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"HENRI COANDĂ"
BRAȘOV
Departamentul
de Științe Fundamentale
și Management



UNIVERSITATEA
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ACADEMIA
ROMÂNĂ
Institutul de Statistică
Matematică și
Matematică Aplicată
„Gheorghe Mihoc–
Caius Iacob”

A 20-a CONFERINȚĂ A SOCIETĂȚII DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

Academia Forțelor Aeriene „Henri Coandă” Brașov

Departamentul de Științe Fundamentale și Management

28-29 aprilie 2017

Președinte: Acad. Marius Iosifescu

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PROGRAMUL CONFERINȚEI SPSR 2017

Vineri 28 aprilie

Academia Forțelor Aeriene “Henri Coandă” Brașov

Str. Mihai Viteazul, nr. 160, cod 500183

Secțiuni:

1. Probabilități și Procese Stochastice
2. Statistică
3. Optimizări
4. Actuarial și Matematici Financiare
5. Matematici Aplicate și Modelare în Domeniul Militar
6. Fiabilitate, Analiza Supraviețuirii și Teoria Riscului
7. Entropii, Divergențe și Selecția modelului
8. Modele pentru Analiza Datelor Funcționale

8:30 – 9:30 *Primirea participanților și înregistrare (Aula)*

9:30 – 10:00 *Deschiderea Conferinței (Aula)*

10:00 – 10:30 *Concert cvartet, Opera Brașov (Aula)*

10:30 – 10:45 *Fotografie de grup*

10:45 – 11:00 *Adunare generală a SPSR (Sala Senatului, E5)*

11:00 – 11:30 *Pauză de cafea (E10)*

11:30 – 13:30 *Comunicări pe secțiuni (săli E32, E72, E73, E77, E78)*

13:30 – 15:00 *Masa de prânz (popota academiei)*

15:00 – 16:30 *Comunicări pe secțiuni (săli E32, E72, E73, E77, E78)*

16:30 – 17:00 *Pauză de cafea*

18:30 – 24:00 *Cină festivă (Restaurant Cerbul carpatin)*

Sâmbătă 29 aprilie

Excursie la Castelul Bran

COMUNICĂRI PE SECȚIUNI

**Secțiunea Fiabilitate, Analiza Supraviețuirii și Teoria Riscului
(Sala E72)**

Chair: Alex Karagrigoriou, Vlad Ștefan Barbu

11:30 – 11:45

Vlad Ștefan Barbu, Alex Karagrigoriou, Andreas Makrides

(University of Rouen, France; University of the Aegean, Samos, Greece;
University of Cyprus)

*Statistical inference for a general class of distributions
with time-varying parameters*

11:45 – 12:00

Georgios-Jason Siouris (University of the Aegean)

Estimation and backtesting of expected shortfall

12:00 – 12:15

Ionuț Bebu (The George Washington University)

Probabilistic Measures of Cost-Effectiveness for Decision Models

12:15 – 12:30

Irina Băncescu

(Doctoral School of Mathematics, University of Bucharest)

New generalized Weibull statistical models and coherent systems

12:30 – 12:45

Vasile Preda, Maria Miroiu
(University of Bucharest; University of Pitești)

Generalized TL-moments for a Generalized Power Law Distribution

12:45 – 13:00

Manuela-Simona Cojocea (University of Bucharest)

Despre clasa t -exponențială și aplicații la modele grafice

13:00 – 13:15

Bogdan Corneliu Biolan (University of Bucharest)

About the Hodrick-Prescott Filter. A short survey

13:15 – 13:30

Vlad Ștefan Barbu, Alex Karagrorgoriou, Andreas Makrides (University of Rouen, France; University of the Aegean, Samos, Greece; University of Cyprus)

Semi-Markov processes for multi-state systems: modelling, estimation and reliability/survival analysis

Secțiunea Statistică (Sala E32)

Chair: Eugen Păltănea

11:30 – 11:45

Ion Văduva (University of Bucharest)

On a particular lifetime distribution

11:45 – 12:00

Bogdan Gh. Munteanu (Academia Forțelor Aeriene Henri Coandă, Brașov)

Qualitative aspects of the Min Pareto Binomial distributions

12:00 – 12:15

Voicu Boscaiu („Gheorghe Mihoc – Caius Iacob” Institute of Mathematical Statistics and Applied Mathematics, Bucharest)

Comparison of Romanian historical regions based on the frequency of HLA alleles

12:15 – 12:30

Manuela Ghica, Nicoleta Dimcevici Poesina, Irina Prasacu (University of Medicine and Pharmacy „Carol Davila”, Bucharest)

Exponentiated power quasi Lindley distribution/ Submodels, properties, stochastic ordering, statistical inference

12:30 – 12:45

Gabriela-Roxana Dobre, Radu Gogu, Dragoș-Ștefan Gaitanari (Technical University of Civil Engineering Bucharest)

Hydrogeological Parameters Estimation

12:45 – 13:00

Patricia Giurgescu (ISJ Brașov)

On empirical data depth

13:00 – 13:15

Sandra Teodorescu (Universitatea Nicolae Titulescu, București)

A statistical analysis of the relationship between economy and education in Romania vs. European Union

13:15 – 13:30

Anamaria Popescu (Universitatea din Petroșani)

The analysis of the correlation between the consumer price indices by multiple regression

Secțiunea Modele pentru Analiza Datelor Funcționale (Sala E73)

Chair: Julien Jacques, Cristian Preda

11:30 – 11:45

Julien Jacques (Université de Lyon)

Co-clustering for functional data

11:45 – 12:00

Vincent Vandewalle (University of Lille & INRIA)

Clustering categorical functional data. Application to medical discharge letters

12:00 – 12:15

Cristian Preda

(University of Lille/ ISMMA „Gheorghe Mihoc – Caius Iacob”)

Clustering functional data

12:15 – 12:30

Alexandru Amărioarei (University of Bucharest)

Approximations for the distribution of the three dimensional scan statistics

12:30 – 12:45

Sophie Dabo (University of Lille)

Predictive spatio-temporal model for spatially sparse global solar radiation data

Secțiunea Probabilități și Procese Stocastice (Sala E77)

Chair: Acad. Ioan Cuculescu

11:30 – 11:45

Alexandru Lazari (Universitatea de Stat din Moldova)

Stochastic games with real transition costs and final sequence of states

11:45 – 12:00

Anna Soos (Universitatea Babes Bolyai)

Stochastic approximations with spline functions

12:00 – 12:15

Mioara Buiculescu (ISMMA)

On excessive and subvariant measures for regular step processes

12:15 – 12:30

Valentin Ionescu (Academia Română)

Nou tip de bimodal Fock și teoreme limită centrală universală pentru variabile aleatoare cuantice cu valori operatori

12:30 – 12:45

Vasile Stănculescu, Oana Lupașcu (IMAR; University of Pitești)

