture, Salón Gelabert.
15:30-16:30 Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
Ac1	AE4	CM3	AD1

16:30-16:50: Coffee Break.
16:50-18:30 Parallel Sessions:

Room 1	Room 2	Room 3	Room 4
Ac2	AE 5/RIDECA	CM4	AD2

20:00 Conference Dinner, Restaurant Vuelta Abajo, Habana Vieja.

Friday, 11th

Hotel Habana Riviera.

09:00-9:40: Panel **Monique Florenzano in Memoriam.** Salón Gelabert.
9:40-10:00: Coffee Break.
10:00-12:00 Parallel Sessions:

Room 1	Room 2
SPM4	ME2/ OR Meeting

12:10-13:10: Closing Plenary Session.
13:15-...: Farewell Lunch and Closing Address.

SESSIONS

Tuesday, 8th
Morning

09:00-10:00: Opening Session, Salón Internacional.

Opening Plenary Lecture, Salón Internacional.
10:00-11:00: Cochran, J.: The importance of collective science.
Introducer: S. Allende.

11:00-11:30: Coffee Break, Patio de los Laureles, Facultad de Matemática y Computación.

11:00-14:00: Registration. Library Facultad de Matemática y Computación.
11:30-12:00: Special Session **50th Anniversary of the Journal Revista Investigación Operacional.**

Tuesday, 8th
Afternoon

17:00-17:40: Poster Session 1: Hall, Hotel Habana Riviera.
Chair: A. Fernández.

Speaker	Title
Aguero, L.	Design of application of a procedure for diagnosis of data quality.
Díaz, M.	Correspondence analysis: an application to clinical behavior of SGB.
Otero, J.M.	Simulated tropism: a new metaheuristic for multimodal optimization problems.
Permuy, C.	An artificial bee colony algorithm for the multiobjective multi depot heterogeneous vehicle routing problem with time windows.
Urquiola, I.	Use of multicriterial tools to detect the causes of failure of self employed business in Cuba.

17:50-18:30: Poster Session 2: Hall, Hotel Habana Riviera.
Chair: A. Fernández.

Speaker	Title
Bacallao, J.	Missing values in generalized linear models.
Corujo, J.	Mean time comparisons of repairable systems with absolute priorities.
Miret, E.	CMA-ES applied to the solution of multidimensional scaling problem.
Raíces, I.	Analysis of parametric frailty models to estimate the risk of amputation.

Wednesday, 9th
Morning

Plenary Lecture, Salón Gelabert.
09:00-10:00: Doukhan, Paul: A new vision of extreme values theory under dependence.
Introducer: M. Cottrell.

10:00-10:30: Coffee Break.

Decision and Optimization Models 1: Room 1.
Chair: C. Cruz-Corona.

Time	Speaker	Title
10:30-11:10	Cruz Corona, C.	Decision Models and Optimization. **Main Lecture**
11:10-11:30	Cruz Corona, C.	Measuring effectiveness in dynamic environments.
11:30-11:50	Brito, J.	Modeling Tourist Route Planning with fuzzy preferences and constraints.
11:50-12:10	Fajardo, J.	Software tool for model and solve the maximum coverage location problem.
12:10-12:30	Vergara-Moreno, E.	Fuzzy model optimization for berth allocation problem.

Teaching OR 1: Room 2.
Chair: J. Cochran.

Time	Speaker	Title
10:30-10:50	Dietz, H.M.	Teaching mathematics for economists: a metacognitive approach.
10:50-11:10	Grossman, T.A.	Spreadsheet Optimization with Excel Solver, for beginners and experts alike.
11:10-11:30	Morales, S.J.	Use of typical testers for determining the impact of the learning units in education
11:30-11:50	Velastegui, L. E.	Study of the capacitation of the docent of Universidad Tcnica de Ámbato in the use of educative multimedia using the Principal Component Analysis for categorical data.
11:50-12:10	Vila-Parrish, A. R.	A framework for assessing students problem solving behaviors during capstone design courses.
12:10-12:30	Sofer, A.	OR Education in the Age of Analytics.

Computer Methods 1: Room 3.
Chair: A. León.

Time	Speaker	Title
10:30-10:50	Baguer, M.L.	Specularity removal in colposcopic images.
10:50-11:10	Estevez, S.	Multiclasification strategies for the problem of opinion mining in Twitter.
11:10-11:30	Suzuki, E.	Compression-based evaluation of ameta-pattern in terms of a belief and a data ensemble.
11:30 11:50	Almeida, Y.	Using POS-tagging for dimensionality reduction in opinion mining in Twitter.
11:50-12:10	Piad, A.	Rays matching in GPU.
12:10-12:30	Chang, D.	Total Variation method for the differentiation of noisy data.

Optimization Theory 1: Room 4.
Chair: Ruckmann, J-J.

Time	Speaker	Title
10:30-11:10	Tammer, C.	On set-valued optimization problems with variable ordering structure. **Main Lecture.**
11:10-11:30	Günther, C.	Relationships between constrained and unconstrained multi-objective optimization and application in location theory.
11:30-11:50	Hillmann, M.	Necessary optimality conditions for some nonconvex facility location problems.
11:50-12:10	Quintana, E.	On a partial augmented lagrangean for mathematical programs with second order cone complementarity constraints.
12:10-12:30	Bouza, G.	On the stability of the set of feasible solutions for the auxiliary problems of the adaptivemethod for non-smooth multiobjective optimization problems.
12:30-12:50	Miranda, R.	Hybrid Strategy for quadratic programming problem with box constraints.

Wednesday, 9th
Afternoon

Plenary Lecture, Salón Gelabert.
14:30-15:30: José Luis Verdegay: Fuzzy Optimization: Since 1970 until today and back.
Introducer: C. Bouza.

Decision and Optimization Models 2: Room 1.
Chair: José Luis Verdegay.

Time	Speaker	Title
15:30-15:50	Torres, I.	Using methods for ranking fuzzy numbers in the TTRP with fuzzy demands and capacities.
15:50-16:10	Chalco, Y.	Some remarks on optimality conditions for fuzzy optimization problems.
16:10-16:30	Bello, R.	Construction of similarity relations based on the quality of the similarity.

Statistics and Probability Models 1: Room 2.
Chair: C. Bouza.

Time	Speaker	Title
15:30-15:50	Randon-Furling, J.	Maxima of two random walks: universal Statistics of lead changes.
15:50-16:10	Iglesias, M.	Voice activity detection based on higher order cumulants and convolution.
16:10-16:30	Rynkiewicz, J.	Identification of Bayesian network with structural equations.

Applications to Economy 1: Room 3.
Chair: J. Daduna.

Time	Speaker	Title
15:30-15:50	Jablonsky, J.	Multi-period DEA models and their applications.
15:50-16:10	Sheth, A.	Leveraging Herd behavior in foreign exchange markets.
16:10-16:30	Berka, P.	Using exploration trees in the loan applications domain.

Optimization Theory 2: Room 4
Chair: C. Tammer.

Time	Speaker	Title
15:30-16:10	Gfrerer, H.	On Lipschitzian properties of implicit multi-functions. **Main Lecture.**
16:10-16:30	Ruckmann, J-J.	On proper efficiency in multiobjective semi-infinite optimization.

16:30-16:50: Coffee Break.

Decision and Optimization Models 3: Room 1
Chair: José Luis Verdegay.

Time	Speaker	Title
16:50-17:10	Figueroa-García, J.C.	A note on the fuzzyextension principle for LP problems with fuzzy coefficient matrix.
17:10-17:30	Mar Cornelio, O.	Competency assessment model for a virtual laboratory systems and distance using Fuzzy Cognitive Maps.

Statistics and Probability Models 2: Room 2.
Chair: C. Bouza

Time	Speaker	Title
16:50-17:10	Fujita Yashima, H.	Invariant measure for the stochastic equation of one-dimensional motion of barotropic viscous gas.
17:10-17:30	Estrada, J.	Analysis of the stability of the Lorenz system under linear uni-parametric perturbation.
17:30-17:50	Korichi, F.	On the existence of a periodic solution for a stochastic equation with interruption intervals.
17:50-18:10	El Methni, J.	Extreme versions of Wang risk measures and their estimation for heavy-tailed distributions.
18:10-18:30	Boushaba , M.	New method to evaluate joint reliability importance of a consecutive-system for non-homogeneous Markov-dependent components.

Applications to Economy 2, Room 3.
Chair: J. Daduna.

Time	Speaker	Title
16:50-17:10	Fiala, P.	Design of multi-objective supply networks.
17:10-17:30	Marek, L.	Statistical Model for Foreign Trade I.
17:30-17:50	Vrabec, M.	Statistical Model for Foreign Trade II.
17:50-18:10	Mosna, F.	Hyperbolic equation with memory.
18:10-18:30	Neruda, R.	Metalearning for datamining.

Optimization Theory 3: Room 4
Chair: C. Tammer

Time	Speaker	Title
16:50-17:10	Ngo, T-N.	Weak Pontryagin principle in infinite horizon in presence of asymptotic constraints.
17:10-17:30	Selmane, S.	Dynamic transmission of cutaneous leishmaniasis.
17:30-17:50	López Reyes, N.	The discrete Brockett hierachy and the realization theory.
17:50-18:10	Weber, T.A.	Dynamic information acquisition.

Thursday 10th
Morning

Plenary Lecture, Salón Gelabert.
09:00-10:00: L.R. Keller: A Markov decision tree model to evaluate cost-effectiveness of cervical cancer treatments.
Introducer: D. Haughton.

10:00-10:30: Coffee Break.

Statistics and Probability Models 3: Room 1.
Chair: P. Monterrey.

Time	Speaker	Title
10:30-10:50	Zreik, R.	Clustering of dynamic networks through subgraphs: a study of the Enron Scandal.
10:50-11:10	Sistachs, V.	Bayesian Average Models (BMA) applied to binary logistic regression.
11:10-11:30	Menéndez, E. P.	Linear regression: an alternative to logistic regression through the non-parametric regression.
11:50-12:10	Dong-Guen, K.	The correlation between three major criteria of preliminary feasibility study.
12:10-12:30	Schaffrin, B.	On various Kriging predictors for Geoid densification: a comparison.
12:30-12:50	Mohdeb, Z.	On testing linearity of regression models in non-regular case.

Mathematical Economics 1: Room 2.
Chair: N. Allouch.

Time	Speaker	Title
10:30-11:10	Cornet, B.	Choquet representability of submodular functions. **Main Lecture.**
11:10-11:30	Baillon, J-B.	Asymptotic behavior of compositions of under-relaxed non-expansive operators.
11:30-11:50	Sobel, M.J.	A discounting-risk paradox with quadratic felicity.
11:50-12:10	Wernz, C.	Incentives in chronic disease management: a game theoretic analysis.

Computer Methods 2: Room 3.
Chair: M. Baguer.

Time	Speaker	Title
10:30-10:50	Bello, M.	A method based on genetic algorithms for the generation of rankings in the team selection by two decision-makers.
10:50-11:10	Rodriguez, E.	Reinforcement learning algorithms for scheduling problems in online environments.
11:10-11:30	Yanes, D.	Optimization of an orthogonal cutting process by combining fuzzy logic and genetic algorithms.
11:50-12:10	Martinez, Y.	Adapting a reinforcement learning approach for the flow shop environment with sequence-dependent setup time.
12:10-12:30	Rodríguez, E. D.	Slack-based techniques to handle the robustness in Job-Shop scheduling problems.

Applications to Economy 3: Room 4.
Chair: B.A. Wickström.

Time	Speaker	Title
10:30-10:50	Ahlheim, M.	Consumers willingness to pay for lower pesticide content in food a contingent valuation study in northern Thailand.
10:50-11:10	Löschel, A	On the effects of unilateral environmental regulation on offshoring in multi-stage production processes.
11:10-11:30	Pyka, A.	Simulation experiments with innovation networks.
11:30-11:50	Wickström, B.A.	Optimal language policy for the preservation of a minority language.
11:50-12:10	Daduna, J. R.	Delivery concepts in online retail trade of groceries.
12:10-12:30	Klingelhöfer, H.K.	Integrated service planning and controlling.
12:30-12:50	Mukhopadhyay, S.	Role of marketing effort to counter gray marketing activity.

Thursday 10th
Afternoon

Plenary Lecture, Salón Gelabert.
14:30-15:30: Bouveyron, C.: Model-based clustering of functional data: application to the analysis of bike sharing systems.
Introducer: L. Keller.

Actuarial. Room 1.
Chair: S. Loisel.

Time	Speaker	Title
15:30-15:50	Lefevre, C.	Polynomials, order statistics and risk models in insurance and epidemics.
15:50-16:10	Loisel, S.	Several problems of ruin theory.
16:10-16:30	Kaishev, V. K.	On the time to ruin and deficit at ruin under an extended order statistics risk process.

Applications to Economy 4: Room 2.
Chair: A. Seth.

Time	Speaker	Title
15:30-15:50	Caamal Cauich, I.	Growth rate and behavior of economic variables in the production of coffee in Mexico.
15:50-16:10	García Farinas, A.	Technical efficiency in International Center of Neurological Restoration's clinics.
16:10-16:30	Caamal Cauich, I.	Econometric models and relationships between economic variables in the production of coffee in Mexico.

Computer Methods 3, Room 3.
Chair: A. Mesejo.

Time	Speaker	Title
15:30-15:50	Fernández, E.	Analysis of the effectiveness of the Theseus multi-criteria sorting method.
15:50-16:10	Salgueiro, Y.	Multi-objective model for ferro alloy additions in stainless steel production.
16:10-16:30	Bierwirth, C.	A Grasp heuristic for the JSP-TWT.

Analytics across the Disciplines 1: Room 4.
Chair: J. Haughton.

Time	Speaker	Title
15:30-15:50	Haughton, D.	Music analytics: an overview of feature extracting tools and preliminary results on kick starter rock music projects.
15:50-16:10	Changpetch, P.	Alcohol consumption in Thailand: a study of the associations between alcohol, tobacco, gambling, socioeconomic status, and demographic factors.
16:10-16:30	Haughton, J.	Discrimination against migrants in urban Vietnam.

16:30-16:50: Coffee Break.

Actuarial 2: Room 1.
Chair: S. Loisel.

Time	Speaker	Title
16:50-17:10	Salhi, Y.	A credibility approach of the Makeham mortality law.
17:10-17:30	Milhaud, X.	Tree-based estimators in censored regression: applications to segmentation and reserving in life insurance.
17:30-17:50	El Karoui, N.	Fast change of time detection on proportional two populations hazard rates.

Applications to Economy 5: Room 2.
Chair: A. Seth.

Time	Speaker	Title
16:50-17:10	Souto Anido, L.	Human resources management model based on the fuzzy subsets theory.
17:10-17:30	García Rodríguez, J. F.	Analysis of the inequality in Mexico.

17:30-18:30: **RIDECA Meeting.** Coordinator: C. Bouza.

Computer Methods 4: Room 3.
Chair: A. Mesejo.

Time	Speaker	Title
16:50-17:10	Sackmann, D.	A heuristic for the solution of vehicle routing problems with time windows and multiple dumping sites in waste collection.
17:10-17:30	Fernández, A.	An improved Grasp strategy applied to vehicle routing problem with simultaneous deliveries and pick-up service.
17:30-17:50	Mirchandani, P.	A proactive traffic management system without physical infrastructure.

Analytics across the Disciplines 2: Room 4.
Chair: J. Haughton.

Time	Speaker	Title
16:50-17:10	Fei, M.	Business analytics gaps between academia and industry.
17:10-17:30	Haughton, D.	Is the corporate elite disintegrating? Interlock boards and the Mizruchi hypothesis.

Friday 10th
Morning

9:00-9:40: Panel **Monique Florenzano in Memoriam.**

9:40-10:00: Coffee Break.

Statistics and Probability Models 4: Room 1.
Chair: E. Menéndez.

Time	Speaker	Title
10:00-10:20	Sebrango, C.	Modeling dengue outbreak data using nonlinear mixed effects model.
10:20-10:40	Uranga, R.	Optimization of average sample number in a unilateral sequential design compatible with the assumption of normality.
10:40-11:00	Monterrey, P.A	P-value distribution for t-test in non-inferiority designs with parallel samples.
11:00-11:20	Bouza, C.	Subsampling rules for item non response of an estimator based on the combination of regression and ratio.
11:20-11:40	Lahera, G.	Cardiovascular risk evaluation model for Cuba.
11:40-12:00	Bouza, C.	Prediction of fresh water in a basin.

Mathematical Economics 2: Room 2.
Chair: B. Cornet.

Time	Speaker	Title
10:00-10:20	Allouch, N.	Policy reform in networks.
10:20-10:40	Konow, J.	An economic model of distributive preferences and application to the workplace.
10:40-11:00	Owen, G.	A game theoretical approach to networks.

11:00-12:00: **OR Cuban Association Meeting.** Coordinator S. Allende and L.R. Piñeiro

Closing Plenary Lecture, Salón Gelabert.
12:10-13:10: M. Gröstschel: Digital Humanities and Operations Research.
Introducer: G. Bouza.

ABSTRACTS

DESIGN AND APPLICATION OF A PROCEDURE FOR DIAGNOSIS OF DATA QUALITY.

Liset Agüero Zardón and José A. Vilalta Alonso

Instituto Superior Politécnico José Antonio Echeverría, Cuba.

