SPMS 2015

Stochastic and Physical Monitoring Systems

Book of abstracts of the 6th international conference SPMS2015

June 22 - June 27, 2015, Svijany Training Center, Drhleny, Czech Republic

Organized by the Group of Applied Mathematics and Stochastics (GAMS),
Department of Mathematics, Faculty of Nuclear Sciences and Physical Engineering,
Czech Technical University in Prague

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Foreword

Dear Colleagues,
it is our pleasure to welcome you to the 6^{th} STOCHASTIC & PHYSICAL MONITORING SYSTEMS.

The SPMS 2015 conference is held for the sixth time with the aim to bring together students and researchers with areas of interest related to the following topics: Analysis of microscopical structure of vehicular traffic streams and traffic modeling, Monitoring and classification of acoustic signals in material defectoscopy, New statistical distances and informational divergences with applications in acoustic emission, Small area estimation of geographical characteristics gained from data sets, and Data processing in high energy particle physics, which are all together briefly called Stochastic and Physical Monitoring Systems (SPMS). The conference links both the informal character of lively student meeting and the unique platform for the research presentations and discussions of the conference participants.

The meeting is organized by the Group of Applied Mathematics and Stochastics, Department of Mathematics, Czech Technical University in Prague and this year's venue is Svijany Brewery training center, Drhleny, in the scenic landscape park Bohemian Paradise.

Local Organizing Committee:

Jiří Franc, Pavel Hrabák, Tomáš Hobza, Václav Kus (Chair)

Scientific and Program Committee:

Václav Kůs, Tomáš Hobza, Milan Krbálek.

Invited Speakers:

Jarosław Waş - AGH University of Science and Technology, Kraków, Poland,
Antolino Gallego -Department of Applied Physics, University of Granada, Spain
Francisco A. Sagasta - Department of Applied Physics, University of Granada, Spain ,
Serge Dos Santos - INSA CVL, Blois, France,
Miroslav Kárný - UTIA, Academy of Science, Czech Republic,
Tatiana V. Guy - UTIA, Academy of Science, Czech Republic,
Milan Chlada - IT, Czech Academy of Sciences, Prague, Czech Republic,
Zdeněk Převorovský - IT, Czech Academy of Sciences, Prague, Czech Republic.

We gratefully acknowledge the institutional support provided by the funds of specific research, namely by the SGS grant SVK 29/15/F4.

The Organizers.

Contents

Data analyzing in HEP - Top quark physics at D0

Kamil Augsten

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Abstract

Data analyzing in high energy physics is the fundamental part of physics program of each modern high energy experiment. We will follow the process from recorded data with skimming, corrections and selections to the final data used for analyzers with examples from D0 top quark selection and physics.

Key words: Data processing, Top quark

Estimation of dynamical systems parameters via approximate Bayesian computation

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Abstract

The estimation of dynamical system parameters is generally troublesome as, in many cases, the likelihood function is computationally intractable. Therefore, most of the traditional estimating methods cannot be employed. The approximate Bayesian computation (ABC) methods, based on the Monte Carlo methods, provide a solution to the problem of the intractability of the likelihood. The methods will be demonstrated on well known Lorenz system, which is associated with term 'butterfly effect', and the results will be discussed.

Key words: Bayesian inference, dynamical system, intractable likelihood, Monte Carlo, ABC

Divergence separation techniques for high energy physics data.

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Abstract

Binary decision trees are a widely used tool for unsupervised classification of high-dimensional data, for example among particle physicists. We present our proposal of the supervised binary divergence decision tree with nested separation method of the generalized linear models. A key insight we provide is the clustering driven only by a few selected physical variables. The proper selection consists of the variables achieving the maximal divergence measure between two different classes. Further we apply our method to the Monte Carlo data set simulating measured observations from the particle accelerator at DO experiment in Fermilab. We also introduce the modification of statistical tests applicable to weighted data sets in order to test homogeneity of the Monte Carlo simulation and real data.

Key words: binary decision trees, phi-divergence, multivariate data analysis, statistical hypothesis testing

Modelling of customers' arrival into the reservation system

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Abstract

Precise prediction of customer demand is critical for any successful revenue management system. This work is concerned with modelling of customers' arrival into the railway reservation system. First, we propose parametric models based on Poisson processes and derive their estimators. For comparision variety of nonparametric models widely used in airline tickets reservation and hotel booking is also implemented and compared on real data.

Key words: Inhomogenous Poisson process, forecasting demand

Estimation of Multidimensional Multimodal Probability Density Functions by Using Distribution Mixtures

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Abstract

To estimate Multidimensional Multimodal Probability Density Functions mixture of product components may be used. These mixture can be efficiently estimated from data by means of EM algorithm. On the other hand, in some cases the simplicity of product components could be too restrictive. Then can be used a more complex mixture of dependence-trees distribution. By dependence tree we can describe the relationship between pairs of variables in individual components and thereby achieve a better estimate of the unknown probability density.