Numerical Solution for the Non-linear Dirichlet Problem of a Branching Process

12:45 – 13:00

Constantin Lădescu (Universitatea Transilvania din Brașov)

Funcții aleatoare aproape periodice în medie de ordinul al doilea

13:00 – 13:15

Bogdan Cioruță (Centrul Universitar Nord, Baia Mare)

Implicații ale teoriei proceselor aleatoare în studiul sistemelor dinamice

13:15 – 13:30

Roxana-Elena Tudoroiu (Universitatea din Petroșani)

Stochastic optimal control of ph neutralization process in a water treatment plant

**Secțiunea Matematici Aplicate și Modelare în Domeniul Militar
(Sala E78)**

Chair: Maria Tudor, Traian Anastasiei

11:30 – 11:45

Traian Anastasiei (Academia Forțelor Aeriene Henri Coandă, Brașov)

Aspecte matematice ale fundamentării deciziilor în acțiunea militară

11:45 – 12:00

Carolina Opinca (Universitatea de Stat din Moldova)

Opportunities on parallel computing for decision support

12:00 – 12:15

Iuliana Iatan (Technical University of Civil Engineering Bucharest)

Dealing the nonlinearity associated with the data using Artificial Neural Networks

12:15 – 12:30

Silviu-Laurențiu Vasile (ISMMA Bucharest)

Join operations in NOSQL databases

12:30 – 12:45

Nicoleta Enache-David, Livia Sangeorzan (Universitatea Transilvania din Brașov)

Data analysis – between theory and practice

12:45 – 13:00

Carmen Adriana Gheorghe, Sorin Avram, Corina Cipu (National Institute of Economic Research, Romanian Academy; Politehnica University of Bucharest)

Statistical approach to modeling income inequality for territorial units

13:00 – 13:15

Luiza Bădin, Anca-Teodora Șerban-Oprescu (Bucharest University of Economic Studies)

Nonparametric efficiency analysis to evaluate and explain performance in scientific research

13:15 – 13:30

Andrei Anghel, Cristiana Tudor, Maria Tudor (Bucharest University of Economic Studies)

Portfolio Diversification and financial crisis: A principal components analysis (PCA) approach on Eastern European equity markets

Secțiunea Entropii, Divergențe și Selecția Modelului (Sala E72)

Chair: Vlad Ștefan Barbu, Alex Karagrigoriou

15:00 – 15:15

Aida Toma (Bucharest University of Economic Studies and ISMMA “Gheorghe Mihoc – Caius Iacob”, Bucharest)

Robust inference for models satisfying linear constraints using a generalization of the optimal Bs-robust estimator

15:15 – 15:30

Vlad Ștefan Barbu, Alex Karagrigoriou, Vasile Preda (University of Rouen, France; University of the Aegean, Samos, Greece; University of Bucharest and ISMMA “Gheorghe Mihoc – Caius Iacob”, Bucharest)

Entropy, divergence rates and weighted divergence rates for Markov chains

15:30 – 15:45

Vasile Preda, Costel Balcau, Doru Constantin, Ioana Ileana Panait (University of Bucharest; University of Pitești; University of Pitești; Doctoral School of Mathematics, University of Bucharest)

Cumulative entropies: A Survey

15:45 – 16:00

Silvia Dedu, Vasile Preda (Bucharest University of Economic Studies; University of Bucharest and ISMMA, Bucharest)

General Entropy Measures Based Approach to Loss Models

16:00 – 16:15

Răzvan-Cornel Sfetcu (Doctoral School of Mathematics, University of Bucharest)

Discrete Divergences of Orthogonal Polynomials

16:15 – 16:30

Muhammad Sheraz (Institute of Business Administration, Karachi, Pakistan)

Stochastic models and econophysics

Secțiunea Actuarial și Matematici Financiare (Sala E32)

Chair: Raluca Vernic, Gheorghică Zbăganu

15:00 – 15:15

Elena-Grațîela Robe-Voinea, Raluca Vernic (Academia Navală "Mircea cel Bătrân", Universitatea Ovidius Constanta)

On the optimization of an algorithm designed for the evaluation of a multivariate compound distribution

15:15 – 15:30

Ana Răducan (Institutul de Statistică Matematică și Matematică Aplicată "Gheorghe Mihoc - Caius Iacob")

Proprietăți ale transformatei Laplace

15:30 – 15:45

Anastasia Gronscaia, Carolina Opinca (Universitatea de Stat din Moldova)

Decision making under uncertainty and risk

15:45 – 16:00

Tiberiu Socaciu (Universitatea din Suceava)

Critici cu privire la ecuațiile Heston și Heston-S

16:00 – 16:15

Muhammad Sheraz (Institute of Business Administration, Karachi, Pakistan)

Black-Scholes model with GARCH volatility and kurtosis computations

16:15 – 16:30

Florentin Șerban (Bucharest University of Economic Studies; Doctoral School of Mathematics, University of Bucharest)

Maximum entropy in portfolio optimization

Secțiunea Probabilități și Procese Stocastice (Sala E73)

Chair: Mioara Buiculescu, Mihai Pascu

15:00 – 15:15

Neculai I. Crișmaru ("George Bacovia" University of Bacău)

O generalizare a teoremei de aproximare stocastică a lui Dvoretzky

15:15 – 15:30

Daniel Ciuiu (Technical University of Civil Engineering, Bucharest)

Decomposition of the time series and of the shocks using the simple fractions decomposition and applications

15:30 – 15:45

Andreea Fulga (Universitatea Transilvania din Brașov)

A new Suzuki type fixed point theorem

15:45 – 16:00

Cristian-George Constantinescu (Academia Forțelor Aeriene "Henri Coandă", Brașov)

O aplicație a schemei hipergeometrice

16:00 – 16:15

Anca Ileana Lupaș (Academia Tehnică Militară București)

Considerații asupra parametrului de scală al repartiției exponențiale

16:15 – 16:30

Andrei Anghel, Cristiana Tudor, Maria Tudor (Bucharest University of Economic Studies)

The performance of portfolios formed using second order stochastic dominance

Secțiunea Optimizări (Sala E78)

Chair: Ion Văduva, Romică Trandafir

15:00 – 15:15

Andreea Mădălina Stancu, I.M. Stancu-Minasian (ISMMA Bucharest)

Optimality and duality in nonsmooth semi-infinite multiobjective optimization problems

15:15 – 15:30

Sorin Demetriu, Vasile Preda, Romică Trandafir (Technical University of Civil Engineering, Bucharest; University of Bucharest and ISMMA Bucharest; Technical University of Civil Engineering, Bucharest)

Statistical Models for extreme Air Temperatures

15:30 – 15:45

George Anescu (Universitatea "Politehnica" București)

A fast self-adaptive DE approach to reliability optimization problems

15:45 – 16:00

Mihaela Mioara Mirea (Colegiul Național Militar "Tudor Vladimirescu", Craiova)

Optimization and Equilibria an economy

16:00 – 16:15

Tatiana Pașa, Valeriu Ungureanu (Universitatea de Stat din Moldova)

Solving the transportation problem with piecewise-linear concave cost functions on edge flows

16:15 – 16:30

Daniela Vrînceanu (Emergency University Hospital, Bucharest)

Cost-Effectiveness Analysis and Optimal Decision in Hospital Departments Management

REZUMATE

- Alexandru Amărioarei (University of Bucharest)

Approximations for the distribution of the three dimensional continuous scan statistics

The object of this talk is to derive an approximation for the three dimensional distribution of the continuous scan statistics for Poisson processes. To illustrate the accuracy of our results we conduct a numerical comparison study where several simulation techniques are presented.