The lack of data quality is one of the major problems currently being faced by those responsible for information and business systems. Given this issue, data management is a strategic resource in the organization and its essential to ensure data quality in any business today. This work is part of a project carried out in the Integrated System Research Complex (CITI). Its proposed as problematic situation: The absence of a study on the quality of data limits the implementation and monitoring of strategic planning and information systems in Cuban enterprises Hence it is defined as general objective: Designing a procedure for diagnosing data quality. This procedure was applied in a company of agricultural inputs. The application of the method allowed detection of errors associated with integrity and data currently in critical dimensions, resulting in 25% of them meet the condition of integrity and only 8.33% are current. These tasks were completed through the use of theoretical methods and document analysis and literature synthesis. Tools and techniques such as Ishikawa diagram, checklist, matrix relationship and Delphi method were used.

CONSUMERS' WILLINGNESS TO PAY FOR LOWER PESTICIDE CONTENT M FOOD - A CONTINGENT VALUATION STUDY IN NORTHERN THAILAND

M. Ahlheim and U. Siepmann

University of Hohenheim, Germany.

Pesticide overuse by farmers is a severe problem in many developing and emerging countries. In Northern Thailand, this results in pollution of water bodies, soil and high pesticide residues in fruit and vegetables. In a recent screening of the residents of Chiang Mai, 73 population showed a critical level of pesticide residues in their blood. In the study underlying this paper, we wanted to find out how worried consumers are about pesticide residues in fruit and vegetables and how much money they would be willing to pay in order to improve the situation. In a Contingent Valuation Method (CVM) study with 2346 personal (face-to-face) interviews, we assessed Chiang Mai residents' willingness to pay (WTP) for the implementation of a pesticide reduction program. The WTP of individuals is interpreted as a monetary equivalent of the utility they expect from that program. Comparing the aggregate WTP of all citizens affected by such a program to its costs indicates if the program should be realized or not. As a methodological goal, we also investigate the influence of several general interview conditions (interviewers' attire and gender, time of day of the interview, monetary and in-kind gifts to respondents as an incentive to participate) on the validity of CVM results. We find a tendency that casually dressed interviewers elicit higher response rates than interviewers in business attire and that interviewer gender has a distortionary impact on stated WTP whereas the time of the interview also biases WTP statements.

A GAME-THEORETIC APPROACH TO NETWORKS

Encarnación Algaba*, Guillermo Owen*** Susana López**, and Martha Saboyá**

*Universidad de Sevilla, Spain.

**Universidad Autónoma de Madrid, Spain.

Naval Postgraduate School, USA.

In this article, we consider teams whose members (a manager, workers, robots, etc.) are represented as nodes of a graph (network). The links in the graph allow the several team members to communicate. By collaboration, the several members can normally accomplish much more than by acting individually. This is represented by

a super-additive n-person game in characteristic function form. This collaboration is however only possible if the several team members can communicate, which is the reason for the links in the graph. The links can be more or less efficient; more efficient links are generally more costly. Using the Myerson approach to games on graphs, we introduce the notion of a supergame to represent the amount of work that can be done, and the amount that is wasted because of inefficient links. The method of multilinear extensions is then used to modify the Shapley value by changing the expected time of arrival of the links: A more efficient link has an earlier time of arrival, while a less efficient link has a later arrival. This modification allows us to represent more or less efficient links. (The Beta distribution is useful in this regard.) We can then look for optimal links, subject to budgetary constraints. Some examples are worked out in detail.

PREDICTION OF THE QUALITY OF FRESH WATER IN A BASIN

S.M. Allende*, A. Santiago*** D. C. Chen**, C. N. Bouza*, and J. M. Sautto***
*Universidad de La Habana. Cuba.
**Smith and King College, India.
***Universidad Autónoma de Guerrero, Mexico.

Social scientists and applied economists often use estimations of the derivatives with parametric specifications of the conditional expectation function, m(x). As derivatives are relatively easily computed fitting the regression function the popularity of parametric estimators has been due to the un-knowledge of other more effective methods. The validity of this approach depends on assumptions on the functional form. We develop a study on the usage of soft computing methods for providing an alternative to the use of non-parametric regression. We develop modeling through neural networks and rough sets. The data on the eutrophication due to the growth of the population of algae are used for developing the comparison. Real life data on a fresh water basin is used and a methodology recommended for implementing a monitoring system of the water quality

POLICY REFORM IN NETWORKS

Nizar Allouch and Maia King
Queen Mary, University of London, UK.

We investigate a weighted utilitarian welfare approach in networks with private provision of public goods. Warr (1983) and Bergstrom, Blume, and Varian (1986) show that for pure public goods (equivalent to complete networks) income redistribution is neutral "in that contributing agents exactly offset the transfer by changing their public good provision. Allouch (2012) showed that neutrality breaks down outside complete networks, which means the social planner can use income redistribution to affect equilibrium behaviour and welfare in networks. This paper characterises these effects, identifying conditions for Paretoimprovments and developing some example cases.

MISSING VALUES IN GENERALIZED LINEAR MODELS.

Jorge Bacallao Guerra
Universidad de La Habana, Cuba.

Generalized linear models are vastly used in research. They are useful to model the relation between a response variable and a group of predictors for which classic linear models are not adequate. Particularly interesting are the cases in which the response variables are counts (Poisson regression) or binary (dichotomous logistic regression). In practical applications it is often necessary to deal with missing values both in the predictors and the response variable. There does not seem to be many valid options to deal with this kind of complex missingness. The purpose of this paper is to propose a multiple imputation algorithm which takes into account the structure of data in a generalized linear models problem.

ON VARIOUS KRIGING PREDICTORS FOR GEOID DENSIFICATION: A COMPARISON

Tae-Suk Bae* and Burkhard Schaffrin**
*Sejong University, Korea.
**The Ohio State University, USA.

For geoid densification, traditionally the method of Least-Squares Collocation (LSC) has been heavily used which requires the knowledge of a suitable covariance function. Interestingly, it could be shown that equivalent results can be achieved by means of Kriging, a method that is usually based on the semi-variogram or, perhaps, the

homeogram. This equivalence, however, turns out to be perfect only as long as the spatial "coherency functions" are not estimated separately. In this study, the influence of such estimates on a variety of empirical Kriging predictors (Simple Kriging, Ordinary Kriging, Optimal Biased Kriging) is analyzed, and some conclusions will be drawn.

ELIMINACIÓN DEL EFECTO ESPECULAR EN IMÁGENES COLPOSCÓPICAS

Martha L. Baguer Díaz-Romañach*, Alejandro Palmer San Pedro*, and Jorge del Risco Martínez**

Universidad de La Habana, Cuba.

**INSTEC, Cuba.

Este trabajo se realiza en el marco de en un proyecto con el Centro de Inmunoensayo y tiene como objetivo desarrollar herramientas de apoyo al diagnóstico imagenológico del cáncer de cuello de útero. El Centro de Inmunoensayo produce y comercializa el colposcopio cubano SUMASCOPE el cual se encuentra en uso en casi todos los municipios del país. Con el objetivo de desarrollar una herramienta de ayuda al radiólogo es preciso eliminar el efecto de brillo que produce el flash de la cámara al retratar una zona húmeda. Este efecto resulta indeseable en la imagen al no permitir inspeccionar adecuadamente las lesiones. En particular, la cámara cubana produce un borde negro en las marcas del flash que impiden el buen desempeño de los algoritmos de inpainting reportados en la literatura. Para ello se proponen tres algoritmos que permiten obtener las máscaras que logran detectar adecuadamente los pixeles de brillo en la imagen. Es preciso aclarar que las imágenes colposcópicas así como las diferentes lesiones de cuello de útero pueden tener una apariencia bien diferente. Por ello no todos los algoritmos funcionan con la misma efectividad en todas las imágenes. Una vez marcados adecuadamente los píxeles de brillo se utilizan diferentes algoritmos de inpainting reportados en la literatura adaptados a las imágenes colposcópicas. Los resultados que se han obtenido en la experimentación son bien alentadores para la mayoría de las imágenes. La experimentación se realizó con una Base de Datos de pacientes cubanas.

ASYMPTOTIC BEHAVIOR OF COMPOSITION OF UNDERRELEASED NON EXPANSIVE OPERATOR

Jean Bernard Bailon, Patrick L. Combettes, and Roberto Cominetti

SAMM Université Paris 1 Panthéon-Sorbonne, France.

In general there exists no relationship between the fixed point sets of the composition and of the average of a family of nonexpansive operators in Hilbert spaces. In this paper, we establish an asymptotic principle connecting the cycles generated by under-relaxed compositions of nonexpansive operators to the fixed points of the average of these operators. In the special case when the operators are projectors onto closed convex sets, we prove a conjecture by De Pierro which has so far been established only for projections onto affine subspaces.

A METHOD BASED ON GENETIC ALGORITMS FOR THE GENERATION OF RANKINGS IN THE TEAM SELECTION BY TWO DECISION-MAKERS

Marilín Bello, María M. García* Lázaro Lugo*, Rafael Bello*, and Ann Nowe***

*Universidad Central de Las Villas, Cuba.

Vrije Universiteit Brussel, Belgium.

The personnel selection problem is a classical decision making problem. The aggregation of rankings of candidates represents a problem in the context of personnel selection. Different methods based on heuristic search have been proposed for achieving aggregation. In this paper, the problem of personnel selection is developed, but not in the classic way, because we consider two decision-makers who must form teams from a single set of candidates. For this new problem, an aggregation method based on genetic algorithms is proposed.

USING EXPLORATION TREES IN THE LOAN APPLICATIONS DOMAIN

Petr Berka*,**

*University of Economics and **University of Finance and Administration, Czech Republic.

Induction of decision trees belongs to the most popular algorithms used in machine learning and data mining. When building a decision tree, we recursively partition the attribute space in a top-down way at each branching node looking for best attribute to make a split. This process will result in a single tree that can be use both for classification of new examples and for description the partitioning of the training set. In the paper we describe an

alternative approach that is related to the idea of finding all interesting relations in given data. When building the so called exploration trees, we consider not a single best attribute for branching but more attributes for each split. This modification of the tree learning algorithm will result in more trees, each partitioning the data in a little different way giving thus alternative knowledge for segmentation and concept description of the data with respect to the classes. The proposed method will be compared with the standard C4.5 algorithm on several data sets from the loan application domain. The results show, that among the exploration trees created for different data sets, there was always a tree that better splits the training data than the tree created using C4.5. We are aware of the fact, that trees in C4.5 are tuned to perform well on the testing data (to avoid over-fitting) but if the task is to find and describe segments of training data related to the class attribute, our method gives better results.

A GRASP HEURISTIC FOR THE JSP-TWT

Christian Bierwirth* and Jens Kuhpfahl**
*Martin-Luther-University Halle-Wittenberg, Germany.
**4flow AG., Germany.

The contribution proposes a heuristic for the job shop scheduling problem with minimizing the total weighted tardiness of jobs as objective. It is built upon the well known metaheuristic GRASP and strengthened with an inclusion of specific local search components. The design is based on an advanced disjunctive graph model which enables capturing solution schedules through a tree graph called critical tree. The tree graph allows for effectively steering a first-descent search algorithm which further incorporates powerful neighborhood operators and a fast move evaluation procedure based on heads updating. Additionally, amplifying and path relinking is adaptively applied to the best schedules discovered. We present computational results of the new heuristic on two famous sets of benchmark instances, we identify ten new best solutions, and we demonstrate the high potential of the approach through a comparison with state-of-the-art methods.

WEAK PONTRYAGIN PRINCIPLE IN INFINITE HORIZON IN PRESENCE OF ASYMPTOTICAL CONSTRAINTS

Joël Blot and Thoi-Nhan Ngo
University Paris 1, France.

We establish necessary conditions of optimality for discrete-time infinite-horizon optimal control in presence of constraints at infinity. These necessary conditions are in form of weak Pontryagin principles. We use a functional analytic framework and multipliers rules in Banach (sequence) spaces and we establish new properties on Nemytskii operators in sequence spaces.

NEW METHOD TO EVALUATE JOINT RELIABILITY IMPORTANCE OF A CONSECUTIVE-SYSTEM FOR NON-HOMOGENEOUS MARKOV-DEPENDENT COMPONENTS

M. Azeddine Benyahia Boushaba
Department of Mathematics, Ecole Normale Supérieure de Constantine, Constantine, Algeria.

The JRI follows the spirit of the MRI and evaluates the interaction of a pair of components (Hong, J., Lie, C., 1993. Joint reliability importance of two edges in an undirected network. IEEE Transactions on Reliability 42, 1723) and a group of components (Gao, X., Cui, L., Li, J., 2007. Analysis for joint importance of components in a coherent system. European Journal of Operational Research 182, 282299.) in their contribution to system reliability. Armstrong M., 1995.: Joint reliability importance of components. IEEE Transaction on Reliability 44 (3), 408-412, extended the JRI to the case of two dependent components. The JRI of dependent components u and v, $u \neq v$, is defined as

$$JRI(u;v) = Pr[S|X_u = 1; X_v = 1] - Pr[S|X_u = 1; X_v = 0] - Pr[S|X_u = 0; X_v = 1] + Pr[S|X_u = 0; X_v = 0$$

The JRI of r dependent components can be written as in Zhu, X., Boushaba, M., Reghioua, M., 2015. Joint reliability importance in a consecutive-k-outof-n:F system and an m-consecutive-k-out-of-n:F system for Markov-dependent components. IEEE Transactions on Reliability 64, 784 -798.

$$JRI(u_1; u_2; \ldots; u_r) = \sum_{l_1, l_2, \ldots l_r \in [0,1]} (-1)^{\sum_{j=1}^{r}(1-l_j)} Pr\{S|X_{u_1} = l_1, X_{u_2} = l_2, \ldots, X_{u_1} = l_1\}$$

The sign and the value of the JRI represent the type and the degree of interactions between two components with respect to system reliability. Two components are called reliability complements (substitutes) if the sign of their JRI is nonnegative (nonpositive), Hagstrom, J., 1990. Redundancy, substitutes and complements in system reliability. Technical report, College of Business Administration, University of Illinois. In the case of complements (substitutes), one component becomes less (more) important when the other fails. Throughout this paper, we assume that the system and components are binary and that the components are non-homogenous Markov-dependent, unless otherwise stated. In this paper, we use the probability generating function (pgf) method to derive the formula the JRI for a Consecutive-System.

SUBSAMPLING RULES FOR ITEM NON RESPONSE OF AN ESTIMATOR BASED ON THE COMBINATION OF REGRESSION AND RATIO

C. N. Bouza
*Universidad de La Habana. Cuba.
***Universidad Autónoma de Guerrero, Mexico.

The present paper is devoted to the development of a study of subsampling rules of popular use. We consider a class of estimators proposed by Sing-Kumar, where a combination of ratio and regression estimation generates a class that under some condition is better than other estimation procedures. We consider the existence of item non-response where the auxiliary variables are measured in all the sampled units. A comparison among the rules is developed in terms of variance and costs.

ON THE STABILITY OF THE SET OF FEASIBLE SOLUTIONS FOR THE AUXILIARY PROBLEMS OF THE ADAPTIVE METHOD FOR NON-SMOOTH MULTIOBJECTIVE OPTIMIZATION PROBLEMS

Gemayqzel Bouza Allende*, Gabriele Eichfelder**, and Christiane Tammer***
*University of Havana, Havana, Cuba.
**Technische Universität Ilmenau, Germany.
***Martin-Luther-University Halle-Wittenberg, Germany.

In most cases, multi-objective optimization problems have many solutions. The adaptive method is a solution approach for non-smooth problems which tries to recover the set of solutions by solving parametric optimization problems P(a). That is why it is important to analyze the in uence of the variation of the parameter on the variability of the solutions. In this work, we study the stability of the set of feasible solutions of P(a). The consequences of this result for the set of optimal solutions is also sketched.

MODELLING TOURIST ROUTE PLANNING WITH FUZZY PREFERENCES AND CONSTRAINTS

Julio Brito, Airam Expósito y José Andrés Moreno
Universidad de La Laguna, Spain.

Tourists plan a trip based on their personal preferences and point of interest (POI) information of the destination. It usually is not possible to visit all POIs. The problem is to select the POIs to visit during the trip and to establish the routes every day. This paper proposes a multi-day planning problem for sightseeing where the preferences of tourists on points of interest and travel time constraints can be considered fuzzy. This planning problem is modelled as Team Orienteering Problem with fuzzy coefficients in the objective and fuzzy constraints. Soft Computing methodology proposed solves the model by integrating of fuzzy optimization methods and constructive metaheuristic. The fuzzy approach proposed provides methods for solving optimization problem with fuzzy terms from equivalent auxiliary model. A Greedy Randomized Adaptive Search Procedure is applied as metaheuristic to obtain solutions.

ECONOMETRIC MODELS AND RELATIONSHIPS BETWEEN ECONOMIC VARIABLES IN THE PRODUCTION OF COFFEE IN MEXICO

Ignacio Caamal Cauich, Dolores Larios Saldivar and Verna Gricel Pat Fernández
Universidad Autónoma Chapingo, Mexico.

Econometric models allow a theoretical representation of the functioning of various economic processes, through the use of variables and identification of mathematical relationships. They are economic models that include

specifications for its empirical application, when it has defined variables (endogenous and exogenous) that explain and determine the model, the structural parameters that accompany the variables, equations, and its formulation in mathematical form, random perturbation that explains the non-systematic part of the model and statistical data. They are used to estimate, based on certain data, economic relations, test hypothesis and predict the behavior of economic variables. Econometric models allow to identify the relationships between variables and the coffee production in Mexico. The area planted and harvested coffee in Mexico practically have remained stagnant, while the yields and production have been declining. In this research, a characterization of the coffee sector is done, analyzed the factors that determine changes in production and are quantified the elasticities of the variables that determine the changes in the production of coffee. A multiple linear regression model was developed, the variables used information was obtained from the national survey of rural households in Mexico, and estimated the parameters of the model with the method of ordinary least squares. The results reflect that the producers are small, planted less than a hectare, the main problem of the crop are pests, most of the producers sold coffee to intermediaries and, in general, do not use machinery. The econometric model estimated reflects the sowed surface, amount of coffee sold in the previous year, stocks of coffee, labor, quantity of used fertilizer and fertilization costs explain production behavior, and obtained elasticities are inelastic, less than one, which reflects that they are in the second stage of production, excluding the quantity sold. It is of type smallholder producers, with little technological development and found in the efficient production stage.