Key words: EM algorithm, Normal distribution mixture, Dependence trees

Analysis of individual behavior in front of the bottleneck

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Abstract

Various experiments have been conducted in order to verify crowd behavior models and to enable fundamental research of various phenomena. Advanced processing of video records provides microscopic analysis of individual behavior, which plays an important role in egress situations. Less aggressive pedestrians spend more time in affected area, which may cause unexpected complications. This article is based on passing through scenario, participants were instructed to pass the room as fast as possible. By means of unique codes on the hats of participant, the travel time and trajectory of pedestrians for each transit has been extracted and assigned to specific person. As expected, recorded travel time significantly depends on the occupancy, but the trend is individual and quite complex. While some participants reached similar travel time in free flow and congested mode, the others were not able to pass through the dense crowd and spent incomparable more time in the room. Moreover, the deviations of individual travel time are explained by the statistical analysis of trajectory. To describe participant's

properties, the term velocity is generalized to capture the effective velocity inside the dense crowd. It is shown that the "aggressiveness" and the desired velocity is less correlated than expected.

Key words: Pedestrian dynamics, egress experiment, video processing

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Finding of Geodesic Paths in Discrete Bodies

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Abstract

The shortest way estimation is crucial task in many research or engineering fields. The choice of most suitable method depends largely on the kind or form of the body shape definition. The theory of differential geometry provides necessary apparatus for case of mathematically well-describable surfaces. Further, the graph theory is capable to solve the problem when there exists an interpretation of a body as a system of mass points (nodes) and their interconnections (edges), i.e. a graph. Another recently designed method was inspired by Huygens principle as a simple to implement alternative suitable for discrete bodies derived from 2D or 3D bitmap pictures. Such approach also enables the tracing of elastic waves propagating through bodies of complicated shape.

Key words: geodesic path, discrete body, flooding algorithm

Seismic tomography of the Earth's upper mantle around the Trans-european suture zone

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Abstract

Seismic tomography is a geophysical technique for imaging of the Earth's interior. It is an inverse problem, which uses modified weighted least squares method to compute velocity model of the investigated volume. Distribution of seimic wave velocities can be associated with varying age of the lithosphere and other physical properties. Area of interest for our research was an important tectonic boundary - the Trans-European Suture Zone (TESZ) - which divides European lithosphere into two parts. North-east

of the TESZ is a thick monolithic lithosphere of the East European Craton. Lithosphere south-west of the TESZ is thinner and without single dominant tectonic unit. We will present tomographic model, which was computed from P-wave arrival times recorded during the PASSEQ passive seismic experiment (2006-2008).

Key words: seismic tomography, Passeq, structure of the upper mantle

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Application of classification methods in echodentography

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Abstract

Statistical classification methods are widely used in many fields of research. We test two classification methods, namely Fuzzy Classification (FC) and Divergence Decision Tree (DDT), in the field of echodentography. These methods are used in the connection with the Nonlinear Time Reversal method in order to find some scatterrers in the extracted human tooth. Measured signals are responses of the tooth to positive or negaive chirp signal in different directions. In order to find some information about scatterers in the measured signals, the divergence parameters are applied. In our case the divergence is computed between a reference normed spectrum of signals and normed spectra of individual signals. The results of classification are compared with the results published in [1].

[1] Dos Santos S, Prevorovsky Z. Imaging of human tooth using ultrasound based chirp-coded nonlinear time reversal acoustics, Ultrasonics, 51 (6), 667–674, (2011).

Key words: classification, divergence, echodentography

Robustness of score functions

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Abstract

We introduce a class of statistical distances called score functions. Simulation results comparing robustness of minimum distance score estimators with other types of well-known minimum distance estimators are presented. We show that modified score kernel of the Kolmogorov distance exhibits better robustness for high-valued outliers and propose further modifications.

Key words: score function, robustness, minimum distance estimator

New statistical approaches in the measurement of the inclusive $t\bar{t}$ production cross section in $p\bar{p}$ collisions at D0

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Abstract

We present new statistical methods applied in the measurement of the inclusive top pair production cross section in $p\bar{p}$ collisions at 1.96 TeV employing the full RunII data ($9.7fb^{-1}$) collected with the D0 detector at the Fermilab Tevatron Collider. We consider the final state of the top quark pair containing one electron or muon and at least two jets. We show new statistical tests for variables selection, present various methods for separating the signal from the background and compare them with the TMVA Boosted Decision Trees (BDT). We derive the inclusive cross section and introduce some possibilities how to determine uncertainties.