- Traian Anastasiei (Academia Forțelor Aeriene „Henri Coandă”, Brașov)

Aspecte matematice ale fundamentării deciziilor în acțiunea militară

Acțiunea militară modernă nu poate fi concepută fără o fundamentare științifică adecvată. Alegerea unei linii de acțiune pentru realizarea obiectivelor ținând seama de resursele la dispoziție și configurația mediului intern/extern este o activitate foarte complexă care se desfășoară în condiții de incertitudine și de timp limitat. Optimizarea acțiunilor precum și aplicarea unor soluții eficiente de luare a deciziilor este un aspect de primă importanță în fizionomia câmpului de luptă actual și presupune un aparat matematic corespunzător. În acest articol analizăm necesitatea găsirii/adaptării unor metode matematice corespunzătoare noilor tehnologii și armamente implicate în confruntările contemporane, folosind un exemplu din domeniul aviației.

- George Anescu (Universitatea „Politehnica” București)

A fast self-adaptive DE approach to reliability optimization problems

Nowadays we assist to the global expansion of reliability optimization problems from the design phase of systems and sub-systems to the operational phases, not only of systems and sub-systems, but also of complex industrial plants. Essentially the reliability optimization problems are dealing with the fine trade-off between two contradictory requirements, the maximization of system's reliability and the minimization of system's cost. The paper is investigating the suitability of the Fast Self-Adaptive Differential Evolution (FSA-DE) optimization algorithm for solving reliability optimization problems by approaching a set of test problems comprising two known Redundancy Allocation Problem (RAP) case studies, one Fault Tree Optimization (FTO) case study and one Event Tree Optimization (ETO) case study. The FTO and ETO case studies have only illustrative purposes, while the RAP case studies are used for comparison between the numerical results obtained by FSA-DE method and the numerical results obtained by other optimization methods published in the literature. The comparisons prove that FSA-DE is a competitive optimization method for solving reliability optimization problems.

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- Vlad Ștefan Barbu; Alex Karagrigoriou; Andreas Makrides (University of Rouen, France; University of the Aegean, Samos, Greece; University of Cyprus)

Statistical inference for a general class of distributions with time-varying parameters

In this work we are interested in a general class of distributions for independent not necessarily identically distributed random variables, closed under extrema, that includes a number of discrete and continuous distributions like the Geometric, Exponential, Weibull or Pareto. The scale parameter involved in this class of distributions is assumed to be time varying with several possible modeling options. This is of particular interest in reliability and survival analysis for describing the time to event or failure. The maximum likelihood estimation of the parameters is addressed and the asymptotic properties of the estimators are discussed. We provide real and simulated examples and we explore the accuracy of the estimating procedure as well as the performance of classical model selection criteria in choosing the correct model among a number of competing models for the time-varying parameters of interest.

- Vlad Ştefan Barbu; Alex Karagrigoriou; Andreas Makrides (University of Rouen, France; University of the Aegean, Samos, Greece; University of Cyprus, Cyprus)

Semi-Markov processes for multi-state systems: modelling, estimation and reliability/survival analysis

In this work we are interested in multi state systems that we model by means of semi-Markov processes. The sojourn times are seen to be independent not identically distributed random variables and assumed to belong to a special class of distributions that includes several popular reliability distributions like the exponential, Weibull, and Pareto. We obtain maximum likelihood estimators of the parameters of interest and investigate their asymptotic properties. Plug-in type estimators are furnished for various quantities related to the system under study and also for reliability indicators.

- Vlad Ștefan Barbu; Alex Karagrigoriou; Vasile Preda (University of Rouen, France; University of the Aegean, Samos, Greece; University of Bucharest and ISMMA „Gheorghe Mihoc – Caius Iacob”, Bucharest, Romania)

Entropy, divergence rates and weighted divergence rates for Markov chains

Divergence measures are of great importance in statistical inference. Equally important are their limiting versions, known as divergence rates. In this work we focus on generalized divergence measures for Markov chains. We consider generalizations of Alpha divergence measure (Amari and Nagaoka, 2000) and Beta divergence measures (Basu et. al, 1998) and investigate their limiting behaviour. We also study the corresponding weighted generalized divergence measures and the associated rates (Belis and Guiasu, 1968; Guiasu, 1971; Kapur, 1994). Special attention is paid to the generalized form of the popular Cressie and Read power divergence class of measures. Illustrative 2-state and 3-state Markov chain examples are furnished and analysed.

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- Luiza Bădin; Anca-Teodora Șerban-Oprescu (Bucharest University of Economic Studies and ISMMA; Bucharest University of Economic Studies)

Nonparametric efficiency analysis to evaluate and explain performance in scientific research

Latest trends in evaluating performance in Research & Development show that advanced methodologies in econometrics and operations research have proved extremely useful and relevant in analyzing efficiency and productivity of scientific research. In this paper we present

a general framework for assessing scientific research performance, based on flexible nonparametric frontier models, which allow including exogenous factors with essential role in research evaluation. Taking into account cross-disciplinary factors considered so far in separate contexts, the analysis may lead towards a broader and multifaceted appraisal of scientific research. Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, Project number PN-II-RU-TE-2014-4-2905.

- Irina Băncescu (Doctoral School of Mathematics, University of Bucharest)

New generalized Weibull statistical models and coherent systems

In reliability some well-known systems are coherent systems. These coherent system can be represented as either a parallel-series system (a parallel system with all the components connected in series) or as a series-parallel system. An open problem of interest concerning these systems is the ordering of expected system lifetimes. In this paper we deal with the ordering of the coherent systems based on new generalized Weibull statistical models. Weibull distribution is one of the most popular distribution which is widely used in reliability and in analysis of lifetime data. Some of the different fields in which the Weibull distribution has been used are: engineering, physics, quality control, meteorology, geology, pharmacy, material science, biology and geography, economics and

business, medicine, chemistry. We introduce new statistical models, namely new generalized Weibull models. We give an interpretation of these models in the context of reliability engineering. An application is performed.