GROWTH RATE AND BEHAVIOR OF ECONOMIC VARIABLES IN THE PRODUCTION OF COFFEE IN MEXICO

Ignacio Caamal Cauich, Dolores Larios Saldivar and Verna Gricel Pat Fernández
Universidad Autónoma Chapingo, Mexico.

The growth rate reflects movements ascending, stagnant or descendants of a value determined in a period of time. The behavior of the indicators being measured through the growth rate, which reflects the proportion in that it increases or decreases a variable from one period to another, reflect the profitability and competitiveness, when they relate to products. When economic variables (sown, harvested area, yield and production) have positive growth rates, means that the crop, product, is profitable while real prices tend to decrease. While if the growth rates of these variables are declining, means that the product, crop, it is losing profitability, and it may even be unprofitable. Coffee is an important crop in the world and in Mexico. The main coffee producing countries are Brazil, Viet Nam, Colombia, Indonesia and Ethiopia, while Mexico lies in eighth place as producer. In Mexico the coffee occupies seventh place by area sown and the twelfth place for his contribution to the agricultural gross domestic product. The area sown and harvested practically have remained stagnant, while the yields and production have been declining, explained by the decrease of real conventional coffee prices, in the last twenty-five years. In this research, a characterization of the main economic variables of the coffee sector is made, analyzes the behavior of the variables of production and trade of coffee. The variables studied are sown, harvested area, yield, production, price, exports and imports. The information was obtained from the Servicio de Información Agroalimentaria y Pesquera (SIAP) and Sistema de Información Agroalimentaria de Consulta (SIACON) of Mexico. The results reflect that the growth rate of the area sown and harvested are stagnant, while than the growth rate of the yield, production and prices are negative. These characteristics explain the stagnation of production, low income levels and poverty of coffee producers. The levels of profitability of coffee are low in these conditions. It is of type smallholder producers, with low levels of profitability.

MUSIC ANALYTICS: ANOTHER VIEW OF FEATURE STARTING TOOLS AND PRELIMINARY RESULTS A KICK STARTED ON ROCK MUSIC PROJECTS

Nathan Carter*, Joe Derya****, Dominique Haughton*,**,***, Tao Li*, and Vince Nan*
*Bentley University, USA.
**Paris 1 University, France.
***Toulouse 1 University, Toulouse, France.
****EMC Corporation.

The talk gives an overview of three music analytics tools, Music 21, Echonest and Seawave, and then discusses how measures extracted from audio files with the Echonest API help derive insights on predictors of success for rock music projects in the crowdfunding site Kickstarter. Future interesting directions for music analytics research will be outlined as well.

TOTAL VARIATION METHOD FOR THE DIFFERENTIATION OF NOISY DATA

Dayron Chang*, José A. Mesejo Angela M. León, and Susana Gómez***
*Instituto de Meterologá, Cuba.
**Universidad de la Habana, Cuba.
***Universidad Nacional Autónoma de Mexico, Mexico.

In this work the total variation method (TV) to approximate the derivative of functions specified by data having noise is applied. This is a problem that occurs frequently in different branches of science and engineering and for which unsatisfactory results are reported when finite differences are used to calculate the derivative or when the derivative is calculated after removal the noise of data. The total variation method involves minimization of a functional obtained by Tijonov regularization theory. The mathematical foundation is discussed for TV and for the fixed-point algorithm with delayed diffusivity used for the computational solution. Results are shown for three cases varying the main parameter for the total variation method.

ALCOHOL CONSUMPTION IN THAILAND: A STUDY OF THE ASSOCIATIONS BETWEEN ALCOHOL, TOBACCO, GAMBLING, SOCIOECONOMIC STATUS, AND DEMOGRAPHIC FACTORS

Pannapa Changpetch*, Dominique Haughton*,**,***,****, Mai T. X. Le*****, Sel Ly****, Phong Nguyen******, and Tien T. Thach****
*Bentley University, USA.
**Paris 1 University, France.
***Toulouse 1 University, France.
****Ton Duc Thang University, Vietnam.
*****The University of sciences, Vietnam.
******General Statistics Office, Vietnam (retired).

This research provides a thorough study of alcohol consumption in Thailand in terms of the relationships between this activity and tobacco consumption, gambling consumption, socioeconomic status, and demographic factors. Three statistical models and data-mining techniqueslogistic regression, Treenet, and directed acyclic graphsare used to analyze datasets drawn from socio-economic surveys of 43,844 Thai households conducted in 2009. From logistic regression, we found that the region where the household is located, urban/rural location of the household, household income, tobacco household expenditure, gambling household expenditure, education, religion, marital status, gender, age, and work status of the household head are all associated with the alcohol consumption of households. From Treenet, we found that the proportion of tobacco expenditure is the most important factor in explaining the proportion of alcohol expenditure. From the directed acyclic graph (DAG), we found that the proportion of alcohol expenditure has a direct effect on both the proportion of tobacco expenditure and the proportion of gambling expenditure. We expect our results to be useful to both researchers and government practitioners in their efforts to design and implement programs targeting households that include alcohol-dependent members and to thereby reduce alcohol consumption in Thailand.

CHOQUET REPRESENTABILITY OF SUBMODULAR FUNCTIONS

ALAIN CHATEAUNEUF* and BERNARD CORNET*,**
Université Paris 1, France.
**University of Kansas, USA.

Let Ω be an arbitrary set, equipped with an algebra $\mathcal{A} \subset 2^{\Omega}$ and let $f : B(\mathcal{A}) \to \mathbb{R}$ be a functional defined on the set $B(\mathcal{A})$ of bounded measurable functions $x : \Omega \to \mathbb{R}$. We provide necessary and sufficient conditions for a submodular functional f to be representable as a Choquet integral. From standard properties of the Choquet integral the functional f should be positively homogeneous and translation invariant. Our first result shows that these two properties together with submodularity characterize a subadditive Choquet integral, when Ω is finite. In the general case, f is a subadditive Choquet integral if and only if it satisfies the three previous properties, together with sup-norm continuity. This result provides another characterization of subadditive Choquet integrals different from the seminal paper by Schmeidler, 1986 that relies on comonotonic additivity.

MEAN TIME COMPARISONS OF REPAIRABLE SYSTEMS WITH ABSOLUTE PRIORITIES

Josué M. Corujo* and Juan C. Laria** José E. Valdés*
*Universidad de La Habana, Cuba.
**Universidad Carlos III de Madrid, España.

Standby repairable systems with absolute priority in functioning of its components are considered. It is supposed that when a component fails, its repair starts immediately. Lifetimes and repairing times are considered random variables, all mutually independent. Lifetimes are considered exponentially distributed. The mean lifetime of the systems are investigated and some comparisons among the lifetimes of the systems were made by changing stochastic characteristics on functioning and repairing.

MODELOS DE DECISIÓN Y OPTIMIZACIÓN

Carlos Cruz Corona
**Universidad de Granada, Spain.

La Soft Computing es una familia de m etodos y técnicas de resolución de problemas, reconocida como la base teórica de los Sistemas Inteligentes. Sus componentes principales son el Razonamiento Aproximado y los Métodos de Aproximacióón Funcional y de Optimización, y en un segundo nivel están el Razonamiento Probabilístico, la Lógica y los Conjuntos Difusos, las Redes Neuronales y las Metaheurísticas. Todo este concepto hay que entenderlo como el resultado de la hibridación, la cooperación o la complementariedad de sus componentes de segundo nivel. Es en este marco en el que están apareciendo nuevos esquemas y modelos de decisión y optimización tanto teóricos como prácticos que permiten tener un portafolio amplio de herramientas para abordar la gran diversidad de problemas que estamos enfrentando a diario. Entre los teóricos están por ejemplo: la construcción de medidas de relaciones difusas a partir de la combinación de medidas de calidad y similaridad, métodos capaces de resolver problemas en ambientes dinámicos e inciertos, nuevas ideas y conceptos de las condiciones de optimalidad para problemas de optimización, así como una propuesta acerca del principio de extensión difuso para problemas lineales. Entre los casos prácticos podemos nombrar los siguientes: la planificación de viajes basados en las preferencias del turista, la asignación de atracos en terminales marítimas de contenedores, problemas de transporte con camiones y remolques, modelos de evaluación de competencias para laboratorios virtuales y a distancia, y una herramienta software para problemas de máxima cobertura.

DELIVERY CONCEPTS IN ONLINE RETAIL TRADE OF GROCERIES

Joachim R. Daduna
Berlin School of Economics and Law, Germany.

Delivery of groceries in online retail trade in many cases differ from other product sectors due to specific requirements in transport operations. Normally in online retail trade the standard concepts are based on deliveries operated by parcel services or forwarding companies. However, these concepts can be applied only in a few cases caused by specific technical and legal framework conditions in grocery transport operations as well as by weight and volume of orders. For this reason it is necessary to develop appropriate logistic structures which can meet the given specifications. In a first step the specific requirements for possible delivery concepts must be determined regarding the different product categories in grocery retail trade. Then the existing delivery procedures will be outlined and analyzed with respect to their usefulness and applicability in grocery transport. Based on this suitable solution approaches are developed and presented in detail. In this various routing procedures are included which can be applied in these approaches. Finally it is referred to development potentials and possible limitations in grocery online retail trade.

ANÁLISIS DE CORRESPONDENCIA: UNA APLICACIÓN AL COMPORTAMIENTO CLÍNICO DEL SGB

Miguel A. Díaz Martínez*, Vivian Sistachs Vega*** and Zurina Lestayo O'Farrill**
*CEMAT Instituto Superior Politécnico José A. Echevarría, Cuba.
**Instituto de Neurología y Neurocirugía, Cuba.
***Universidad de La Habana, Cuba.

Las enfermedades neurológicas, con frecuencia, implican limitaciones funcionales importantes o pueden ser fatales. Este síndrome tiene un alto impacto social ya que conllevan a limitaciones neurológicas, las cuales generalmente ocurren de manera crónica, progresiva e irreversible o se instalan de manera aguda, pero no son necesariamente fatales. Es por ello que resulta de inters el análisis clínico del comportamiento del SGB

(Síndrome de Guillain Barré). En el trabajo se realiza el estudio de una serie de casos de SGB obtenidos del INN a los cuales se les aplica el análisis de correspondencia para caracterizar la información aportada por las variables cualitativas sobre diferentes aspectos clínicos y estudiar así las relaciones de dependencia entre esas variables categóricas presentadas en forma de tablas de contingencia.

PROMEDIO BAYESIANO DE MODELOS (BMA) APLICADO A REGRESIÓN LOGÍSTICA BINARIA

G. L. Díaz*, V. Sistachs**, and D. Covarrubias**
*Universidad Autónoma de Guerrero, Mexico.
**Universidad de La Habana, Cuba.

La selección modelos se ha desarrollado ampliamente en regresión lineal y en menor medida en regresión logística. Se han propuesto varios criterios (frecuentistas y bayesianos), sin embargo el problema de la incertidumbre en la selección de modelos no ha sido formalmente considerado. En regresión logística, uno de los criterios más usados es el criterio de información de Akaike (AIC), que se considerada un criterio de bondad de ajuste con penalización para modelos complejos y además no toma en cuenta la incertidumbre en la selección de dicho modelo. En este trabajo se propone el criterio Promedio Bayesiano de Modelos (BMA) como una opción para el tratamiento de la incertidumbre en la selección de modelos en regresión logística. Se muestra a través de un estudio de simulación que el criterio es bueno para la selección de modelos y se hace una comparación entre los criterios BMA y AIC en una aplicación.

TEACHING MATHEMATICS FOR ECONOMISTS: A METACOGNITIVE APPROACH

Hans M. Dietz
University of Paderborn, Germany.

Optimization and other branches of modern mathematics provide key ingredients of modern economics; accordingly, the mathematization of economics grew substantially over the last years. As a consequence, the mathematical requirements to economists have increased substantially as well. This should be reflected adequately in the mathematics education for future economists, in particular, by advancing the level of their mathematical education. On the other hand, it is commonly observed that basic mathematics courses are perceived as quite difficult by many beginning students of applied disciplines. According to the author's longrun teaching experience, rather than a simple lack of mathematical preknowledge, the main sources for the students' difficulties are inadequate working methods, the non-aptitude of reading" and understanding the language of mathematics properly, and an inadequate attitude towards abstraction. In order to provide an effective remedy, the author introduced a specific support system named CAT. In contrast to many other existing support systems, CAT works on a metacognitive level; moreover, it is fully integrated in the regular teaching process. CAT's methodological instructions implemented so far focus on two main targets: First, to enable the students to read and understand the language of mathematics to such an extent that they can built valid mental concepts from given mathematical texts by their own; and second, to render the students' self study process effective. Recent work is devoted to the intended future support of abstraction abilities. The paper presents some experiences from teaching CAT and from accompanying empirical studies; moreover, an outlook to future developments is given.

THE CORRELATION BETWEEN THREE MAJOR CRITERIA OF PRELIMINARY FEASIBILITY STUDY.

Kim Dong-Guen
Korea Institute of Science & Technology Evaluation and Planning, Korea.

The preliminary feasibility study(PFS) is carried for the newly proposed large-scaled government programs in Korea since 1998. PFS about research and development (R&D) programs also became compulsory since 2008. In case of a PFS on R&D programs, there are three major criteria about technology, policy and economic effects. Each expert evaluates the program about three major criteria and the score of each criterion is aggregated into overall score. The newly proposed program is finally evaluated into two alternatives, feasible or infeasible. In this study, the correlation between three major criteria and overall score is analyzed. In addition, the feasible cases in which overall score are more than 0.5 and the unfeasible cases in which overall score are less than 0.5 are compared. The results show that the major criteria of preliminary feasibility study have correlation and the difference on feasible and infeasible programs is existed.

ON SET-VALUED OPTIMIZATION PROBLEMS WITH VARIABLE ORDERING STRUCTURE

Marius* Durea, Radu Strugariu**, and Christiane Tammer***
*Al. I. Cuza University, Romania.
**Gh. Asachi Technical University, Romania.
***Martin-Luther-University Halle-Wittenberg, Germany.

We introduce and investigate an optimality concept for set-valued optimization problems with variable ordering structure. In our approach, the ordering structure is governed by a set-valued map acting between the same spaces as the objective multifunction. Necessary optimality conditions for the proposed problem are derived in terms of Bouligand and Mordukhovich generalized differentiation objects.

FAST CHANGE OF TIME DETECTION ON PROPORTIONAL TWO POPULATIONS HAZARD RATES

Nicole El Karoui*, Stephane Loisel**, and Y. Sahli**
Université Paris 6, France.
Université Lyon 1, France. France.

Our first motivation in quickest detection problem of change in proportional hazard rates was the mortality evolution which may change in projection period. In experienced mortality, deaths can be observed sequentially, but detecting change as soon as possible allows to update mortality assumptions. Given the heterogeneity of the populations, only the ratio of the change may be assumed deterministic, when the reference hazard rate is assumed to be random. Given this double uncertainty, the criterium must be robust with respect of the uncertainty of the hazard rate (intensity) process. So, we adopt the robust Lorden criterion in place of the classical Bayesian point of view. The latter is formulated in terms of the number of events until detection, both for the worst-case delay and the false alarm constraint. In the Wiener case with proportional deterministic drift change, such a problem was solved using the so-called cumulative sums (cusum) strategy by many authors (Moustakides (2004), or Shyraiev (1963,..2009)). Our setting concerns doubly stochastic (deaths) point process, and the still so-called cumulative sums (cusum) strategy defined from the supremum in time of the log-likelihood process. Both criteria are invariant by time rescaling, which minimizes the impact of stochastic intensity. We derive the exact optimality of the cusum stopping rule by using finite variation calculus and elementary martingale properties to characterize the performance functions of the cusum stopping rule as solutions of some delayed differential equations that we solve elementary. The case of detecting a decrease in the intensity is easy to study because the performance functions are continuous (Moustakides (2008)). In case of detecting an increase, the optimality of the cusum rule was until now only a conjecture, even in the Poisson case. The difficulty is that the performance functions are not continuous and martingale properties require using a discontinuous local time. Nevertheless, from a thin identity on the performance functions, the conjecture is proved. Numerical applications are provided.

EXTREME VERSIONS OF WANG RISK MEASURES AND THEIR ESTIMATION FOR HEAVY-TAILED DISTRIBUTION

Jonathan Gilles Stuper** El Methni*
*Universite Paris Descartes, France.
Aix Marseille Universite, France.

Among the many possible ways to study the right tail of a real-valued random variable, a particularly general one is given by considering the family of its Wang distortion risk measures. This class of risk measures encompasses various interesting indicators, such as the widely used Value-at-Risk and Tail Value-at-Risk, which are especially popular in actuarial science, for instance. In this communication, we first build simple extreme analogues of Wang distortion risk measures and we show how this makes it possible to consider many standard measures of extreme risk, including the usual extreme Value-at-Risk or Tail-Value-at-Risk, as well as the recently introduced extreme Conditional Tail Moment, in a unified framework. We then introduce adapted estimators when the random variable of interest has a heavy-tailed distribution and we prove their asymptotic normality. The finite sample performance of our estimators is assessed on a simulation study and we showcase our techniques on an actuarial data set.

MULTI-CLASSIFICATION STRATEGIES FOR THE PROBLEM OF OPINION MINING IN TWITTER

Suilán Estévez, Alejandro Piad, and Yudivián Almeida

Universidad de La Habana, Cuba.

In this paper we present a study of several strategies for multi-classification for the problem of opinion mining, particularly in the domain of Twitter messages. We perform a comparison between three different strategies: the AdaBoost algorithm, the classic bagging approach and a modified bagging strategy using different classifiers. These variants are compared with respect to their accuracy when classifying tweets in 4 different classes (objective, positive, negative and neutral) in a standard corpus of Spanish Twitter messages.

REDUCCIÓN DE DIMENSIONES BASADO EN POS-TAGGING PARA EL PROBLEMA DE MINERÍA DE OPINIÓN EN TWITTER

Suilán Estévez, Alejandro Piad, and Yudivián Almeida

Universidad de La Habana, Cuba.

En este trabajo se presenta una propuesta de reducción de dimensiones basada en POS-tagging para el problema de Minería de Opinión en Twitter. Esta propuesta reduce drásticamente el número de dimensiones de la representación de los mensajes de Twitter con respecto a la representación basada en bolsa de palabras. Se clasifican, mediante un enfoque de aprendizaje supervisado, los mensajes en objetivo-subjetivo y negativo-positivo, para cada representación. Finalmente se presenta un análisis comparativo de la precisión alcanzada respecto al número de dimensiones en corpus de Inglés y Español.

ANALYSIS OF THE ESTABILITY OF THE ONE-PARAMETRIC LINEAR PERTURBATION OF THE LORENZ SYSTEM

Jorge Estrada

Universidad de La Habana, Cuba.

The Lorenz system is a dynamical three-dimensional system, introduced by Edward N. Lorenz in 1963. It is derived from the simplification of a two-dimensional partial differential equations system introduced by Saltzmann in 1962. Saltzmanns system models the flow in a fluid of uniform depth, where the temperature difference between the top and bottom layers is constant. This is the case for convection rolls in the atmosphere, and therefore the Lorenz system is important for short and long-range weather forecast. Despite its simplicity, it is also well known for having chaotic unstable orbits, great sensitivity to initial conditions and the appearance of strange attractors for certain parameter values. In the greater part of the literature about the Lorenz system, only the original parameter values that Lorenz analyzed in 1962 are considered. Nevertheless, in recent papers several modifications of the Lorenz system, such as the Chen, Lu and Lorenz- Stenflo systems, have been introduced, and their similarities and differences with the Lorenz system have been analyzed. This work does not analyze a modification of the Lorenz system, but rather a linear oneparameter perturbation. The system is analyzed for arbitrary positive values of its parameters, except for the perturbation parameter, which is infinitesimal. The Center Manifold Theorem is used to reduce the systems dimension. Also, the bifurcations present in both the original system and its perturbation are classified.

SOFTWARE TOOL FOR MODEL AND SOLVE THE MAXIMUM COVERAGE LOCATION PROBLEM

Jenny Fajardo and Leydis Sáchez y Diago E. Estrada Cynthia Porras

Instituto Superior Politécnico José Antonio Echeverría, Cuba.

Many of the optimization problems identifying the man are strategic factors for the development of any society, therefore it is very important to implement and modeling. Currently the location of facilities to meet the demand for services is gaining more interest. Inside the location problems is the problem of maximum coverage (MCLP), known as one of the classic literature models. The model of the MCLP and the solutions obtained as a result of applying metaheuristics are difficult to understand for non-expert users in the areas of optimization. In this sense, this paper aims to propose the development of a component to model and solve the problem MCLP, as well as data management and visualization of the solutions obtained as a result of the application of metaheuristics algorithms implemented in the BiCIAM framework. For the management of the problem data we used combinations based on real points of the space GIS.

AN IMPROVED GRASP STRATEGY APPLIED TO VEHICLE ROUTING PROBLEM WITH SIMULTANEOUS DELIVERIES AND PICK-UP SERVICE

Alina Fernández and Sira M. Allende
Universidad de La Habana, Cuba.

Vehicle routing problem with simultaneous deliveries and pick-up service is a model in which a fleet of vehicles shall pick up and/or deliver products from a set of customers. If a vehicle visits a client it shall satisfy the demand: deliver or pick up the products, the costumer asked. In this paper we assume that the load to delivery is located in a point (origin), where the load which is picked up is also delivered. So, the routes begin and finish in the origin. We consider a heterogeneous fleet with a fixed number of vehicles. At each point of the route, the vehicles load the pickup demands of the visited points and the delivery demand of the points to be visited later. We propose an improved GRASP strategy using in each iteration Simulated Annealing as local search. Since to find a feasible solution of this model is NP-hard problem, we penalize the overload of the vehicles. Computational results show a good behavior of the proposed procedure.

CONSTRUCCIÓN DE RELACIONES DE SIMILARIDAD BORROSAS BASADAS EN LA MEDIDA CALIDAD DE LA SIMILARIDAD.

Yumilka Fernández*, Mabel Frias* Lenniet Coello*, Yaima Filiberto*, Yailé Caballero*, and Rafael Bello**
*Universidad de Camagüey, Cuba.
**Universidad Central de Las Villas, Cuba.

A method to build fuzzy relations is proposed in this paper. The method combines the measure quality of the similarity and the metaheuristic Particle Swarm Optimization. The approach is based in the Granular Computing.

ANALYSIS OF THE EFFECTIVENESS OF THE THESEUS MULTI-CRITERIA SORTING METHOD

Eduardo Fernández and Jorge Navarro y Edgar Covantes
Autonomous University of Sinaloa, Mexico.

The effectiveness of the THESEUS multi-criteria sorting method is here characterized by i) its capacity for suggesting well-defined and appropriate assignments and ii) the probability of suggesting inappropriate assignments. We study how these and other important features are influenced by the number of criteria and categories, the cardinality of the reference set and the level of decision maker consistency.

DESIGN OF MULTI-OBJECTIVE SUPPLY NETWORKS

Petr Fiala
University of Economics, Czech Republic.

Supply chain management has generated a substantial amount of interest both by managers and researchers. Supply chain is defined as a system of suppliers, manufacturers, distributors, retailers and customers where material, financial and information flows connect participants in both directions. Supply chain management is more and more affected by network and dynamic business environment. Coordination and cooperation can significantly improve the efficiency of supply networks. The fundamental decisions to be made during the design phase are the location of facilities and the capacity allocated to these facilities. An approach to designing sustainable supply networks is developed and solved by a mathematical programming model. Traditional concepts of optimality focus on valuation of already given systems. New concept of designing optimal systems is applied. Searching for a better portfolio of resources leads to a continuous reconfiguration and reshaping of systems boundaries. Multi-objective supply chain design is formulated and solved by De Novo approach. Multi-objective linear programming (MOLP) is a model of optimizing a given system by multiple objectives. The paper presents approaches for solving the Multi-objective De Novo linear programming (MODNLP) problem for design of multi-objective supply networks. The approach is based on reformulation of MOLP problem by given prices of resources and the given budget. Technological innovations bring improvements to the desired objectives and the better utilization of available resources. These changes can lead to beyond tradeoff-free solutions.

A NOTE ON THE FUZZY EXTENSION PRINCIPLE FOR LP PROBLEMS WITH FUZZY COEFFICIENT MATRIX

Juan Carlos Figueroa-García
Universidad Distrital Francisco José de Caldas, Colombia.

Linear Programming (LP) is among the most used optimization models due to its efficiency, simplicity and reliability. In the last decades, fuzzy sets have been incorporated into LP models to represent imprecision coming from human being perceptions with successful results. Different approaches to Fuzzy Linear Programming (FLP) problems have been presented in bibliography, and several authors treated the field of classical fuzzy sets and its application in LP problems. LP problems are composed by three sets of parameters: costs c, coefficient matrix A, and constraints b which are considered as deterministic. In FLP models, different combinations of fuzzy parameters namely c^f, A^f, b^f can be considered into the analysis that lead to different optimization methods and routines. In this paper, we focus on the problem of having a fuzzy coefficient matrix Af and how the fuzzy extension principle operates into its optimal solution. This paper focuses on how to compute the membership degree of a random realization of a_{ij} given previous experts perceptions and/or opinions about aij which are represented using fuzzy sets, and applied in LP problems

ADAPTING A REINFORCEMENT LEARNING APPROACH FOR THE FLOW SHOP ENVIRONMENT WITH SEQUENCE-DEPENDENT SETUP TIME

Yunior César Fonseca Reyna* and Yailen Martínez-Jiménez**
*Universidad de Granma, Cuba.
**Universidad Central de las Villas, Cuba.

The tasks scheduling problem on linear production systems, Flow Shop Scheduling Problems, has been a great importance in the operations research which seeks to establish optimal job scheduling in machines within a production process in an industry in general. The problem considered here is to find a permutation of jobs to be sequentially processed on a number of machines under the restriction that the processing of each job has to be continuous with respect to the objective of minimizing the completion time of all jobs, known in literature as makespan or Cmax. Furthermore, is considerate setup-time between two jobs and preparation time machines. This problem is as NP-hard, it is typical of combinatorial optimization and can be found in manufacturing environments, where there are conventional machines-tools and different types of pieces which share the same route. The following research presents an adaptation of Reinforcement Learning algorithm known as Q-Learning to solve problems of the Flow Shop category. This algorithm is based on learning an action-value function that gives the expected utility of taking a given action in a given state where an agent is associated to each of the resources. Finally, the algorithm is tested with problems of different levels of complexity in order to obtain satisfactory results in terms of solutions quality.

INVARIANT MEASURE FOR THE STOCHASTIC EQUATION OF ONE-DIMENSIONAL MOTION OF BAROTROPIC VISCOUS GAS

Hisao Fujita Yashima
Université 8 Mai 1945, Algerie.

We consider a stochastic equation system corresponding to the description of the motion of a barotropic viscous gas in a discretized one-dimensional domain with a weight $\varepsilon > 0$ regularizing the density and prove the existence of an invariant measure for this equation system. The proof of this result is based on the application of Has'minskii's theorem (see Has'minskii, R. Z. : Stochastic stability of differential equations. Sijthoff & Noordhoff, 1980) as well as the construction of the solution of the equations with the initial condition. Moreover, we propose a very weak version of invariant measure for the stochastic equation of motion of a viscous barotropic gas in a domain of one-space dimension with a weight regularizing the density and prove the existence of a measure corresponding to this weak version of invariant measure. The proof is based on the construction of a sequence of measures which are invariant measures for the equation in the discretized domain, constructed as above. These results are illustrated in Benseghir, R., Fujita Yashima, H. Rev. Roumaine Math. Pures Appl., vol. 58 (2013), pp. 149-162 and Lasfer, F., Fujita Yashima, H. Annales Math. Africaines, vol. 5 (2015), pp. 29-46.

ANÁLISIS DE LA SITUACIÓN DE DESIGUALDAD EN MÉXICO

José Félix García Rodríguez*, Ignacio Camal Cauich** Oscar Priego Hernández, Aída Armenta Ramírez, and Rilton B. Goncalvo Primo

*Universidad Juárez Autónoma de Tabasco, Mexico.

**Universidad Autónoma de Chapingo, Mexico.

An expression of inequality in Mexico is the concentration of income in the deciles of the population with greater economic capacity. Thus, the results of the National Survey of Income and Expenditure (ENIGH) 2014 reveal that 62.5higher incomes, that is, in deciles VIII, IX and X. In contrast, 70households with the lowest income, corresponding to the deciles I to VII obtained only 37.5as a measure of income concentration stood at 0.438, showing no significant change from 2012. Overall, in 2014 the total current income decreased by 3.2in real terms compared to the figure recorded in 2012. The same applies to the current quarterly average household income, which fell by 3.5constant prices compared with 2012. As a result, the quarterly total current expenditure fell by 4.8quarterly average total current expenditure of Mexican households, which fell by 5.1crisis in Mexico.

LIPSCHITZIAN PROPERTIES OF IMPLICITELY GIVEN MULTIFUNCTIONS

Helmut Gfrerer* and Jiri Outrata**

*Johannes Kepler Univerity (JKU) Linz, Austria.

**Czech Academy of Sciences, Czech Republic.

This talk is devoted to the development of new sufficient conditions for the calmness and the Aubin property of implicit multifunctions. As the basic tool one employs the directional limiting coderivative which, together with the graphical derivative, enable us a fine analysis of the local behaviour of the investigated multifunction along relevant directions. For verification of the calmness property, in addition, a new condition has been discovered which parallels the missing implicit function paradigm and permits us to replace the original multifunction by a substantially simpler one. The obtained results are in particular applicable for solution mappings of parametric optimization problems.

SPREADSHEET OPTIMIZATION WITH EXCEL SOLVER, FOR BEGINNERS AND EXPERTS ALIKE

Thomas Grossman

University of San Francisco.

This presentation will cover a range of activities with Excel Solver. New users will get an overview of what Solver can do. For those with some experience, you'll get insight into programming approaches to make models into spreadsheet model assets suitable for reuse and transfer to other analysts. If you think you've seen it all, we've give you a look at a recently-developed approach to build Solver models that are scale-independent, allowing new rows and columns to be added effortlessly, without any programming or manipulation of cell formulas.

RELATIONSHIPS BETWEEN CONSTRAINED AND UNCONSTRAINED MULTI-OBJECTIVE OPTIMIZATION AND APPLICATION IN LOCATION THEORY

Christian Günther* and Christiane Tammer

*Martin Luther University Halle-Wittenberg, Germany.

In multi-objective optimization, one considers optimization problems with several conflicting objective functions. Depending on the application in practice these problems often involve certain constraints. Computing the whole set of Pareto efficient solutions of a constrained multi-objective optimization problem is a difficult task in general. In order to develop effective algorithms for computing the whole set of solutions it is very important to use structural properties of the given problems. Note that it is known that there is a lack of a common geometrical description of the solution sets for constrained versions of special classes of multi-objective optimization problems. In this talk we investigate relationships between constrained and unconstrained multi-objective optimization problems. We mainly focus on generalized convex multi-objective optimization problems, i.e., the objective function is a componentwise generalized convex (e.g., quasi-convex, semi-strictly quasi-convex or explicitly quasi-convex) function and the feasible domain is a convex set. Beside the field of location theory the assumptions of generalized convexity are found in several branches of Economics. We derive a characterization of the set of efficient solutions of a constrained multi-objective optimization problem using characterizations of the sets of efficient solutions of unconstrained multi-objective optimization problems. We demonstrate the

usefulness of the results by applying it on constrained multi-objective location problems. Using our new results we show that special classes of constrained multi-objective location problems (e.g., point-objective location problems) can be completely solved with the help of algorithms for the unconstrained case. At the end of the talk, we present some information about the current development of the MATLAB-based software tool "Facility Location Optimizer" (see www.project-o.de).

FUZZY MODEL OPTIMIZATION FOR BERTH ALLOCATION PROBLEM

Flabio Gutiérrez*, Mario Rodríguez*** Edmundo Vergara-Moreno**, and Federico Barber***
*Universidad Nacional de Piura, Peru.
**Universidad Nacional de Trujillo, Peru.
***Universidad Politécnica de Valencia, Spain.

The berth allocation problem (BAP) in a maritime container terminal is defined as a feasible allocation of berths to incoming vessels. In this paper, we developed a fuzzy mathematical programming model for continuous and dynamic BAP. It is assumed that the arriving time of vessels is imprecise, in the sense that the vessels can have an advance or delay but only up to a permitted tolerance. Fuzzy sets are used to represent the imprecision. cuts method is applied to the model solution. The proposed model has been codified in CPLEX solver and evaluated in different instances. The obtained results shows that the proposed model can help the container terminal managers, since it has available berth plans with different degrees of allowed advance or delay, which are optimized according to the waiting time.

DISCRIMINATION AGAINST MIGRANTS IN URBAN VIETNAM

Jonathan Haughton*, Wendi Sun**, and Nguyen Thi Thanh Loan***
*Suffolk University, USA.
**Rockland Trust, USA.
***General Statistics Office of Ho Chi Minh City, Vietnam (retired).

In 2009, migrant workers in the two major cities of Vietnam Hanoi and Ho Chi Minh City earned 42non-migrant (resident) workers. In this paper we ask why this gap is so large, and whether discrimination against migrants plays a role. We estimate earnings equations, after correcting for selection bias, and use the estimates to decompose the earnings differential following the method proposed by Blinder and Oaxaca. Using this method, at least 60all, of the gap can be explained by differences in endowments (such as education and experience). A more elaborate decomposition, following the method proposed by Brown, Moon, and Zoloth, first seeks to explain how workers sort into different sectors (state, private, individual), or occupations (blue or white collar, in industry or services), and then examines wage differentials within each sector or occupation. About two-fifths of the wage gap may be explained by endowments, using this approach, suggesting that migrants face headwinds when they try to find jobs in favored sectors, and when they seek comparable wages to those received by residents. The system of residential permits (ho khao) may contribute to the difficulties faced by migrants. Our results are broadly similar to, although more stable than, those found for the major cities in China.

NECESSARY OPTIMALITY CONDITIONS FOR SOME NONCONVEX FACILITY LOCATION PROBLEMS

Marcus Hillmann
Martin Luther University Halle-Wittenberg, Germany.