- Ionuț Bebu (The George Washington University)

Probabilistic Measures of Cost-Effectiveness for Decision Models

Cost-effectiveness analyses are becoming increasingly common in health and medicine. However, no single measure can fully capture both the cost and the benefit of an intervention, and different metrics may provide complementary information on differences between interventions. Recently proposed probabilistic measures of cost-effectiveness using subject level data from randomized clinical trials are extended to decision analytic models that provide an assessment of cost-effectiveness defined from the joint outcomes observed. The applications to both decision trees and Markov models are described and illustrated using examples. The measures are intuitive, simple to evaluate, and provide additional information compared to what can be obtained from the existing measures of cost-effectiveness.

- Bogdan Corneliu Biolan (University of Bucharest)

About The Hodrick-Prescot Filter. A Short Survey

In this survey we present the Hodrick-Prescott filter and also show some new results for this type of filter, used in

macroeconomics and in DSP field. Furthermore an application in the DSP field is given.

- Voicu Boscaiu („Gheorghe Mihoc – Caius Iacob” Institute of Mathematical Statistics and Applied Mathematics, Bucharest)

Comparison of Romanian historical regions based on the frequency of HLA alleles

The human leukocyte antigen system (HLA) have been considered as criterion for the study of genetic profile of historical Romanian regions. In order to cluster Wallachia, Moldavia, Transylvania, Banat together with Italy, France, Germany, Serbia, Turkey and Bulgaria, we have used the principal component method in the space of allelic frequencies.

- Mioara Buiculescu (ISMMA)

On excessive and subinvariant measures for regular step processes

We characterize the excessive measures of a regular step process in terms of its given data, i.e. the jump kernel and the parameter of the exponentially distributed \ first jump time. A similar characterization is provided for subinvariant measures under the Harris irreducibility condition on the process. We also show that any Harris \ irreducible regular step process is simultaneously irreducible.

References

[1] R. M. Blumenthal, R.K. Gettoor, Markov Processes and Potential Theory, Academic Press, New York, 1968.

[2] R.K. Gettoor, Excessive measures, Birkhauser, Boston, 1990.

[3] P. Tuominen, R. L. Tweedie, Exponential decay and ergodicity of general Markov processes and their discrete skeletons, *Adv. Appl. Probab.* 11, 784-803, 1979.

- Bogdan Cioruța, Nicolae Pop, (Centrul Universitar Nord, Baia Mare)

Implicații ale teoriei proceselor aleatoare în studiul sistemelor dinamice

Scopul principal al teoriei sistemelor dinamice, pe care le-am adus în discuție, este de a înțelege comportamentul pe termen lung al stărilor unui sistem, cel mai adesea, determinist. Pentru studiul de față vom urmări, pornind de la noțiunile specifice teoriei sistemelor, realizarea unei clasificări non-exhaustivă a modelelor, respectiv sistemelor, funcție de linearitatea acestora, numărul de variabile de intrare-ieșire, de comportarea în timp sau luând în considerare alte aspecte. De multe ori, astfel de sisteme implică numeroase variabile și sunt neliniare. Ca atare, studiul comportamental al sistemelor dinamice necesită reprezentări grafice (modelări, simulări) deosebit de complexe, pe care calculatoarele zilelor noastre le pot realiza cu ușurință, o parte dintre ele fiind prezentate și pe parcursul lucrării. Pornind de la cele precizate, lucrarea de față ilustrează, în completarea celor de mai sus, noțiuni care au un rol semnificativ în studiul sistemelor dinamice, din perspectiva teoriei proceselor aleatoare, dintre care menționăm funcția de repartiție, funcția de densitate de probabilitate, momentele statistice ale unui proces aleator, mediile temporale, și corelația unui proces aleator. Un loc deosebit îi este alocat, înspre final, metodologiei care generează în mod aleator și analizează seturi de date (variabile) prin apelarea la soft-uri ușor accesibile, și anume MS Excel, respectiv Origin.

- Daniel Ciuiu (UTCB)

Decomposition of the time series and of the shocks using the simple fractions decomposition and applications

In this paper we will use the decomposition of rational functions in simple fractions. The rational functions are build using the delay polynomials $\phi(L)$ and $\theta(L)$ of an ARIMA time series. For decomposition of the time series $X[t]$ we use the rational fraction $\theta(L)/\phi(L)$, and for the decomposition of the white noise $a[t]$ we use the rational fraction $\phi(L)/\theta(L)$. Finally, because for the decomposition of $X[t]$ we do not take into account that the roots of $\phi(L)$ are greater than one in absolute value, we multiply in the first above case $\phi(L)$ by $(1-L)^d$ for taking into account the possible trend and by $(1-L^s)^{d_s}$ for taking into account the possible seasonal components.

- Manuela-Simona Cojocă (University of Bucharest)

Despre clasa t-exponențială și aplicații în modele grafice

- Cristian-George Constantinescu (Academia Forțelor Aeriene "Henri Coandă")

O aplicație a schemei hipergeometrice

În lucrarea de față se prezintă problema VIII.8, din cartea „Probleme de matematici pentru ingineri”, autor Rodica Trandafir, cu soluția autoarei. Se demonstrează că aceasta este greșită și se propune soluția corectă.

- Neculai I. Crișmaru (Universitatea „G. Bacovia” din Bacău)

O generalizare a teoremei de aproximare stohastică a lui Dvoretzky

Această comunicare conține o generalizare a unei binecunoscute teoreme de aproximare stochastică a lui Dvoretzky. Această generalizare este bazată pe extinderile unei leme al lui Derman și Saks, lemnă care a stat la baza unui rezultat dat de cei doi autori în legătură cu teorema de aproximare stochastică a lui Dvoretzky.

- Sophie Dabo (University of Lille)

Predictive spatio-temporal model for spatially sparse global solar radiation data

This work introduces a new approach for the forecasting of solar radiation series at a located station for very short time scale. We built a multivariate model in using few stations (3 stations) separated with irregular distances from 26 km to 56 km. The proposed model is a spatio temporal vector autoregressive VAR model specifically designed for the analysis of spatially sparse spatio-temporal data. This model differs from classic linear models in using spatial and temporal parameters where the available predictors are the lagged values at each station. A spatial structure of stations is defined by the sequential introduction of predictors in the model. Moreover, an iterative strategy in the process of our model will select the necessary stations removing the uninteresting predictors and also selecting the optimal p-order. We studied the performance of this model. The metric error, the relative root mean squared error (rRMSE), is presented at different short time scales. Moreover, we compared the results of our model to simple and well known persistence model and those found in literature.