The problem of locating a new facility with simultaneous consideration of existing attraction and repulsion points is a single-objective location problem with great practical relevance e.g. in the fields of economy, city planning or industrial design. Unfortunately, the consideration of negative weights makes this problem in general a nonconvex one, so none of the established algorithms for scalar location problems are able to solve it. Based on the usage of differential and classical Fenchel subdifferential for solving convex (location) problems, we will therefore present a new approach to derive necessary optimality conditions for such problems using the nonconvex subdifferentials by Ioffe and Kruger/Mordukhovich. While there are many strong theoretical results on these subdifferentials, it is rarely possible to explicitly calculate them or use them for applications. After giving a brief review on definition, properties and calculus of the mentioned subdifferentials, we will show, that for certain distance functions it is possible to precisely calculate the corresponding subdifferentials. By taking advantage of the special structure of the problems we will then derive necessary optimality conditions for some instances of semi-obnoxious facility location problems. Furthermore, we will use these results to establish

algorithms for (approximately) solving semi-obnoxious facility location problems based on different kinds of distance functions. At the end of the talk, we will give an outlook on open questions and possible future developments.

VOICE ACTIVITY DETECTION BASED ON HIGHER ORDER CUMULANTS AND CONVOLUTION

Miguel Enrique Iglesias Martínez* and Fidel Ernesto Hernández Montero**
*Universidad de Pinar del Río, Cuba.
**Instituto Superior Politécnico José Antonio Echeverría, Cuba.

This paper refers to the application of higher-order statistical signal processing techniques (cumulant calculation) on noise cancellation. The performed procedure, joined to a convolution process, results in the complete estimation (i.e., amplitude, frequency and phase recovery) of any corrupted periodic signal. The aim of this work lies in its application to the voice activity detection (VAD) for environments with high noise levels. The minimum signal to noise ratio for all experiments using the proposed algorithm was -5dB. Obtained results are highly satisfactory compared with existing models.

MULTI-PERIOD DEA MODELS AND THEIR APPLICATIONS

Josef Jablonsky
University of Economics, Czech Republic.

The paper aims at efficiency measurement in multi-period production systems. A common modelling tool for efficiency evaluation is data envelopment analysis (DEA) introduced by Charnes, Cooper and Rhodes in 1978. Conventional DEA models focuses on analysis of the set of homogeneous decision making units within one period. The units are described by several inputs that are transformed into several outputs. The main information given by the most important class of DEA models is the relative efficiency score with its maximum value 1 (100inefficient ones. Measuring efficiency within multiple time periods is an important task which is not solved in a satisfying way yet. A common way used for this purpose is Malmquist index, window analysis, and few modifications of conventional DEA models proposed by several researchers. One of them is Park Sam and Park model (PP model) that attempts to measure the total aggregative efficiency within multiple periods. The disadvantage of this model consists in its orientation to the best period of the decision making unit under evaluation, i.e. the aggregative efficiency is given as the best efficiency score across all periods. This paper formulates original modifications of the PP model the model that is oriented on the worse period of the DMU under evaluation, and the model that computes average efficiency across all periods. In addition, a multi-period SBM and super-efficiency SBM models that measure inefficiencies using relative slacks are proposed. The results of all models are illustrated and compared on the three-period example.

ON THE TIME TO RUIN AND DEFICIT AT RUIN UNDER AN EXTENDED ORDER STATISTICS RISK PROCESS

Vladimir K. Kaishev, Sofia University Zvetan Ignatov, and Dimitrina Dimitrova
City University London, UK.

We present a closed form expression for the joint distribution of the time to ruin and the deficit at ruin assuming that claim arrivals follow a point process with an extended order statistics (OS) property. We generalize the classical OS property by allowing the claim arrivals mean value function to be any (possibly discontinuous) non-decreasing function. This is appealing for insurance applications since it allows to consider clusters of claims arriving instantaneously, which is illustrated on several examples. We show that corollaries of our main result generalize previous non-ruin formulas obtained for the case of stationary Poisson claim arrivals and for claim arrivals following a classical OS point process with a continuous cumulative intensity function.

INTEGRATED SERVICE PLANNING AND CONTROLLING

Heinz Eckart Klingelhöfer
Tshwane University of Technology, South Africa.

By applying methods of investment appraisal, this paper offers a management accounting approach to (financially) evaluate the services offered by a company. In order to do so, the characteristics of services are derived

and formalised to be dealt with in management accounting. On this basis a model will be developed that uses an integrated approach to determine the optimal portfolio of products and service activities, taking into account the companys financial objectives and constraints. This also allows for examining the financial consequences of parameter changes, delivering information useful within the scope of service planning and controlling. Even on imperfect markets, they can be interpreted as (corrected) net present values. In a second step, the model allows for supporting investment decisions on offering new services by calculating the price ceiling for such a venture. Again, applying duality theory of linear programming allows to identify the determinants of the price ceiling for offering these additional services. It can be interpreted as a sum of (corrected) net present values. Under certain conditions, these (corrected) net present values can also be used to easily assess and financially interpret the effects of parameter changes. Using sensitivity analysis supports these findings and allows for getting more information on the effects of these determinants.

AN ECONOMIC MODEL OF DISTRIBUTIVE PREFERENCES AND APPLICATION TO THE WORKPLACE

James Konow* and Haileselassie Medhin** Olof Johansson-Stenman**, Peter Martinsson**
*Loyola Marymount University, USA, and Kiel University, Germany.
**University of Gothenburg, Sweden.

This study formulates a simple economic model of utility that includes distributive preferences for either equality or equity, whereby the latter refers to allocations that are proportional (e.g., to individual productivity). Agents are assumed to maximize a utility function that consists of material utility, the cost of effort/productivity, and a distributive preference term. The theory is formulated in conjunction with a natural field experiment that is designed to test it. The theory generates predictions about the productivity level of workers in response to changes in pay regimes incorporated into the experiment. Agents are assumed to value either equality or equity and to have different costs of effort/productivity. Actual compensation differs across treatments in the experiment: the pay regime is either equal or equitable. This compensation enters the utility function in the material utility and distributive preference terms. The variable of interest is the level of individual productivity, and the theory generates predictions for productivity under different preferences and pay regimes from first order conditions. The theory allows one to infer distributive preferences, and changes in distributive preferences, from worker productivity in the experiment over a two week period. The data analysis indicates that, in fact, worker behavior is consistent with the changes in distributive preferences predicted by the theory. This approach to combining theory with a natural field experiment, and the resulting findings could prove important for future economic research, real world pay schemes, and economic development programs.

ON THE EXISTENCE OF A PERIODIC SOLUTION FOR A STOCHASTIC EQUATION WITH INTERRUPTION INTERVALS

Farhouh Korichi* and Hisao Fujita Yashima**
*École Normale Supérieure de Kouba & Ecole Nationale Préparatoire aux Etudes d' Ingénieur, Algeria.
**Université 8 Mai 1945, Algeria.

We consider a stochastic equation system corresponding to the description of the motion of a barotropic viscous gas in a discretized one-dimensional domain with a weight $\varepsilon > 0$ regularizing the density and prove the existence of an invariant measure for this equation system. The proof of this result is based on the application of Has'minskii's theorem (see Has'minskii, R. Z. : Stochastic stability of differential equations. Sijthoff & Noordhoff, 1980,) as well as the construction of the solution of the equations with the initial condition. Moreover, we propose a very weak version of invariant measure for the stochastic equation of motion of a viscous barotropic gas in a domain of one-space dimension with a weight regularizing the density and prove the existence of a measure corresponding to this weak version of invariant measure. The proof is based on the construction of a sequence of measures which are invariant measures for the equation in the discretized domain, constructed as above. These results are illustrated in Benseghir, R., Fujita Yashima, in H. Rev. Roumaine Math. Pures Appl., vol. 58 (2013), and Lasfer, F., Fujita Yashima, in H. Annales Math. Africaines, vol. 5 (2015),

MODEL FOR EVALUATING CARDIOVASCULAR RISK IN CUBA

Germán Lahera Pérez, Vivian Sistachs Vega and Nurys Armas Rojas

Universidad de la Habana, Cuba.

This paper presents a proposal of a model that allows to predict the risk of suffering cardiovascular disease on Cuban patients. On the model construction were analyzed the data collected on the health care facility Héroes de Corynthia using Ordinal Logistic Regression and thus obtaining the model that best fit the data. The goal of the investigation is to obtain a model that emits results as close to the Cuban reality as possible and to be able to calculate of a more exact manner the real number of people with high risk of suffering cardiovascular disease on the country. At last it is shown the model implementation in the software MATLAB trough an interface allowing to calculate the cardiovascular risk of a patient.

POLYNOMIALS, ORDER STATISTICS AND RISK MODELS IN INSURANCE AND EPIDEMICS

Claude Lefevre

ISFA, Universit Lyon 1 and Université Libre de Bruxelles.

Our main purpose is to construct a bridge between two classical topics in applied probability: the finite-time ruin probability in insurance and the final outcome distribution in epidemics. We start by reformulating these two problems in terms of the joint right-tail and left-tail distributions of order statistics for a sample of uniforms. Thanks to this representation, we are able to show that the hidden algebraic structures are of polynomial type, namely Appell in insurance and Abel-Gontcharoff in epidemics. These polynomials are defined with randomized parameters, which makes their mathematical study interesting in itself.

BUSINESS ANALYTICS GAPS BETWEEN ACADEMIA AND INDUSTRY

Mingfei Li, Alina Chircu, Gang Li, Yannan Shen, Lan Xia and Jennifer Xu

Bentley University, USA.

The business world today is entering a new era. With the widespread use of mobile devices, smart systems, social media, and e-commerce activities,2.5 quintillion bytes of data are being generated every day in the world, according to computer giant IBM. These data featured by high volumes of extremely varied and high velocity data are now called big data.

In particular, there is an increased interest in business analytics, an emerging area focused on obtaining valuable and actionable insights from big data. Experts agree that business analytics requires new skills and knowledge. Unfortunately, current gaps between business and academia make it difficult to respond to this new eras needs. In this study, we use text mining applied to literatures in academia and industry to identify these gaps and opportunities.

SEVERAL PROBLEMS OF RUIN THEORY

Stéphane Loisel

Université Lyon 1, France.

In this talk, we present different problems of ruin theory, inspired by current insurance regulation changes and by changes in claim frequency and claim size distributions over time.

THE DISCRETE BROCKETT HIERARCHY AND THE REALIZATION THEORY

Nancy López Reyes* and Luis E. Benítez Babilonia**

*Universidad de Antioquia, Colombia.

**Universidad del Sinú, Colombia.

We connect the Control Theory of linear dynamical infinite-dimensional systems with a discrete hierarchy of double bracket differential equations, so-called the discrete Brockett hierarchy. We apply the same approach used in N. Lopez Reyes, R. Felipe and T. Castro Polo, The discrete KP hierarchy and the negative power series on the complex plane. Computational and Applied Math. 32, (2013) 483-493, connecting the solutions of this hierarchy with a parametric linear infinite-dimensional system with parameter τ, by means of a group factorization associated to this hierarchy. We show that the dual properties (approximately controllability and approximately observability) are kept in the parametric infinite-dimensional system with semigroup $e^{\tau L}$ where L are solutions of the hierarchy. Also, via realization theory, it is showed that the family of transfer functions of the parametric system represents the space of complex variable functions that can be expanded by a Laurent series with only negative powers of z on $\{z \in \mathbb{C}, |z| > 1\}$.

COMPETENCY ASSESSMENT MODEL FOR A VIRTUAL LABORATORY SYSTEMS AND DISTANCE USING FUZZY COGNITIVE MAPS

Omar Mar Cornelio and Asiel Leal Celdeiro Yeleny Zulueta Véliz, Liudmila Rozhnova
Universidad de las Ciencias Informáticas, Cuba.

With the development of Information Technology and Communications (ICT) are increasingly knowledge areas within it. The automatic control has contributed its Systems of Virtual Labs and Distances (SLVD) in order to share precious resources from the Internet technology which would be very difficult to generalize its cost of implementation. However the absence of a professor for monitoring control strategies designed by students , it is possible that not competent persons can assess the platform and generate a malfunction in their workstations. This paper describes a solution to the issue raised from the implementation of a model for the assessment of competitions which bases its operation on fuzzy cognitive map and operators of aggregation of information as a regulatory mechanism for access control practices in SLVD.A case study is implemented through which it is possible to determine the rate of student skills and support the decision making process for access to running practice.

STATISTICAL MODEL FOR FOREIGN TRADE I

Lubos Marek and Michal Vrabec
University of Economics Prague, Czech Republic.

The main aim of this article is analysis of Czech foreign trade time series. We will demonstrate the appropriate models for these series and use these models for construction of forecasts. The relationship between Czech foreign trade time series and exchange rate of Czech crown will be shown. The dependence of foreign trade time series on exchange rate we described by transfer function model. There is the time lag between both series in the model. These models are used for the construction of forecasts. The export and import time series are output series and the exchange rate series is an input series in the model. The values of the foreign trade are published by Czech Statistical Office every month. But there are not the sharp data, there are the preliminary forecasts only in the first stage. These preliminary forecasts are put more precisely a few times. The problem is that the first values are published with time lag 2-3 months. On the other side the values of the some series are known immediately after realization and there are quite exact (such as series of exchange rate of Czech crown). Therefore, when we will describe the dependence between these series by the appropriate model, we can use this model for a construction of forecasts. Because we know the values of the rate some months before the values of export, we can use the constructed.

REINFORCEMENT LEARNING ALGORITHMS FORSCHEDULING PROBLEMS IN ONLINE ENVIRONMENTS

Beatriz M. Méndez-Hernández*, Yailen Martínez-Jimenez*, Jessica Coto-Palacio*, Erick D. Rodríguez-Bazan*
and Ann Nowé**
*Universidad Central Marta Abreu de Las Villas, Cuba.
**Vrije Universiteit Brussel, Bélgica.

Scheduling problems are present in many processes that occur in our daily life, where a set of operations has to be performed at certain periods of time and they have to be allocated in limited resources. Some of these problems occur in online environments, as there is no prior knowledge of the arrival of the jobs or the time it would take for each job to be processed in each of the machines. In this paper we study and propose a solution to online scheduling problems based on an existing case study from the literature, besides we propose a solution to two new scenarios, using two reinforcement learning algorithms. The results were validated using statistical tests.

SLACK-BASED TECHNIQUES TO HANDLE THE ROBUSTNESS IN JOB SHOP SCHEDULING PROBLEMS

Beatriz M. Méndez-Hernández*, Yailen Martínez-Jimenez* Jessica Coto-Palacio* Erick D. Rodríguez-Bazan*,
and Ann Nowé**
*Universidad Central Marta Abreu de Las Villas, Cuba.
**Vrije Universiteit Brussel, Bélgica

The vast majority of the scheduling problems assumes that you have all the information needed to solve the problem and that the environment in which it will develop is static. However, in the real world, the operations

are subject to considerable uncertainty that is reflected in broken machines, the operations take more time to execute than expected, and urgent arrival or cancellation of orders, among others. In the last decade, the robustness has become an essential part of the scheduling problems. In this paper, we implemented three techniques based on slack, these techniques are applied to Job Shop scheduling problem using the tardiness as objective to optimize (minimize). Last, we applied the techniques implemented to a set of benchmarks and we disturb the scheduling following a Poisson distribution to evaluate what technique is capable of absorbing all disturbs of the problem making the least amount of possible changes.

LINEAR REGRESSION: AN ALTERNATIVE TO LOGISTIC REGRESSION THROUGH THE NON-PARAMETRIC REGRESSION

E.P. Menéndez*, Julia A. Montano**, Zoylo Morales**, and Sergio Hernández**
Universidad Veracruzana, Mexico

For applying the logistic regression, and any other type of regression method, it is necessary to know the model that we want to adjust. In case of a logistic regression, with only one independent variable, the use of a nonparametric regression is useful in order to obtain evidence of the possible relation between the success probabilities (pi) and the independent variable. With this information is possible to determine the adequate model to be adjusted. In this work, it is proposed to use a linear regression model, where the dependent variable is the link function, and whose values are obtained when this function is evaluated in the estimated probabilities that resulting in the application of non-parametric regression.

IS THE CORPORATE ELITE DISINTEGRATING? INTERLOCK BOARDS AND THE MIZRUCHI HYPOTHESIS

Kevin Mentzer*,****, Francois-Xavier Dudouete*****, Dominique Haughton*,**,*** Pandierre Latouche**,
Fabrice Rossi**, Phong Nguyen****** and Tien T. Thach****
*Bentley University, USA.
**Paris 1 University, France.
***Toulouse 1 University, France.
****Bryant University, USA.
*****Dauphine University, France.

This paper proposes an approach for comparing interlocked board networks over time to test for statistically significant change. In addition to contributing to the conversation about whether the Mizruchi hypothesis (that a disintegration of power is occurring within the corporate elite) holds or not, we propose novel methods to handle a longitudinal investigation of a series of social networks where the nodes undergo a few modifications at each time point. Methodologically, our contribution is two-fold: we extend a Bayesian model hereto applied to compare two time periods to a longer time period, and we define and employ the concept of a hull of a sequence of social networks, which makes it possible to circumvent the problem of changing nodes over time.

TREE-BASED ESTIMATORS IN CENSORED REGRESSION: APPLICATIONS TO SEGMENTATION AND RESERVING IN LIFE INSURANCE

Xavier Milhaud
Université Lyon 1, France.

The use of regression trees as a tool for high-dimensional classification and regression problems has boomed since the publication of [1]. Initially designed to estimate nonparametrically the conditional mean of a response given a vector of covariates, this popular technique is here adapted to deal with both density estimation and right-censored data. We derive key nonasymptotic results of tree-based estimators following the growing procedure, as well as consistency results concerning the pruning algorithm. Following the works by [2], applications on real life insurance datasets enable to illustrate the utility of such a method and demonstrate its effectiveness in selecting most impacting risk factors on the phenomenon of interest.