- Silvia Dedu, Vasile Preda (Bucharest University of Economic Studies; University of Bucharest and ISMMA, Bucharest)

General Entropy Measures Based Approach to Loss Models

Risk assessment represents an important topic in various fields, since it allows choosing the optimal strategy in many real world problems. The fundamental concept of entropy can be used to evaluate the uncertainty degree associated with random variables or phenomena. Due to the widespread applicability, the derivation of closed expressions for various entropy measures corresponding to univariate and multivariate distributions has been a subject of interest. The aim of this paper is to develop an information measures based approach to risk models involving truncated and censored random variables. By using some general information measures, such as Tsallis or Kaniadakis entropies, the effect of different partial insurance schemes upon the entropy of losses is investigated. Analytic expressions for the per-payment and per-loss entropies and relationships between them are obtained. The entropies of losses corresponding to proportional hazards and proportional reversed hazards models are derived. The applications presented prove that information theory approach using general entropy measures for loss models allows a higher degree of flexibility. Computational results are provided. Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-2905.

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- Sorin Demetriu, Vasile Preda, Romica Trandafir (Technical University of Civil Engineering Bucharest)

Statistical Models for extreme Air Temperatures

Extreme shade air temperatures are basic parameters for the design of buildings, bridges and other structures which are exposed to temperature variations. In the design codes and national annexes, thermal actions are characterized by annual values of maximum and minimum shade air temperatures with mean return period of 50 years. In this paper, parameters of different extreme value distributions and confidence intervals of extreme air temperature quantiles are estimated using climatic data recorded at some Romanian meteorological stations. The results are compared with the specified characteristic values of extreme temperatures.

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- Gabriela-Roxana Dobre, Radu Gogu, Dragoș-Ștefan Gaitanari (Technical University of Civil Engineering Bucharest)

Hydrogeological Parameters Estimation

For modeling the downward movement of water through the unsaturated zone it is necessary to know the soil hydraulic properties. Because many of the soil parameters cannot be measured directly there are used inverse modeling methods in order to find best solution. This paper offers an overview and highlights the advantages and disadvantages of local search methodologies versus global optimization methods with application in the estimation of the unsaturated soil hydraulic properties. For a limited number of parameters, for example in a homogenous soil column, the minimization approach provides by Levenberg-Marquardt scheme generally work best. For a larger number of parameters, for example when multiple soil horizons are involved, local search methodologies cannot provide unique solution and may fail to locate the global minimum so these cases require the use of global optimization methods. This article presents a case study based on time domain

reflectometry (TDR) measured water contents from an experimental field plot in Bucegi mountain. In order to inversely estimate van Genuchten–Mualem soil parameters we use HYDRUS-1D code based on the Levenberg-Marquardt algorithm.

- Nicoleta Enache-David, Livia Sangeorzan (Universitatea Transilvania din Braşov)

Data analysis - between theory and practice

Data analysis is a process of preprocessing and data modeling to order to discover useful information, suggesting conclusions, and supporting decision-making. Data analysis has multiple approaches and applications in business, science, medicine and social science domains. Data mining is a particular data analysis technique that focuses on modeling and knowledge discovery for predictive purposes. In statistical applications data analysis is organized into descriptive statistics, exploratory data analysis (EDA), and confirmatory data analysis (CDA). This paper presents a few modern data analysis techniques and a case study.

- Andreea Fulga (Universitatea Transilvania Braşov)

A new Suzuki type fixed point theorem

In this paper we prove a fixed point theorem for F-Suzuki contractions which basically derives from the results of Piri and Kumam [Fixed Point Theory and Applications 2014, 2014:210].

- Carmen Adriana Gheorghe, Sorin Avram, Corina Cipu (National Institute of Economic Research, Romanian Academy; Politehnica University of Bucharest)

Statistical approach to modeling income inequality for territorial units

In this paper we investigate the relationship between growth and inequality at regional level taking also into account the important role played by the presence of spatial interactions among units. Using absolute β -convergence tests, the neo-classical hypothesis that poorer territorial units grow faster than richer ones can be tested. Under this hypothesis, there will be a negative relationship between the initial level of income and the average rate of growth of income during the time frame under consideration.

- Manuela Ghica, Nicoleta Dimcevic Poesina, Irina Prasacu (University of Medicine and Pharmacy „Carol Davila”, Bucharest)

Exponentiated power quasi Lindley distribution / Submodels, properties, stochastic ordering, statistical inference

In this paper we introduce a new generalization of the Lindley distribution which generalizes the power Lindley distribution, proposed by Ghitany, and another form of generalized Lindley proposed by Nadarajah. This new kind of generalized Lindley distribution has four parameters and it allows more adaptability to analyze real lifetime data. keywords: Lindley distribution, Lambert function, quantile function, order statistics.

- Patricia Giurgescu (ISJ Braşov)

On empirical data depth

Basic illustrations of empirical data depth features

- Anastasia Gronscaia, Carolina Opinca (Universitatea de Stat din Moldova)

Decision making under uncertainty and risk

Decision-making under uncertainty is based on the fact that the probabilities of various variants of the development of events are unknown. Decision-making under risk conditions is based on the fact that each situation of the development of events can be given the probability of its implementation. This allows to weigh each of the values of efficiency and choose to implement the situation with the lowest level of risk. The theory of statistical solutions can be interpreted as a theory of searching for optimal nondeterministic behavior under uncertainty. Behavior is considered optimal if it minimizes the risk in successive experiments (mathematical expectation of losses of the statistical experiment).
Keywords: decision making, uncertainty, risk, payoff matrix, criteria vector.

- Iuliana Iatan (Technical University of Civil Engineering Bucharest)

Dealing the nonlinearity associated with the data using Artificial Neural Networks

The Artificial Neural Networks (ANNs) are well-suited for a very broad class of nonlinear approximations and mappings. The ANN with nonlinear activation functions are

more effective than linear regression models in dealing with nonlinear relationships. We are trying to find out how relevant is to use a Fuzzy Neural Network for prediction because it handles well the nonlinearity associated with the data.

- Valentin Ionescu (Academia Română)

Nou tip de bimodul Fock și teoreme limită centrală universală pentru variabile aleatoare cuantice cu valori operatori

Prezentăm, în cazul multivariat, teoreme limită centrală universală pentru variabile aleatoare cuantice cu valori operatori, corespunzând unei extensii necomutative adecvate a convoluției universale Accardi-Bozejko. Acestea sunt realizate prin operatori fundamentali pe un nou tip de bimodul Fock generalizând bimodulele Fock interactive apărute în studiul lui L. Accardi și Y.G. Lu asupra limitei stocastice din domeniul electrodinamicii cuantice. Rezultatele noastre extind teoreme obținute, în cazul univariat cu valori scalari, de L. Accardi și M. Bozejko sau L. Accardi, V. Crismale și Y.G. Lu, dar nu numai.

- Julien Jacques (Université de Lyon)

Co-clustering for functional data

In order to provide a simplified representation of key performance indicators for an easier analysis by mobile network maintainers, a model-based co-clustering algorithm for functional data is proposed. Co-clustering aims to identify block patterns in a data set from a simultaneous clustering of rows and columns. The algorithm relies on the latent block model in which each curve is identified by its functional principal components that are modeled by a

multivariate Gaussian distribution whose parameters are block-specific. These latter are estimated by a stochastic EM algorithm embedding a Gibbs sampling. In order to select the numbers of row- and column-clusters, an ICL-BIC criterion is introduced. In addition to be the first co-clustering algorithm for functional data, the advantage of the proposed model is its ability to extract the hidden double structure induced by the data and its ability to deal with missing values. The model has proven its efficiency on simulated data and on a real data application that helps to optimize the topology of 4G mobile networks.

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- Alexandru Lazari (Universitatea de Stat din Moldova)

Stochastic games with real transition costs and final sequence of states

The stochastic games with unit transition time and final sequence of states were investigated in [2] and an efficient algorithm for determining the game duration was developed. The purpose of this paper is to generalize this problem for the case when the transition costs are real.

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- Constantin Lădescu (Universitatea Transilvania din Brasov)

Funcții aleatoare aproape periodice în medie de ordinul al doilea

Lucrarea abordează așa cum ne spune și titlul ei, câteva aspecte legate de funcțiile aleatoare aproape periodice în medie de ordinul al doilea. Lucrarea este structurată pe două capitole (părți). În prima parte sunt prezentate tipurile de funcții aleatoare aproape periodice în medie de ordinul al doilea, prin definiții și proprietăți corespunzătoare. În partea a doua sunt abordate relațiile dintre tipurile de funcții aleatoare aproape periodice în medie de ordinul al doilea concretizate prin două teoreme care evidențiază aceste relații. Pe parcursul lucrării sunt utilizate noțiuni (cuvinte cheie) precum funcții aleatoare aproape periodice în medie de ordinul al doilea, funcții aleatoare aproape periodice în medie de ordinul al doilea în sens Bohr, funcții aleatoare continue normale în medie de ordinul al doilea.

- Anca Ileana Lupaș (Academia Tehnică Militară București)

Considerații asupra parametrului de scală al repartiției exponențiale

Repartiția exponențială este larg folosită în aplicații statistice din cele mai diverse domenii. În această lucrare vom studia repartiția exactă și asimptotică a parametrului de

scală. De asemenea se deduc intervale de încredere pentru parametrul studiat precum și intervale de lungime fixată.

- Mihaela Mioara Mirea (Colegiul National Militar „Tudor Vladimirescu” Craiova)

Optimization and Equilibria an economy

The concept of equilibrium plays a central role in various applied sciences, such as physics (especially, mechanics), chemistry, biology. In terms of the classical mechanics, for example, the equilibrium state for a system means that (a) the impact of all the forces on this system equals zero; and (b) this state can be maintained for an indefinitely long period. Thus, one can formulate the equilibrium problem mathematically, i.e. in the form of a mathematical model, and the solutions of the corresponding problem can be used for forecasting the future behavior of the system and, also, for correcting the deviation between the current state of the system and the equilibrium state. The standard mathematical model for the equilibrium state is a system of equations, which often admits finding a solution in an explicit (closed) form. Observe that solution sets of most of these problems possess certain vector space properties or represent its regular transformation, such as a manifold, and their analysis relies upon these properties. We spoke about the situation in natural sciences, but in the socio-economical sciences the equilibrium approach may be even more powerful and fruitful. The point is that these sciences, in contrast to the natural ones, do not admit in fact other kinds of modeling with the exception of the mathematical one. Hence, suitable formulations of equilibrium models enable

us to make non-trivial conclusions on the behavior of very complicated systems which are considered in socio-economical sciences. Thus, the first key problem is to find suitable formulations of equilibrium models in these fields. It should be noted that equilibrium models were very developed traditionally in economics. Many Nobel Prize winners, such as K.J. Arrow, G. Debreu, L.V. Kantorovich, T. Koopmans, W. Leontief, H. Markovitz, J.F. Nash et al., were awarded just for their contributions in this field. Nevertheless, even in economics, there exist a number of various kinds of equilibrium models, even different concepts of equilibrium.

- Bogdan Gh. Munteanu (Academia Forțelor Aeriene „Henri Coandă” Braşov)

Qualitative aspects of the Min Pareto Binomial distributions

This paper is dedicated to statistical models regarding the qualitative aspects. Based on the statistical simulation algorithm of the power series distribution, named Min Pareto Binomial (MinParB), discussed and analyzed in [2], and EM algorithm for statistical estimation of parameters of MinParB distribution, we can obtain a statistical selection of MinParB distribution for different parameter values by means of Akaike information criterion (AIC). There has been considered the determining of the MinParB distribution from a unitary perspective regarding the class of the power series distributions [1].

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- Carolina Opinca (Universitatea de Stat din Moldova)

Opportunities on parallel computing for decision support

Abstract: Many tasks require calculations with a large number of operations that take up considerable resources. Moreover, it can be safely assumed that no matter how fast the computer technology is reached, there will always be problems for the solution, which took a considerable amount of time to resolve. Many of these complex tasks require that the result be obtained in minimum time or even strictly limited. The decisive role in the modern world is played by the speed with which decisions are made, especially in management decisions. The existence of an organization depends on how quickly decisions are made in response to internal or external conditions changes. To increase the efficiency, accuracy and completeness of the information allow modern technology. Keywords: parallel computing, MPI, speedup, efficiency, decision making.

- Tatiana Paşa, Valeriu Ungureanu (Universitatea de Stat din Moldova)

Solving the transportation problem with piecewise-linear concave cost functions on edge flows

In this work we expose the transportation problem on a network with piecewise-linear concave cost functions on flows of edges. Some properties of the problem are highlighted. A series of results are presented, which concern the implementation of a method exposed in [1] in Wolfram Mathematica System. These results are compared with the results obtained by applying built-in Wolfram Language functions on a family of test problems. Tests are provided both on PC-s and a cluster, by trying parallel computing approach too. Keywords: network transportation problem, optimal solution. [1]. Pasha T., Lozovanu D., *An algorithm for solving the transport problem on network with concave cost functions on flow of edges*, Computer Science Journal of Moldova, volume 10, number 3, Kishinev, 2002.

- Anamaria Popescu (Universitatea din Petroșani)

The analysis of the correlation between the consumer price indices by multiple regression

The analysis of these correlations between the consumer price indices, by multiple regression, supplements the information and the conclusions drawn by the implementation of models of the regression type simple. Additional information obtained through the use of multiple regression represents a support additional information for decision-makers and analysts. This article describes a correlation between the annual index of consumer prices, total annual index of consumer prices of foodstuffs, annual index of consumer prices of non-food goods and the annual index of consumer prices of services, by means of a regression model in multiple. The model explains the influence of the three types of consumption on the evolution of the annual index of consumer prices total and allows the creation of forecasts.

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- Cristian Preda (Universitatea Lille / ISMMA „Gheorghe Mihoc – Caius Iacob”)

Clustering functional data

We present a review of methods for clustering functional data with applications.