HYBRID STRATEGY FOR QUADRATIC PROGRAMMING PROBLEM WITH BOX CONSTRAINTS

Ridelio Miranda*, Boris Pérez**, Sira Allende*, and Gemayqzel Bouza*
*Universidad de Cienfuegos, Cuba.
**Universidad de la Habana, Cuba.

In this work we consider the minimization of a quadratic function with box constraints. As a solution approach we propose a strategies of continuation and cut which is combined with a Branch and Bound method. Given a local optimum x* a cut constraint is added to isolate the computed point and look for a better evaluation of the objective function. A continuation algorithm is used to solve the new problem. If certain singularities appear, a Branch and Bound procedure with double non-negative relaxation is applied for dealing with this problem. The proposed hybrid strategy improves the results concern to number of explored nodes and computation time. Comparisons with embedding strategies and Branch and Bound algorithm with semi definite relaxation are included.

A PROACTIVE TRAFFIC MANAGEMENT SYSTEM WITHOUT PHYSICAL INFRASTRUCTURE

Pitu Mirchandani
Arizona State University, USA.

Our research team has been developing a system that does not need an extensive roadside infrastructure to proactive traffic manage traffic on the current transportation network. The main components in the system are a wireless telecommunication system that is basically equivalent to the backbone of most mobile phone systems; a virtual server that does uses prediction and optimization algorithms for computing proactive traffic signal controls and other traffic management actions; and the currently available traffic signals and other wireless actuated controls such as highway advisory radio. This system can work in USA, Europe, Asia, or any nation where wireless telephones are available with some smart features. In the US, our system referred to MIDAS, hopes to demonstrate the synergistic use of a cyber- infrastructure consisting of smart-phone type devices; cloud computing, wireless communication, and intelligent transportation algorithms to manage vehicles in the complex urban network through the use of traffic controls, route advisories and road pricing/rewards to jointly optimize drivers mobility as well as achieve the sustainability goals of reducing energy usage and improving air quality. A key element of MIDAS is the real-time streaming data collection and data analysis and the subsequent optimal traffic management through proactive traffic controls and advisories, predominantly using real-time optimization based on Rolling Horizon Dynamic Programming.

ON TESTING LINEARITY OF REGRESSION MODELS IN NON REGULAR CASE

Zaher Mohdeb* and Abdelkader Mokkadem**
Université Fréres Mentouri Constantine, Algeria.
**Université de Versailles Saint-Quentin En Yvelines, France.

We consider the following regression model

$$Y_{i,n} = f(t_{i,n}) + \varepsilon_{i,n},\ i = 1, \ldots, n,$$

where f is a unknown real function, defined on the interval $[0,1]$ and $t_{1,n} = 0 < t_{2,n} < \ldots < t_{n,n} = 1$, is a fixed sampling of the interval $[0,1]$. The errors $\varepsilon_{i,n}$ form a triangular array of random variables with expectation zero and finite variance σ^2, and for any n, the random variables $\varepsilon_{1,n}, \ldots, \varepsilon_{n,n}$ are independent. Let $E_p = span\{g_1, \ldots, g_p\}$, where $g_1, \ldots, g_p$ denote p linearly independent functions defined on $[0,1]$. In order to test

$$H_0: \ f \in E + p \text{ against } H_1: \ f \notin E_p,$$

we use a test statistic based on the mean of squared residuals and show that it has a parametric asymptotic behaviour. In contrast to most models suggested in the literature, our procedure is applicable in the nonparametric model case without regularity condition, and also under either the null or the alternative hypotheses. We give the asymptotic normality of the test statistic under the null hypothesis and the alternative one. A simulation study is conducted to investigate the finite sample properties of the test with application to regime switching.

P-VALUE DISTRIBUTION FOR T-TEST IN NON-INFERIORITY DESIGNS WITH PARALELL SAMPLES

Pedro A. Monterrey

Universidad del Rosario, Colombia.

In randomized controlled clinical trials, treatment efficacy is considered as its to produce beneficial effects. Efficacy of an experimental treatment is usually established comparing its effectiveness respect a placebo or comparing with the effect of an active control treatment. The first stage to determine effectiveness of a new treatment is placebo-controlled trial, and, as a second stage, a superiority trial will compare new treatment with a treatment uniformly accepted as a standard one. Sometimes the placebo control is considered unethical; in such a case, a non-inferiority trial may be appropriate. In non-inferiority the new treatment dont need to be superior to a control, it is enough that it doesnt be unacceptably worse and additionally to be better than placebo. The main aspect in non-inferiority hypothesis construction is to choose the non-inferiority margin; its determination would consider both statistical reasoning and clinical judgment. One of the methodological flaws in non-inferiority studies, claiming incorrectly non-inferiority, is related with the determination of non-inferiority margin. Two samples t-test is the statistical criteria to analyze validity of non-inferiority hypothesis when mean value is the parameter to measure treatments efficacy. The objective of present report was to relate t-test power function with the median of its p-value distribution, obtaining median p-values as a function of type I error and test power. Additionally the effect of non-inferiority margin in sensitiveness of the test according to proposed sample size was analyzed and graphical representations of p-values distribution introduced to validate test behavior for proposed non-inferiority margins.

USO DE TESTORES TÍPICOS PARA LA DETERMINACIÓN DEL IMPACTO DE LAS UNIDADES DE APRENDIZAJE EN LA FORMACIÓN PROFESIONAL

Saturnino Job Morales Escobar*, Héctor Rafael Orozco Aguirre*, Sandra Silvia Roblero Aguilar*,** and María Esther Guevara Cruz**

*Universidad Autónoma del Estado de México, Mexico.

**Instituto Tecnológico de Tlalnepantla, Mexico.

***Universidad Tecnológica Fidel Velázquez, Mexico.

In the context of professional formation, it is assumed on one hand, that educational programs (PEs) offered by institutions of higher education consider, among other, the needs of the labor field, and on the other hand, that students acquire and develop, during their stay in the institution, the professional skills that satisfy those needs. Under this premise, the learning units (UDAs) and their thematic contents are defined. However, the impact of these contents should periodically assess in the professional formation, and their relevance about the needs of various areas of professional performance as well. This multifactorial problem generally involves aspects beyond the academic field. Despite the above, it is important to have an approach of the impact of the UDAs in the professional formation and determine its relevance, which can be addressed as a feature selection problem. Hence, a proposal to identify the mentioned impact, is to consider how the obtained scores in the UDAs, by the graduates of an educational program, have a relationship with the obtained score in the exit examination. In this paper, an analysis of the obtained results in the exam Computational Engineering (EGEL ICOMPU), by the graduates of the Engineering Systems and Communications major of the University Center UAEM Valley of Mexico of the Autonomous University of Mexico State. For that, the typical testers developed in the Logical Combinatorial Pattern Recognition were used.

HYPERBOLIC EQUATIONS WITH MEMORY

Frantisek Mosna

Czech Univ. of Life Sciences in Prague, Czech Republic.

The existence of a solution to the equation governing the evolution of a displacement vector in an elastic body with non-local time and spatial memory is considered. A global weak solution to an associated initial-boundary value problem is established by constructing Galerkin approximations. Lebesgue or Sobolev spaces can be generalized for all real numbers and can be defined also on Banach spaces. They are equipped with several equivalent norms based on Fourier or Laplace transform and function expansion. This spaces help to derive suitable energy estimates.

ROLE OF MARKETING EFFORT TO COUNTER GRAY MARKETING ACTIVITY

Samar K. Mukhopadhyay* and Xuemei Su**
*Sung Kyun Kwan University, GSB, South Korea.
**California State University, USA.

different markets. An enterprising entity can buy the product in the low-price market and sell it in the high-price market starting an unauthorized channel. Obviously, price in each market play an important role. But another important variable, marketing effort, can significantly impact the extent of the gray market, and thus, can be used as a weapon to fight the gray market. The role of marketing effort which has a multi-billion dollar outlay in many industries has not been studied in literature. This paper studies the role of marketing effort in fighting gray market under two scenarios. One is when the prices are not under the firms control and second, when they are. We find that the manufacturers profit is significantly improved when he proactively adjusts the marketing effort levels in different markets. When marketing effort provision can be used in conjunction with pricing strategies, the manufacturers profit is further improved. One surprising finding is that, when certain condition is satisfied, it is in the manufacturers best interest to not sell through the authorized channel in the high price market, but to manage the gray market by controlling the marketing effort levels and prices in authorized channels, and thereby boost its global profit.

METALEARNING FOR DATAMINING

Roman Neruda
Academy of Sciences of the Czech Republic.

One of the tasks of meta-learning for data mining processes is to recommend a suitable method for new data sets. We focus on generating and testing complete workflows embedding machine learning methods together with preprocessing and their combinations, such as ensembles. We use two representations of workflows a linear one, and a one based on direct acyclic graphs. Efficient procedures for generating workflows are presented and evaluated by testing the generated schemes on real data.

MEASURING EFFECTIVENESS IN DYNAMIC ENVIRONMENTS

Pavel Novoa*, Carlos Cruz** y David A. Pelta**
*Universidad de Holguín, Cuba.
**Universidad de Granada, Spain.

In this paper we proposed a new performance measure for algorithm assessment in evolutionary dynamic optimization. We derived our proposal from what we considered as effectiveness. Different from existing measures, our proposal involves not only the accuracy, but also the time criteria (efficiency) of the algorithm. In order to illustrate its usefulness and relationship with other literature measures an experimental analysis was conducted. Results show that the proposed measure can be suitable employed in typical experimentation scenarios, offering new information about the algorithm performance.

SIMULATED TROPISM: A NEW METAHEURISTIC FOR MULTIMODAL OPTIMIZATION PROBLEMS

Juan M. Otero* and Carlos Saez**
*Universidad de La Habana, Cuba.
**Universidad de Artemisa, Cuba.

In this paper the metaheuristic Simulated Tropism (ST) for solving multimodal optimization problems is proposed. The natural metaphor on which this algorithm is based is phototropism, a process in which a hormone called auxin plays an important role, concentrating itself on the opposite region to the one where the light falls. This leads to a greater cell proliferation in this region, which results in an inclination of the plant towards the light source. ST works with a population of n points, where n is the dimension of the search space. These points represent cells in a transversal cut of the stem of a plant. The value of the objective function in each point represents the intensity of the light stimulus it receives. We simulate the growth of the plant trough a displacement of the cells in a certain direction. In order to simulate the function of auxin, an additional growth in the point with the worst evaluation of the objective function is considered. ST does not deal with swarms of fishes or birds that can move independently. Here the cells represent part of a stem and therefore must maintain a certain organic unity. Therefore, a similarity parameter is used which forces the cells not to modify the distances between them abruptly. Numerous well known test optimization problems have been solved by ST with excellent results. The algorithm has demonstrated to be capable of obtaining several global solutions.

AN ARTIFICIAL BEE COLONY ALGORITHM FOR THE MULTIOBJECTIVE MULTI-DEPOT HETEROGENEOUS VEHICLE ROUTING PROBLEM WITH TIME WINDOWS

Claudia Permuy Díaz*, Osvaldo Fosado Téllez** and Andros Serrano Hernández*
*University of Pinar del Río, Cuba.
** Technical University of Manabí, Ecuador.

The vehicle routing problem is based on the routing of vehicles to cater to different customers. The proposal addressed in this work is characterized by using a fleet of heterogeneous vehicles where each vehicle has different properties in both transportation costs and capacity; its multi-depot, this means, several depots to supply customers, and has time windows, which are a range of time attention to every client. The problem also becomes multi-objective to define two elements to optimize: minimize transportation costs and the number of vehicles used. An algorithm is proposed based on artificial bee colony metaheuristic to solve the posed problem, using three neighborhood operators and a combination thereof for obtaining new solutions. Finally a comparison between the results obtained by the proposed algorithm and the best known results in the literature for a sample of data sets for the capacitated vehicle routing problem, demonstrating the effectiveness of the algorithm to solve the problem until now. The combination of the three operators obtained the best results.

RAYS MATCHING IN GPU: A VIEW SPACE APPROACH.

Alejandro Piad-Morfis, Jean Le'Clerc Arrastia and Ludwig Leonard-Méndez
Universidad de La Habana, Cuba.

In this paper we present a technique, optimized for executing on graphic acceleration devices, which allows the efficient intersection between rays and geometric surfaces on GPU. This operation lies in the core of several global illumination algorithms, from the correct visualization of shadows to the calculation of Fresnel reflection and refraction. As an example, we also present an implementation of the ray tracing algorithm on GPU, using the intersection technique we describe, that allows the visualization of scenes of medium complexity in real time.

SIMULATION EXPERIMENTS WITH INNOVATION NETWORKS

Andreas Pyka
University oh Hohenheim, Germany.

The thoughtful use of a computational systems approach, in our case agent-based modelling (ABM), can be used to identify and understand the effects of innovation policy strategies and their associated knowledge dynamics. In contrast to conventional methods of social research, this method is capable of dealing with the high complexity and non-linearity of the processes under study. ABM users can address questions that involve different levels of the innovation ecosystem: from start-up firms (micro level) to academic-industry partnerships (meso level) to whole sectors or regions (macro level). ABMs can be informed by large empirical data sets. These factors motivated the model that we have developed and applied over the last decade. Simulating Knowledge Dynamics in Innovation Networks (SKIN) is a multi-agent AMB model used to understand innovation policy initiatives that contain heterogeneous agents that act and interact in a large-scale complex and changing social environment. This presentation is dedicated to elaborating on the SKIN model and the usefulness of its application for better understanding innovation policy initiatives.

ON A PARTIAL AUGMENTED LAGRANGEAN FOR MATHEMATICAL PROGRAMS WITH SECOND ORDER CONE COMPLEMENTARITY CONSTRAINTS

Ernest Quintana* and Gemayqzel Bouza**
*Central University of Las Villas, Cuba.
**University of La Habana, Cuba.

In this paper we study a solution method for Mathematical Programs with Second Order Cone Complementarity Constraints(SOCMPCC for short). The main difficulty of this class of problems lies on the fact that, due to the complementarity constraints, Robinson's constraint qualification, a generalization of MFCQ for problems with cone constraints, doesn't hold at any feasible point. We follow a partial augmented lagrangean approach in which the complementarity constraints are taken into account in the Lagrange function and the other constraints remain in the lower level. At each iteration a stationary point for a nonlinear second order cone program is found; then the multipliers and the penalty parameter are updated. We call the resulting algorithm SOCMPCC-PAL.

ANALYSIS OF PARAMETRIC FRAILTY MODELS TO ESTIMATE THE RISK OF AMPUTATION

Ivette Raices*, Hannelore Liero*** Vivian Sistachs**, and Liset Marínez*

*Center for Genetic Engineering and Biotechnology, Cuba.

** University of Havana, Cuba.

*** University of Potsdam, Germany.

With the goal of knowing what variables might influence in the occurrence time of amputation in medical practice we used multivariate parametric frailty models. Specifically we used two models where the baseline hazard function follows a Weibull distribution and the frailty term has a Gamma and inverse Gaussian distribution respectively. The data set contains observations of 69 patients with diabetic foot ulcers from a retrospective study. We used PARFM package from statistical software R 3.1.3. As result, we obtained in both models that Etiopatogenia variable has statistically significance in the occurrence of amputation.

MAXIMA OF TWO RANDOM WALKS : UNIVERSAL STATISTICS OF LEAD CHANGES

Julien Randon-Furling*, E. Ben-Naim* and Paul Krapivsky

*Université Paris-1 Panthéon-Sorbonne, France.

**Los Alamos National Laboratory, USA.

***Boston University, USA.

We investigate statistics of lead changes of the maxima of two random walks in one dimension. We show that the average number of lead changes grows as $(1/\pi)ln(t)$ in the long-time limit. We present theoretical and numerical evidence that this asymptotic behavior is universal. Specifically, this behavior is independent of the jump distribution: the same asymptotic underlies standard Brownian motion and symmetric Lvy flights. We also show that the probability to have at most n lead changes behaves as $t^(1/4)[lnt]^n$ for Brownian motion and as $t^(\beta(\mu))[lnt]^n$ for symmetric Lévy flights with index μ. The decay exponent $\beta(\mu)$ varies continuously with the Lvy index when $0 < \mu < 2$.

CMA-ES APPLIED TO THE SOLUTION OF MULTIDIMENSIONAL SCALING PROBLEM

Javier Alejandro Quintero Roba and Elina Miret Barroso

Universidad de La Habana, Cuba.

In Multivariate Analysis the Multidimensional Scaling (MDS) is used to obtain a visual representation of data for a better understanding of the relationship between the multivariate data collected by the researchers. A perfect representation is carried out when the loss function reaches a minimum. In several cases the classic solution of the MDS problem doesnt guaranteed a good and realistic representation, in that situation the loss of information is measured by STRESS function. Due to this difficulty the MDS problem is modeled as an optimization problem, in the space of representation of the data (search space) minimizing the loss function (STRESS). A solution employing CMA-ES (Covariance Matrix Adaptation Evolution Strategy) is used taking advantage of this algorithms design to manage the special characteristics of the objective function in the problem (its expensive evaluation, its continuous and large search space). This algorithm is used to solve some classic examples of literature and is applied to real health data with excellent results.

TECHNICAL EFFICIENCY IN INTERNATIONAL CENTER OF NEUROLOGICAL RESTORATION'S CLINICS

Iván Rodríguez Chile*, Anai García Fari nas**, and Gabino García Tapia***

*Centro Internacional de Restauración Neurológica, Cuba.