- Vasile Preda, Costel Bălcău, Doru Constantin, Ioana Ileana Panait (University of Bucharest, University of Pitești, University of Pitești, University of Bucharest)

Cumulative Entropies: A Survey

We present a review of cumulative entropies from reliability theory.

- Vasile Preda, Maria Miroiu (University of Bucharest; University of Pitești)

Generalized TL-Moments for a Generalized Power Law Distribution

In this paper we study the generalized TL-Moment estimation together with the corresponding coefficients of variations, skewness and kurtosis for a new generalization of power law distribution (Prieto and Sarabia, 2016) which uses a nonlinear exponent depending on two parameters.

- Ana Răducan (Institutul de Statistică Matematică și Matematică Aplicată „Gheorghe Mihoc – Caius Iacob”)

Proprietăți ale transformatei Laplace

Probabilitatea de ruina in orizont finit poate fi calculata in unele cazuri in mod recursiv cu ajutorul derivatelor transformatei Laplace. In ipoteza de dominare stocastica aceste formule de recurenta ne permit sa determinam noi proprietati ale transformatei Laplace.

- Elena-Grațîela Robe-Voinea, Raluca Vernic (Academia Navală „Mircea cel Bătrân”, Universitatea Ovidius Constanța)

On the optimization of an algorithm designed for the evaluation of a multivariate compound distribution

The aim of this study is to present how a specific recursive algorithm behaves on various types of processors and, also, to discuss some ideas in order to optimize it. The recursive algorithm was developed for the compound distribution of a multivariate aggregate claims model with the purpose to evaluate its probability function when the number of claims follows a multivariate Poisson distribution. Because this multivariate model includes different types of dependent claims (from which some could simultaneously affect an insurance portfolio), the complexity of the resulting recursion can become quite large. Therefore, in order to reduce the computing time, we previously studied alternative methods like the Fast Fourier Transform, which though very quick, is, however, an approximate method, affected by specific errors. Therefore, in this work, we pay a special attention to the optimization of the recursive procedure because it is an exact algorithm that avoids other errors like those of, e.g., the FFT method.

- Razvan-Cornel Sfetcu (Doctoral School of Mathematics, University of Bucharest)

Discrete Divergences of Orthogonal Polynomials

We consider a sequence of discrete probability distributions $\psi_n(x)$, where $\psi_n(x) = \psi_{\{n,1\}}(x), \psi_{\{n,2\}}(x), \dots, \psi_{\{n,n\}}(x)$. We prove that the sequence of Tsallis divergence $\{D\}^T(\psi_n(x))_n$ and the sequence of Renyi divergence $\{D\}^R(\psi_n(x))_n$ are convergent for any x in $(-1,1)$.

- Muhammad Sheraz (Institute of Business Administration, Karachi, Pakistan)

Stochastic Models and Econophysics

In finance, particularly pricing derivatives the estimation of correct Risk-Neutral-Density (RND) implied by the option prices, remains one of the most important problem. Most of the theoretical and empirical studies, which are aimed to improve the performance of the BS model, have focused on recovering the correct RND implied by option prices. In this paper we present the significance of various entropy measures in finance and economics. Some examples of entropy maximization problems subject to different kind of constraints for RND's and construction of the risk neutral probabilities for the Hunt-Devolder regime switching interest rate model will be discussed.

- Muhammad Sheraz (Institute of Business Administration, Karachi, Pakistan)

Black-Scholes model with GARCH volatility and kurtosis computations

GARCH processes are known to deal with non-constant volatility. In this paper we derive the kurtosis formula for underlying financial time series using BS-Model with GARCH volatility for the case of in the money option. We present the kurtosis formula in terms of the model's parameters. Also we compare our computational results by using another measure of kurtosis for different values of volatilities.

- Georgios-Jason Siouris (University of the Aegean)

Estimation and backtesting of expected shortfall

Expected shortfall (ES) is more challenging both in its estimation as well as in its backtesting. For more complicated distributions, such as some skew t-Student forms, there is no close form for ES. Also, it is harder to backtest expected shortfall than VaR because we are testing an expectation rather a single quantile. In order to deal with the above mentioned problem, especially in GARCH family models, new methods must be called forth.

- Tiberiu Socaciu (Universitatea din Suceava)

Critici cu privire la ecuatiile Heston si Heston-S

Pornind de la modelul Heston am realizat o alta derivare si am obtinut o EDP alternativa pentru Ecuatia Heston, pe care am denumit-o Ecuatia Heston-S. Considerand ca cele doua ecuatii sunt identice, gasim o formula noua pentru factorul lambda, alta decat cea sugerata de Breeden. Se vor prezenta critici cu privire la abordarile referite.

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- Anna Soos (Universitatea Babeș Bolyai)

Stochastic approximation with spline fractals

The spline interpolation method is the most important and well-known classical real data interpolation method. It has a lot of applications especially in computer geometric design. The classical method can be generalized with fractal interpolation. These fractal interpolation functions provide new methods of approximation of experimental data. This paper combines the spline and fractal interpolation method in stochastic case.

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- Andreea Mădălina Stancu, I. M. Stancu-Minasian (I.S.M.M.A. Bucharest)

Optimality and duality in nonsmooth semi-infinite multiobjective optimization problems

The paper is devoted to the study of optimality conditions and duality in nonsmooth multiobjective problems with an arbitrary (possibly infinite) number of inequality constraints.

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- Vasile Stănculescu, Oana Lupașcu (IMAR; University of Pitești)

Numerical Solution for the Non-linear Dirichlet Problem of a Branching Process

We give a probabilistic numerical approach for the nonlinear Dirichlet problem associated with a branching process. Main tools are the probabilistic representation of the solution with

the measure-valued branching process, as well as specific techniques for the numerical solution of linear partial differential equations, introduced and developed by Milstein and Tretyakov, and Monte Carlo methods.

- Florentin Şerban (Bucharest University of Economic Studies; Doctoral School of Mathematics, University of Bucharest)

Maximum entropy in portfolio optimization

The key factors associated with classical portfolio optimization models are return and risk. We adopt an approach incorporating maximum entropy theory, which enables us to supplement the classical two factor model with an additional element, diversification (as a measure of liquidity) quantified using the concept of entropy. We construct three new portfolio optimization models integrating the concept of entropy into the Markowitz portfolio model. Firstly we present an entropic approach to portfolio optimization. Then, by using Shannon, second order or Renyi entropy we derive analytical formulas to solve portfolio optimization problems, thus having a more complex analysis of the return-risk relationship. The computational results are presented at the end of the paper. Acknowledgment: This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project number PN-II-RU-TE-2014-4-2905.

- Sandra Teodorescu (Universitatea Nicolae Titulescu, București)

A statistical analysis of the relationship between economy and education in Romania vs. European Union

The main objective of this study was to analyze a series of statistical methods to observe the differences between the level of education in Romania and other European countries and the influence on the economy. The paper points out the use of an exploratory approach, i.e. factor analysis, as a data-reduction technique as it reduces the number of selected educational indicators which are strongly correlated, in order to conduct multiple regression.