**Escuela Nacional de Salud Pública, Cuba.

*** Universidad Nacional Autónoma de México, Mexico.

To measure the technical efficiency of clinics of International Center of Neurological Restoration and to establish the potential improvement. Methods: Study descriptive observational. It was analyzed the pure and scale technical efficiency, based in Garcia and collaborator's algorithm based in data envelopment analysis. Four clinics was evaluated, among January and October 2012 and 2013. Results: The media of the efficiency of scale was 94,5 78,7 clinic was efficient during the all period, using CRT or VRS. The inefficient clinics have potential in all the inputs considered. They have to decrease in determined inputs and to increase in the selected output. Conclusions: The study provided evidence of critical factors of performance that can be used for the hospitable managers, for establishing programs of continuous improvements for each clinic. We endowed to the institution of an innovative tool. This is a pioneer job in the Cuban hospital level.

ON PROPER EFFICIENCY IN MULTIOBJECTIVE SEMI-INFINITE OPTIMIZATION

Jan-J. Rückmann* and F. Guerra**
**University of Bergen , Norway.
**Universidad de las Américas, Mexico.

We consider multiobjective semi-infinite optimization problems which are defined by finitely many objective functions and infinitely many inequality constraints in a finite-dimensional space. We discuss constraint qualifications as well as necessary and sufficient conditions for locally weakly efficient solutions. Furthermore, we generalize two concepts of properly efficient solutions to the semi-infinite setting and present corresponding optimality conditions.

SOME REMARKS ON OPTIMALITY CONDITIONS FOR FUZZY OPTIMIZATION PROBLEMS

A. Rufián-Lizana*,H. Román-Flores** and Y. Chalco-Cano**
*Universidad de Sevilla, Spain.
**Universidad de Tarapacá, Chile.

In this article we present a new concept of stationary point for gH-differentiable fuzzy functions which generalize previous concepts that exist in the literature. Also, we give a concept of generalized convexity for gH-differentiable fuzzy functions more useful than level-wise generalized convexity (generalized convexity of the endpoint functions). Then we give optimatily conditions for fuzzy optimization problems.

IDENTIFICATION OF BAYESIAN NETWORK WITH STRUCTURAL EQUATIONS

Joseph Rynkiewicz*, Wafa Karouche** and Mohamed Raouf Benmakrelouf**
*Université de Paris I, France.
**Université des Sciences et de la Technologie Houari Boumediene Bab Ezzouar Algiers, Algeria.

In France, the Front National has been a growing political party in the last 30 years. The most consistent findings in social research on ethnic attitudes is the negative association between educational attainment and ethnic prejudice: People with higher education are less prejudiced toward ethnic out groups than those with lower education. In a previous work a Bayesian network has been built to assess the influence of the level of education on the voting intention for the Le Pen candidate. It appears that the variable Opinion on globalization is a fundamental one. Indeed, according to the theory of Bayesian network, this variable satisfies the back door criterion, hence the causal effect of level of education on the vote intention is identifiable and can be computed with a control of possible confounding bias. However, the results from the package bnlearn used for the construction of the network are very unstable and can lead to very bad networks depending on the chosen algorithm. Hence our trust in the results of this package is weak. In this paper we propose an alternative method to construct the network. This method consists in working directly with the possible structural equation of the network and to choose the most parsimonious model according the principle of Occams window. We show that, with this method, we get a better network and that the variable Opinion on globalization satisfies still the back door criterion. This result reinforces our previous finding.

A HEURISTIC FOR THE SOLUTION OF VEHICLE ROUTING PROBLEMS WITH TIME WINDOWS AND MULTIPLE DUMPING SITES IN WASTE COLLECTION

Dirk Sackmann, Christoph Krieger, Richard Hinze and Ben Michael
University of Applied Sciences Merseburg, Germany.

Municipalities have to collect the waste of households at least once a week. Households place their generated waste, which are stored in either bins or bags, on the designated days in front of their properties where waste collection vehicles can then collect the waste. This process is highly repetitive and performed throughout the year, therefore even a small improvement in waste collection and vehicle routing can lead to significant savings. The waste collection vehicle routing problem with time windows (WCVRPTW) differs from the traditional VRPTW by that the waste collecting vehicles must empty their load at disposal sites. We present a solution to a real world WCVRPTW in a residential waste collection environment with 5.676 requestors. In our application private homes are grouped to street segments and are partitioned into disjoint clusters with known capacity afterwards. During clustering the items with shortest assigning paths from centroids are grouped together. The summation of grouped items should not exceed the capacity of cluster. All clusters have uniform capacity. In addition we suggest a heuristic that solves the routing problem. Each vehicle can, and typically does, make

multiple disposal trips per day. A constructive heuristic that is capable of solving the problem is developed and tested, created to improve waste collection in residential areas.

A CREDIBILITY APPROACH OF THE MAKEHAM MORTALITY LAW
Yahia Salhi

Université Lyon 1, France.
Interest from life insurers to assess their portfolios' mortality risk has considerably increased. The new regulation and norms, Solvency II, shed light on the need of life tables that best reflect the experience of insured portfolios in order to quantify reliably the underlying mortality risk. In this context and following the work of Buhlmann and Gisler (2005) and Hardy and Panjer (1998), we propose a credibility approach which consists on reviewing, as new observations arrive, the assumption on the mortality curve. Unlike the methodology considered in Hardy and Panjer (1998) that consists on updating the aggregate deaths we have chosen to add an age structure on these deaths. Formally, we use a Makeham graduation model. Such an adjustment allows to add a structure in the mortality pattern which is useful when portfolios are of limited size so as to ensure a good representation over the entire age bands considered. We investigate the divergences in the mortality forecasts generated by the classical credibility approaches of mortality including Hardy and Panjer (1998) and the Poisson-Gamma model on portfolios originating from various French insurance companies.

ON THE EFFECTS OF UNILATERAL ENVIRONMENTAL REGULATION ON OFFSHORING IN MULTI-STAGE PRODUCTION PROCESSES - A QUANTITATIVE ASSESSMENT
Oliver Schenker*, Simon Koesler* and Andreas Löschel**

*Centre for European Economic Research (ZEW), L7,1, Mannheim, Germany.

**Westfälische Wilhelms-Universität Münster, Germany.
We employ an analytical partial-equilibrium model and a calibrated multi-sector multi-region computable general equilibrium model of the world economy to analyse offshoring in multi-stage production processes. In the last decades supply chains emerged that stretch across many countries. Decreasing trade and communication costs have been identified as main drivers of this process. We extend the literature by analyzing if and how unilateral environmental regulation induces offshoring of parts of the supply chain to unregulated jurisdictions. We first apply an analytical partial-equilibrium model of a two-stage production process that can be distributed between two countries and investigate the effects of unilateral emission pricing and their supplementation with border taxes on imported embodied emissions. We find that unilateral reductions force emission-intensive producers to offshore a greater proportion of their supply chain to unregulated jurisdictions. Border taxes are successful in mitigating this. However, whereas medium-emission intensive upstream production can be protected successfully, downstream industries from regulated countries lose competitiveness on foreign markets due to increasing input costs. In order to get a more comprehensive picture, we subsequently turn our attention to a calibrated multi-sector multi-region computable general equilibrium model. Using input-output data and elasticities from the World Input Output Database to calibrate the model we find mixed effects of a unilateral twenty percent carbon emission reduction by the European Union on the degree of vertical specialization of European industries. These differences to the analytical model can be explained by additional heterogeneity in the pre-policy vertical specialization of European industries. If the reduction policy is complemented with border carbon taxes, vertical specialization decreases in particularly in carbon-intensive upstream sectors.

MODELING DENGUE OUTBREAK DATA USING NONLINEAR MIXED EFFECTS MODEL
Carlos Rafael Sebrango Rodríguez*, Lizet Sánchez Valdés** and Ziv Shkedy***

*Universidad de Sancti Spiritus, Cuba.

** Centro de Inmunología Molecular, Cuba.

***Center for Statistics, Hasselt University, Belgium.
In recent years there has been increased interest in using statistical models for analysis of single dengue outbreaks based on the reported cumulative cases. Sometimes this type of data is collected for all urban areas in a particular region and modeling in order to estimate epidemiological parameters is usually performed for each area separately, but when interest is in estimating the average behavior of a particular area in the population and variability among and within areas, a nonlinear mixed effects model is recommended. In this research, we describe two approaches that both provide estimates of three key epidemiological parameters: the turning point, the final size of outbreak, and the basic reproduction number R0, using nonlinear models. The first

approach consists of fitting an individual nonlinear model for each area separately. In the second method we use a nonlinear mixed effects model, which accounts for heterogeneity between areas. In both approaches, the Richards model was used as mean structure. The proposed methods are applied to data of seven Primary-Health Care Areas of Plaza municipality, Havana City, Cuba during 2006 dengue outbreak.

DYNAMIC TRANSMISSION OF CUTANEOUS LEISHMANIASIS

Schehrazad Selmane
University of Science and Technology Houari Boumediene, Algerie.

We present a multi-host deterministic model for the transmission dynamics of cutaneous leishmaniasis (CL). The model includes three hosts, namely, an incidental host for human, a primary reservoir host for rodent, and a secondary reservoir host for sand fly. In addition to involved hosts in the dynamic transmission of the disease, we incorporated into the model the deaths due to use of insecticides and rodenticides as control measures. The conditions for the stability of the model are determined. The model has two equilibria; one disease free equilibrium and one endemic equilibrium. The basic reproduction, computed using the next generation operator, do not explicitly include parameters relating to the dynamic transmission in the incidental hosts and is influenceable by the control values consisting of the use of insecticides and rodenticides. The local and global stability of equilibria are established and the threshold conditions for disease persistence are completely determined by the reproduction number. We conclude that the disease becomes endemic if it persists endemically in the primary reservoir hosts. Therefore the control measures should be directed towards both primary and secondary reservoir hosts. The control measures are simulated using human CL data from Biskra province in Algeria, and their consequences are analyzed, furthermore, a brief discussion of theoretical and numerical results is derived.

LEVERAGING HERD BEHAVIOR IN FOREIGN EXCHANGE MARKETS

Arnav Sheth*, Keisuke Teeple** and Adam Duncan***
Saint Mary's College of California, USA.
CEB Procurement Leadership Council, USA.
***Cambridge Associate, USA.

We examine market micro-structure in foreign exchange markets at, and around, the WM/Reuters benchmark exchange rate known as the the 'Fix'. Execution at the Fix is a service offered by brokers (normally banks), who deliver execution at the fix provided they obtain the trade order until a certain time prior to 4pm. This benchmark is used to value derivative contracts, measure portfolio tracking error for foreign benchmark equity indexes, and provide a reference exchange rate for purchasing foreign stocks. Based on the importance of the Fix in trading both equities and foreign exchange, we hypothesize that portfolio managers act in herds and perform most of their trading around the Fix together. Based on this hypothesis, we examine the behavior of exchange rates around the Fix. We further hypothesize that this herd behavior can be exploited to create a trading strategy that will provide positive returns. Additionally, we find that end-of-month behavior of exchange rates is markedly different from the rest of the year, and we find that market rates match up well with the Fix. We further find that we can indeed exploit this herd behavior to provide us with a small, positive profit. We also provide steps for further research.

SIMULATION OF EXTREME EVENTS AND THEIR EFFECTS

Michael Bayard Smith* and Masoud Zadeh**
*FCAS, MAAA. Independent Consulting Actuary, USA.
**P.E Risk and Reliability Engineering, USA.

Extreme events can cause socioeconomic losses, including loss of life, injuries, damage to properties, and financial and economical losses not only at the time of occurrence, but their effects can also extend into the future. Catastrophe models measure the effect on property and sometimes the effect on individuals and families. There can also be resulting effects on infrastructure and government. The authors summarize the background of models that measure catastrophes and explore how various stakeholders use model outputs and other information sources to mange the effects of catastrophes at the micro and the macro levels. In many countries policies and practices have evolved over time and are still in a state of flux.

A DISCOUNTING-RISK PARADOX WITH QUADRATIC FELICITY

Matthew Sobel

Case Western Reserve University, USA.

In research and applications we often represent the preferences of someone facing alternative time streams of risky outcomes. What representation should we use? This talk identifies a paradox in the representation that is used (and criticized) throughout economics and operations research. A preference structure is a binary relation on a set of stochastic processes. The dominant representation uses a felicity function ϕ and a sequence of discount factors: the decision maker is represented as preferring process X to process Y if the weighted average of the felicities of the X components is greater than that of the Y's. The weights are discount factors, the average is mathematical expected value, and the felicity function is an intra-period utility function. The paradox does not depend on particular parametric forms, but the talk focuses on quadratic felicity functions. Axioms for preferences to be consistent with a representation are sufficient but not quite necessary conditions. The weakest set of axioms has this implication: if W is a random variable with $E[\phi(W)] \geq 0$, then $E[\phi(W+Z)] \geq E[\phi(Z)]$ for all random variables Z that are independent of W. This talk shows that a quadratic ϕ violates this axiom unless the quadratic coefficient is 0; only linear felicity functions satisfy the axiom on which discounting rests. The paradox is that nonlinear felicity functions model risk sensitivity, but only linear functions behave well and admit discounting although they are insensitive to risk. The talk ends with research directions to resolve the paradox.

OR EDUCATION IN THE AGE OF ANALYTICS

Ariela Sofer

George Mason University, USA.

With the explosion of data in the past few years, many universities have raced to establish new graduate programs in data analytics, or big data. Such programs are often interdisciplinary, drawing from disparate faculty from statistics, computer science, business, and of course, operations research. At the same time traditional masters programs in operations research have not (for the most part) rushed to revise their core curriculum (That is the body of knowledge that every graduate should have) in response to the rapid growth in data. It is our contention that every OR graduate going into the workplace today must have a broad comprehension of how large quantities of data can be acquired, transformed to information, and then in turn to informed decisions. How can we change the OR core to accommodate this need while still maintaining an OR-centric curriculum? This presentation will examine the challenges and offer some possible approaches.

HUMAN RESOURCES MANAGEMENT MODEL BASED ON THE FUZZY SUBSETS THEORY

Lourdes Souto Anido*, Irene García Rondón*, and Ana Maria Gil LaFuente**

*University of Havana, Cuba.

**University of Barcelona, Spain.

The human resources are strategic resources for every single modern organization, since it figures out to be a source of competitive benefits, given its capacity to be carriers and generators of knowledge. Then it is vital that companies implement a model of human resource management that allows maximum use and potential of their capabilities, where the optimal use of these resources can make a difference in the way to success of management. The theory of fuzzy subsets stands as a solution for decision making as regards a most accurate and objective area of human resources. The novelty of the research lies in the integration of tools of the theory of fuzzy subsets in the key processes of Human Resources Management in effort to manage under scientifically argued assumptions. Among the main contributions are: the application of the method of fuzzy exponential smoothing to planning staff, the extrapolation of an allocation model solved through the Hungarian algorithm to staff training, and building a system of fuzzy indicators for the evaluation of the Human Resource Management. The investigation was validated from expert judgment and partial applications in selected enterprises.

COMPRESSION-BASED EVALUATION OF A META-PATTERN IN TERMS OF A BELIEF AND A DATA ENSEMBLE

Einoshin Suzuki

Kyushu University, Japan.

With the objective of further automating a data mining process, we have proposed a framework for finding meta-patterns, each of which represents a pattern of patterns, from a data ensemble, which consists of several data sets. However, a theoretical evaluation measure for preferring a meta-pattern over another one was missing, which was an obstacle for a data miner when the number of meta-patterns is huge because he/she had to inspect the discovered meta-patterns without any sound guidance. In this paper, we propose such a measure which can even incorporate a user belief in the evaluation. Our measure can be considered as a natural extension of Smyths J-measure, which essentially represents the amount of information compressed by a rule in a data set. The extension consists of considering the absolute amount of compression at the target data in the data ensemble as well as incorporation of the coding lengths of the relevant events specified by the belief. Our measure has a theoretical basis and satisfies three important characteristics: generality, accuracy, and preciousness. We also provide an efficient and exhaustive discovery algorithm based on our newly-derived upper-bound of our interestingness measure. Experiments on benchmark, real data prove that our proposals are highly promising in terms of both the relevant statistics of the discovered meta-patterns and the run time for discovering them.

OPTIMAL LANGUAGE POLICY FOR THE PRESERVATION OF A MINORITY LANGUAGE

Torsten Templin, Andrea Seidl, Bengt-Arne Wickström and Gustav Feichtinger

Andrassy-University of Budapest, Hungary.

We develop a dynamic language-competition model with dynamic state intervention. Parents choose the language(s) to raise their children in based on the communicational value of each language as well as on their emotional attachment to the languages at hand. Languages are thus conceptualized as tools for communication as well as carriers of cultural identity. The model includes a high and a low status language, and children can be brought up as monolinguals or bilinguals. Through investment into language policies, the status of the minority language can be increased. The aim of the intervention is to obtain the minority language in a bilingual subpopulation at low costs. We investigate the dynamic structure of the optimally controlled system

USING METHODS FOR RANKING FUZZY NUMBERS IN THE TTRP WITH FUZZY DEMANDS AND CAPACITIES

Isis Torres* and Alejandro Rosete* y José Luis Verdegay** Carlos Cruz**

*Instituto Superior Politécnico José Antonio Echeverría, Cuba.

**Universidad de Granada, Spain.

Fuzzy Optimization models and methods has been one of the most and well-studied topics inside the broad area of Soft Computing. Particularly relevant is the field of Fuzzy Linear Programming (FLP) that constitutes the basis for solving fuzzy optimization problems. FLP models are classified according to the way the fuzziness is introduced. In the last past years several kinds of FLP models have appeared in the literature being, most probably, the main that FLP models in which coefficients of the constraints and right hand side values are defined as fuzzy numbers. The case of Truck and Trailer Routing Problem (TTRP) with this kind of uncertainty in the coefficients is considered in this paper.

OPTIMIZATION OF AVERAGE SAMPLE NUMBER IN A UNILATERAL SEQUENTIAL DESIGN COMPATIBLE WITH THE ASSUMPTION OF NORMALITY

Rolando Uranga*, Sira Allende**, and Geert Molenberghs***

*Centro Nacional Coordinador de Ensayos Clínicos, Cuba.

Universidad de La Habana, Cuba.

University of Hasselt, Belgium.

Sample size estimation is an aspect of particular interest in the design of applied studies (Chiuzan et al., 2015, Brown, 2015). Specifically, in the planning stage of a clinical trial, a specific section of the research protocol is intended the justification of the sample size of individuals to study. Optimization of sample size in an applied study is usually operationalized through a statistical tool known as hypothesis testing. A particular case of

hypothesis testing is called Sequential Design. The essence lies in making information processing more than once over time, allowing to stop the study early if a definite effect of the product is detected, or a definite absence of effect. None of the designs proposed in the literature contains a description, accurately justified, about the behavior of Average Sample Number (ASN), when varying one or other parameter. Only results from numerical simulation studies are presented (see Pocock, 1982; Jennison and Thurnbull, 2000). The lack of this characterization prevents any response to the following problem: What is the optimal sequential design, which keeps ASN bounded under certain reference value? This paper describes, in terms of monotony, ASN behavior in a normal three-stage sequential design with unilateral criterion for early stopping by futility. The approach is undertook via simulation, and conjectures about regularities identified are posed.

USE OF MULTICRITERIAL TOOLS TO DETECT THE CAUSES OF FAILURE OF SELF-EMPLOYED BUSINESS IN CUBA.

Idalianys Urquiola Garcia
Instituto Superior Politécnico José Antonio Echeverría, Cuba.

The Self-Employment plays a decisive role in the expansion of the economy and satiety of unmet needs in the population. Currently, the single activity in Cuba can be exercised in 201 occupations. They satisfy domestic demand not covered by state enterprises, provides a non-negligible contribution to gross domestic product, occupies more than a quarter of the workforce in some sectors such as agriculture, it ensures most of it, making important positions in services such as construction, food and tourist accommodation. However, despite the tendency to relax this sector, the number of officially registered workers has been declining presenting a total of 571,239 casualties to date. This decline appears to be explained by the effect of various factors such as insufficient demand for the good or service provided, difficulty in obtaining raw materials, greater control, high taxation, end customer dissatisfaction, among others, joined the ignorance They hold managers and staff responsible for business converge to failure. The purpose of this study is to identify the causes that affect the closure of these small businesses. To achieve it, the study is based on the use of multicriterial tools as they are a support in the decision-making allowing to integrate different criteria according to the opinion of actors in one analytical framework for a comprehensive vision.

ESTUDIO DE LA CAPACITACIÓN DEL DOCENTE DE LA UNIVERSIDAD TÉCNICA DE ÁMBATO EN EL USO DE MULTIMEDIA EDUCATIVAS MEDIANTE EL ANÁLISIS DE COMPONENTES PRINCIPALES PARA DATOS CATEGÓRICOS.

Luis Efraín Velastegui and Maribel Paredes Cabezas y Yasser Vázquez Alfonso
Universidad Agraria de la Habana, Cuba.

This work was developed at the Technical University of Ambato in Ecuador and aimed to apply multivariate methods for the study of teacher training in the use of educational multimedia. A survey of teachers and principals of race interview was designed. The survey was conducted to 363 teachers, with the purpose of conducting a study on the improvement in the use of educational multimedia and self-assessment of their performance in the use of them, and was self-administered by the 20 race directors. Application of Principal Component Analysis for Categorical Data (CATPCA) could verify the variables that had more weight on the criteria of those surveyed teachers and principals interviewed career, they are: the area of knowledge (AC), the type of how to receive technical information (TFRIT), teaching experience (ED), type of materials processed (TME), the knowledge of teachers to use the computer as a working tool (CPUC), the knowledge of teachers to design environments Learning to consider the use of multimedia technologies (CPDEAM), the ability of teachers to make designs undergraduate and graduate interactive multimedia assisted in different ways (CRCM) and knowledge of teachers to use the computer as a tool work (CPUC).

A FRAMEWORK FOR ASSESSING STUDENTS PROBLEM SOLVING BEHAVIORS DURING CAPSTONE DESIGN COURSES

Ana R. Vila-Parrish
North Carolina State University, USA

Transitioning Industrial Engineering students from the classroom to the workplace is typically a four- to five year process involving proven proficiency in a combination of science, mathematics, humanities, and engineering

courses. There is no course as translatable to the workplace experience as the senior capstone design course. At North Carolina State Universitys Edward P. Fitts Department of Industrial & Systems Engineering all students undertake a senior design project which is industry sponsored. These projects can be described as large and unstructured and the students apply many of their analytics tools to develop recommendations for their clients. This study will focus on assessment of the problem solving process throughout the engineering design cycle as observed in industry sponsored senior capstone projects in several engineering disciplines. We will present a framework for utilizing Wolcotts Steps for Better Thinking rubric to assess student problem solving throughout their capstone design project. Wolcotts Steps for Better Thinking framework provides a spectrum of problem solving behaviors students might display during generic problem solving phases. By applying this framework we can develop a profile of individual students as well as group problem solving behaviors that exemplifies the iterative nature of problem solving. Such profiles will enable an instructor to use results for timely intervention and support of students as they engage in their technical project life cycle.

STATISTICAL MODEL FOR FOREIGN TRADE II

Michal Vrabec and Lubos Marek
University of Economics Prague, Czech Republic.

In our article we try to contribute to the discussion of the possibility to predict the trend of the wage distribution in the Czech Republic. Classical models use the probability distribution such as lognormal, Pareto, etc., but their results are not very good. We suggest using a mixture of normal probability distribution (normal mixture) in our model. We focus mainly on the possibility of constructing a mixture of normal distributions based on parameter estimation. We estimate these parameters on the basis of their evolution in time. We work with data collected in the last 15 years. The data is divided into groups with respect to gender, age, and regions.

DYNAMIC INFORMATION ACQUISITION

Thomas A. Weber* and Viet Anh Nguye**
*Ecole Polytechnique Fédérale de Lausanne.

We consider optimal information acquisition for the control of linear discrete-time random systems with noisy observations and apply the findings to the problem of dynamically implementing emissions-reduction targets. The optimal policy, which is provided in closed form, depends on a single composite parameter which determines the criticality of the system. For subcritical systems, it is optimal to perform noise leveling, that is, to reduce the variance of the uncertainty to an optimal level and keep it constant by a steady feed of information updates. For critical systems, the optimal policy is noise attenuation, that is, to substantially decrease the variance once and never acquire information thereafter. Finally for supercritical systems, information acquisition is never in the best interest of the decision maker. In each case, an explicit expression of the value function is obtained. The criticality of the system, and therefore the trade off between spending resources on the control or on information to improve the control, is influenced by a policy parameter which determines the importance a decision maker places on uncertainty reduction. The dependence of the system performance on the policy parameter is illustrated using a practical climate-control problem where a regulator imposes state-contingent taxes to probabilistically attain emissions targets.

OPTIMIZATION OF AN ORTHOGONAL CUTTING PROCESS BY COMBINING FUZZY LOGIC AND GENETIC ALGORITHMS

Dirma Yanes, Ramón Quiza, Mercedes Pérez and Marcelino Rivas
University of Matanzas, Cuba.

The work presents the multiobjetive optimization of an orthogonal cutting process, where two mutually conflicting objectives are considered: unit cutting time and tool wear rate. The relationship between the tool wear rate and the decision variables (cutting parameters and tool geometry) is modeled by using a Sugeno-type fuzzy inference system, fitted from finite element-based simulations. Optimization is carried out by using a multi-objective genetic algorithm, through an a posteriori approach, where the non-dominated solutions set is firstly obtained and, then, the most convenient solutions is chosen depending on the specific workshop conditions.

INCENTIVES IN CHRONIC DISEASE MANAGEMENT: A GAME THEORETIC ANALYSIS

Hui Zhang and Christian Wernz

Virginia Tech, USA.

The prevalence and costly effects of chronic disease can often be prevented, delayed or mitigated by designing proper incentives for individual decision makers including physician and patient. In this research we develop a two-level, multi-period decision making framework where patients and physicians jointly decide the engagement activities in and the delivery of chronic disease management, under the influence of the incentive system. The physician-patient interactions are modeled as a general-sum stochastic game with perfect information and switching control structure. Using a nonlinear program, we compute Nash equilibria or optimal strategies for both players. The Health Belief Model (HBM) is incorporated as our theoretical basis to capture the behavioral aspect of the decision processes. We illustrate our modeling approach by applying it to a case study, the coronary heart disease (CHD) management. We focus the analysis on physicians effort level during clinical encounters and patients choices of lifestyle and primary care visit. We find that the two players decisions are mutually interdependent, and that a re-alignment of incentives, including payment, reimbursement, and action cost, can improve the effectiveness of chronic disease management.

CLUSTERING OF DYNAMIC NETWORKS THROUGH SUBGRAPHS : A STUDY OF THE ENRON SCANDAL

Rawya Zreik

SAMM, Université Paris I, France.

In recent years, many clustering methods have been proposed to extract information from networks. The principle is to look for groups of vertices with homogenizes connection profiles. Most of these techniques are suitable for static networks, that is to say, not taking into account the temporal dimension. This work is motivated by the need of analyzing evolving networks where a decomposition of the networks into subgraphs is given. Therefore, in this paper, we consider the random subgraph model (RSM) which was proposed recently to model networks through latent clusters built within known partitions. Using a state space model to characterize the cluster proportions, RSM is then extended in order to deal with dynamic networks. We call the latter the dynamic random subgraph model (dRSM). A variational expectation maximization (VEM)algorithm is proposed to perform inference. We show that the variational approximations lead to an update step which involves a new state space model from which the parameters along with the hidden states can be estimated using the standard Kalman filter and Rauch-Tung-Striebel (RTS) smoother. Simulated data sets are considered to assess the proposed methodology. Finally, dRSM along with the corresponding VEM algorithm are applied to an original maritime network built from printed Lloyds Voyage Records.

LIST OF PARTICIPANTS

Agüero Zardón, Liset (Cuba): Design and application of a procedure for diagnosis of data quality, 21.

Ahlheim, Michael (Germany): Consumers' willingness to pay for lower pesticide content m food - a contingent valuation study in Northern Thailand, 21.

Allende, Sira M. (Cuba): An improved Grasp strategy applied to vehicle routing problem with simultaneous deliveries and pick-up service, 32.

Allende, Sira M. (Cuba): Hybrid strategy for quadratic programming problem with box constraints, 41.

Allende, Sira M. (Cuba): Optimization of average sample number in a unilateral sequential design compatible with the assumption of normality, 50.

Allende, Sira M. (Cuba): Prediction of the quality of fresh water in a basin, 22.

Allouch, N. (UK): Policy reform in networks, 22.

Almeida, Yudivián (Cuba): Using POS-tagging for dimensionality reduction in opinion mining in Twitter, 31.

Almeida, Yudivián (Cuba): Multi-classification strategies for the problem of opinion mining in Twitter, 31.

Arcniegas, Jessie RAND Corporation, (USA).

Bacallao, Jorge (Cuba): Missing values in generalized linear models, 22.

Bae, Tae-Sung (Korea): On various Kriging predictors for Geoid densification: a comparison, 22.

Baguer, Martha L. (Cuba): Specularity removal in colposcopic images, 23.

Bailon, Jean Bernard (France): Asymptotic behavior of composition of underreleased non expansive operator, 23.

Bello, Rafael (Cuba): A method based on genetic algoritms for the generation of rankings in the team selection by two decision-makers, 23.

Bello, Rafael (Cuba): Construction of similarity relations based on the quality of the similarity, 32.

Berka, P. (Czech Republic): Using exploration trees in the loan applications domain, 23.

Bierwirth, Christian (Germany): A Grasp heuristic for the JSP-TWT, 24.

Boushaba, Mahmoud (Algeria): New method to evaluate joint reliability importance of a consecutive-system for non-homogeneous Markov-dependent components, 24.

Bouveyron, Charles (France): Model-based clustering of functional data: application to the analysis of bike sharing systems, 8.

Bouza, Gemayqzel (Cuba): On the stability of the set of feasible solutions for the auxiliary problems of the adaptive method for non-smooth multiobjective optimization problems, 25.

Bouza, Carlos (Cuba): Prediction of the quality of fresh water in a basin, 22.

Bouza, Carlos (Cuba): Subsampling rules for item non response of an estimator based on the combination of regression and ratio, 25.

Bouza, Gemayqzel (Cuba): Hybrid strategy for quadratic programming problem with box constraints, 41.

Bouza, Gemayqzel (Cuba): On a partial augmented Lagrangean for mathematical programs with second order cone complementarity constraints, 44.

Bracho, René, Universidad de Panamá, (Panama)

Brito, Julio (Spain): Modelling Tourist route planning with fuzzy preferences and constraints, 25.

Caamal Cauich, Ignacio (Mexico): Econometric models and relationships between economic variables in the production of coffee in Mexico, 25.

Caamal Cauich, Ignacio (Mexico): Growth rate and behavior of economic variables in the production of coffee in Mexico, 26.

Caamal Cauich, Ignacio (Mexico): Analysis of the inequality in Mexico, 34.

Chang, Dayron (Cuba): Total variation method for the differentiation of noisy data, 27.

Changpetch, Pannapa (USA): Alcohol consumption in Thailand: a study of the associations between alcohol, tobacco, gambling, socioeconomic status, and demographic factors, 27.

Cochran, James J. (USA): The importance of collective science, 8.

Cornet, Bernard (USA): Choquet representability of submodular functions, 27.

Corujo, Josué M. (Cuba): Mean time comparisons of repairable systems with absolute priorities, 28.

Cruz Corona, Carlos (Spain): Measuring effectiveness in dynamic environments, 43.

Cruz Corona, Carlos (Spain): Decision models and Optimization, 28.

Cruz Corona, Carlos (Spain): Using methods for ranking fuzzy numbers in the TTRP with fuzzy demands and capacities, 50.

Daduna, Joachim (Germany): Delivery concepts in online retrial trade groceries, 28.

Díaz, Miguel A. (Cuba): Análisis de correspondencia: una aplicación al comportamiento clínico del SGB, 28.

Dietz, Hans M. (Germany): Teaching mathematics for economists: a metacognitive approach, 29.

Dong-Guen, Kim (Korea): The correlation between three major criteria of preliminary feasibility study, 29.

Doukhan, Paul (France): A new vision of extreme values theory under dependence, 8.

El Karoui, Nicole (France): Fast change of time detection on proportional two populations hazard rates, 30.

El Methni, Jonathan (France): Extreme versions of Wang risk measures and their estimation for heavy-tailed distribution, 30.

Estévez, Suilán (Cuba): Multi-classification strategies for the problem of opinion mining in Twitter, 31.

Estévez, Suilán (Cuba): Using POS-tagging for dimensionality reduction in opinion mining in Twitter, 31.

Estrada, Jorge (Cuba): Analysis of the stability of the one-parametric linear perturbation of the Lorenz system, 31.

Eyraud-Loisel, Anne, Université Lyon 1, (France).

Fajardo, Jenny (Cuba): Software tool for model and solve the maximum coverage location problem, 31.

Fernández, Alina (Cuba): An improved Grasp strategy applied to vehicle routing problem with simultaneous deliveries and pick-up service, 32.

Fernández, Eduardo (Mexico): Analysis of the effectiveness of the Theseus multi-criteria sorting method, 32.

Fiala, Petr (Czech Republic): Design of multi-objective supply networks, 32.

Figueroa-García, Juan Carlos (Colombia): A note on the fuzzy extension principle for LP problems with fuzzy coefficient matrix, 33.

Fonseca Reyna, Yunior César (Cuba): Adapting a reinforcement learning approach for the flow shop environment with sequence-dependent setup time, 33.

Frias, Mabel (Cuba): Construction of similarity relations based on the quality of the similarity, 32.

Fujita Yashima, Hisao (Algeria): Invariant measure for the stochastic equation of one-dimensional motion of barotropic viscous gas, 33.

Fujita Yashima, Hisao (Algeria): On the existence of a periodic solution for a stochastic equation with interruption intervals, 37.

García Fariñas, Anai (Cuba): Technical efficiency in international center of neurological restoration's clinics, 45.

García Rodríguez, José Félix (Mexico): Analysis of the inequality in Mexico, 34.

Gfrerer, Helmut (Algeria): Lipschitzian properties of implicitly given multifunctions, 34.

Gil Lafuente, Ana María (Spain): Human resources management model based on the fuzzy subsets theory, 49.

Grossman, Thomas (USA): Spreadsheet optimization with excel solver, for beginners and experts alike, 34.

Grötschel, Martin (Germany): Digital Humanities and Operations Research, 9.

Günter, Christian (Germany): Relationships between constrained and unconstrained multi-objective optimization and application in location theory, 34.

Haughtons, Dominique (USA): Alcohol consumption in Thailand: a study of the associations between alcohol, tobacco, gambling, socioeconomic status, and demographic factors, 27.

Haughtons, Dominique (USA): Is the corporate elite disintegrating? Interlock boards and the Mizruchi hypothesis, 40.

Haughtons, Dominique (USA): Music analytics: another view of feature starting tools and preliminary results a kick started on rock music projects, 26.

Haughtons, Jonathan (USA): discrimination against migrants in urban Vietnam, 35.

Hillmann, Markus (Germany): Necessary optimality conditions for some non-convex facility location problems, 35.

Notes

Notes

Notes

Notes

Notes

Notes

Notes