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- Aida Toma (ASE Bucuresti and ISMMA)

Robust inference for models satisfying linear constraints using a generalization of the optimal Bs-robust estimator

Minimum dual divergence estimators for models satisfying linear constraints have been proposed recently in literature. The main advantage, of using this approach based on divergences and duality, lays in the fact that it leads to asymptotic properties of the estimators and corresponding test statistics under the model, as well as under misspecification, which cannot be achieved through the classical empirical likelihood context. On the other hand, these estimators are generally not robust. In this paper we define robust versions of these estimators using a generalization of the optimal Bs-robust estimator in the duality formula. The classical optimal Bs-robust estimator,

which is defined in literature for parametric models, is adapted in the present context by replacing the score function with a function specific to the optimized criterion in the duality formula. Some theoretical aspects related to this new proposal are discussed.

- Andrei Anghel, Cristiana Tudor, Maria Tudor (Bucharest University of Economic Studies)

Portfolio Diversification and financial crisis: A principal components analysis (PCA) approach on Eastern European equity markets

This paper investigates portfolio diversification benefits on Eastern European equity markets (EE) by studying the co-movements and the lead/lag linkages between stock markets from Romania, Hungary, Czech Republic and Russia. We also include in the analysis the world's leader stock market, the US. The study employs daily observations for a twelve years period (2004-2016) and uses both the principal components analysis (PCA) and Granger-causality tests in order to identify the channels of news transmission (if any) from one market to another. A priori, we expect the principal components analysis (PCA) results to indicate that the co-movements among Eastern European stock markets have become closer during the crisis period and thus that the potential gains that investors can achieve when they diversify their portfolio into international markets have decreased during the considered time interval.

- Andrei Anghel, Cristiana Tudor, Maria Tudor (Bucharest University of Economic Studies)

The performance of portfolios formed using second order stochastic dominance

In this paper we investigate the use of second order stochastic dominance as a tool for constructing portfolios consisting of investment strategies. We examine the out-of-sample performance of portfolios constructed in such a way that the probability of SSD is maximized, and we compare it with the performance associated with some other well-known techniques. Our results, based on various metrics, might challenge the way some investments firms operate: they indicate that the popularity of mean-variance optimization is not justified when only historical data is used as input, while the use of other methods such as minimum-variance or equal-weighting techniques have their distinctive advantages.

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- Roxana-Elena Tudoroiu (Universitatea din Petroșani)

Stochastic optimal control of pH neutralization process in a water treatment plant

Abstract: This paper opens a new research exploration direction in a real time MATLAB/SIMULINK simulation environment to optimize the pH neutralization process level of a generic waste water treatment plant following a stochastic approach. The control system design of pH neutralization process is a very difficult task to be accomplished due to its severe nonlinearity and complexity characterized by a persistent change in the chemical systems with complex kinetic and thermodynamic reactions, nonlinear responses, a sensitive environment uncertain results and large variety of operating conditions to be covered. Furthermore, the standard control strategies design fail unfortunately when the system performance is

concerned. In the new approach the proposed control strategy proved its effectiveness and high accuracy in terms of its performance compare to the traditional control mechanisms. To validate all these results a simplified intuitive nonlinear model of the neutralization reactor from the literature is considered. The solution of the optimization problem is found in a Linear Quadratic Gaussian optimization framework. In this new approach the nonlinear dynamics of the neutralization reactor must be linearized around an equilibrium point, the cost function is quadratic, and the process and measurement noises are white Gaussian noises, independent, of zero mean, and normally distributed. The system's control is Markovian and linear as a combination of observable or estimated states. In addition the implementation of stochastic optimal control approach is more restrictive by introducing a few key concepts and requirements such as controllability, stabilizability, observability, and the certainty-equivalence principle, as well as the well-known separation principle between optimal estimation and optimal control. Keywords: LQG stochastic control, control system optimization, Linear Quadratic regulator, Linear quadratic estimator, neutralization reactor, MATLAB/SIMULINK.

- Vincent Vandewalle (University of Lille & Inria)

Clustering categorical functional data Application to medical discharge letters

Categorical functional data represented by paths of a stochastic jump process are considered for clustering. For paths of the same length, the extension of the multiple correspondence analysis allows the use of well-known methods for clustering finite dimensional data. When the paths are of different lengths, the analysis is more complex.

In this case, for Markov models we propose an EM algorithm to estimate a mixture of Markov processes. A simulation study as well as a real application on hospital stays will be presented.

- Silviu-Laurențiu Vasile (I.S.M.M.A. Bucharest)

Join operations in NOSQL databases

In this paper the main objective is to study the cardinality of the join operations into a non relational database for tables having column values following different types of probability distributions. The goal of this research is to transpose results from another type of databases into non relational one for query optimization purpose. Some numerical results are presented and conclusions are drawn for different type of join operations.

- Ion Văduva (University of Bucharest)

On a particular lifetime distribution

The paper introduces a probability distribution as a mixture between a Gamma($0, \lambda\eta, \nu$) distribution and an exponential $\text{Exp}(\mu)$ distribution of η . The first and second order moments are calculated, together with the variance. Algorithms for simulation of the introduced distribution are presented. These include the inverse method and the rejection method. The last section discusses an application to reliability of a system with n components, with stochastic independent lifetimes, namely the distributions of maximum W and minimum V of lifetimes, when components have the introduced distribution. Simulation of W and V is also presented. The last part of the paper presents distributions of V and

When the number of components is (truncated) random with distributions: Poisson(λ), Geometric(p), or Binomial(n , p), $n \geq 1$. Simulation of these distributions is also underlined.

Key words: Gamma and Exponential distributions, Mixture distribution, Random variate simulation, Reliability.

- Daniela Vrînceanu (Emergency University Hospital, Bucharest)

Cost-Effectiveness Analysis and Optimal Decision in Hospital Departments Management

Nowadays a special interest is given to efficacy and effectiveness in medical services and health care, efficacy meaning to get the result no matter the resources and effectiveness meaning to get the result with minimum of resources. The most expensive medical cares are found in hospitals and cost-effectiveness analysis represents a real concern for hospital managers. It is clear that not only one measure can capture both cost and the benefit and it is necessary to find and define different metrics to provide complementary information. Some models for the assessment of cost-effectiveness defined from the observed outcomes can be found in the literature. Cost-effectiveness measures using level data from randomizes clinical trials have been developed. In this paper, starting from a real model found in a surgical hospital department, we aim to study the behavior and influence of several variables with different outcomes, which are involved in the decisional process. Some probabilistic models for cost-effectiveness analysis are used in order to obtain optimal decision models. We can ask if the result means healing the patients or spending less money for medical care or taking more

money from public medical assurances for medical care. The answer have to be put in a more exactly mathematical framework in order to minimize the risk of error in medical management decision.