Key words: MVA methods, signal separation, ttbar cross section, D0, Tevatron

Vibration signals for damage evaluation in dampers used in seismic resistant structures: Proposal of new damage indices

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Abstract

Several damage indices to assess the level of damage in Web Plastified Dampers (WPDs) which are installed in building structures are proposed in this work. The WPD is a hysteretic type energy damper recently developed and patented by the University of Granada, for the passive control of structures subjected to earthquakes. It consists of several I-section steel segments connected in parallel. The energy is dissipated through plastic deformations of the web of the I-sections, which constitute the dissipative parts of the damper. In this work, WPDs were subjected to successive histories of dynamically-imposed cyclic deformations of increasing magnitude with the shaking table of the University of Granada. Basically, three kind of indices have been developed by our research group in the last recent years, depending of the techniques used to process the vibration signals captured by the actuator attached to the I-Sections:

- ADI: Based on the Frequency Response Function (FRF)
- WER: Based on the Wavelet Packet Analysis
- RWEE: Based on the Wavelet Energy Entropy

In all cases the vibration signals were acquired by means of piezoelectric sensors attached on the I-sections, and the new damage indices were correlated with another energy-based damage index ŮIDŮ which past research has proven to accurately characterize the level of mechanical damage. The ID is rooted in the decomposition of the load-displacement curve experienced by the damper into the so-called skeleton and Bauschinger parts. ID predicts the level of damage and the proximity to failure of the damper accurately, but it requires costly instrumentation and the measurements of the load and displacement during the earthquakes.

The experiments reported in this work for two specimens (FD and SD) demonstrate a good correlation between the vibration indices and ID in a realistic seismic loading scenario consisting of dynamically applied arbitrary cyclic loads. Based on this correlation, it is possible to estimate ID indirectly from these indices, which calls for much simpler and less expensive instrumentation.

Key words: Signal processing; Wavelet; Entropy; Dampers; Earthquakes; Damage evaluation

Decision-making in the Ultimatum Game: Fairness vs. Reason

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Abstract

The talk considers rationality of a human-responder in Ultimatum Game (UG). It studies new models able to account the responder's behaviour. The key idea is that human rationality is based on a complex reward that includes a social profit as well as the expected economic profit. The balance between economic and social terms is expressed by the responder's attitude to fairness of sharing an amount in UG.
The evaluations dynamically estimate human-responders' attitude to fairness and predict the next decision using the attitude learned from the previous trials.
The proposed model is positively tested against a set of original experimental data, thus providing an insight into human's motivation as a social being. The results obtained confirm the hypothesis about rationality of a human-responder in UG with the reward function including selfish player's sense for fairness.

Key words: ultimatum game, rationality

An application of logit mixed model to poverty risks estimation

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Abstract

This contribution deals with an empirical best predictor (EBP) of small area specific random effect in the context of a unit-level logistic mixed model. Behavior of the EBP based on parameter estimates obtained by the method of simulated moments (MSM) is studied by a Monte-Carlo simulation experiment. Performance of an estimator of the mean squared error (MSE) of EBP based on approximation of

the analytic form is compared with performance of a bootstrap estimator. Finally, an application to estimation of domain poverty incidences based on data of the 2012 Spanish Living Conditions Survey (SLCS) from the Autonomous Community of Valencia is presented.

Key words: Logit mixed model, empirical best predictor, method of simulated moments, poverty risk, living conditions survey

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Estimation of hopping rates from real traffic trajectories

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Abstract

Variety of hopping particle systems (ZRP, TASEP, MTP) have been investigated from the point of view of the traffic flow modelling. Such models are characterized by the local hopping rates determining the model dynamics. Several techniques of estimating appropriatelly the hopping rates from real traffic trajectories are introduced. Properties of corresponding models are discussed.

Key words: Hopping particle systems, stationary distribution, traffic flow.

Consistency rates of MKE under quite general assumptions

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Abstract

The $n^{-1/2}$ consistency in the L_1–norm of the minimum distance density estimators (Kolmogorov, Lévy, Discrepancy estimators) is proved for nonparametric families. Computer simulation of these estimates is shown. Further, the consistency of Kolmogorov estimator is studied under more generalized assumption imposed on the degree of variations DV of the nonparametic family considered.

Key words: Minimum distance estimates, Consistency, Kolmogorov distance

Permanent Learning Needs Forgetting

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Abstract

Bayesian learning provides theoretical basis of the design and exploitation of algorithms in data-streams processing (change detection, hypothesis testing, clustering, etc.). It relies on a recursive parameter estimation of a firmly bounded complexity. Mostly, it has to approximate the exact posterior probability density (pd), which comprises unreduced information about the estimated parameter. In the recursive treatment of the data stream, the latest approximate pd is usually updated using the treated parametric model and the newest data and then approximated. The fact that approximation errors may accumulate over time course is mostly neglected in the estimator design. The talk, based on the paper [1], inspects the estimator design with respect to the error accumulation and concludes that a sort of forgetting (pd flattening) is an indispensable part of a reliable approximate recursive estimation.
Acknowledgment: The research was supported by GACR 13-13502S.

[1] M. Karny, Approximate Bayesian recursive estimation, Information Sciences, 289, 100-111, 2014

Key words: Approximate parameter estimation, Kullback-Leibler divergence Bayesian recursive estimation, Forgetting

Cluster Function in particle ensembles with composite potentials

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Abstract

One way to describe the particle ensemble is to study the cluster function. The particle ensemble with composite potential is a thermodynamic system with the particle interaction through the linear combination of logarithmic and harmonic potential. The mathematical model is composed and the probability density function of particle spacing between two nearest neighbor particles is derived.

We concern with the derivation of the probability density function of spacing of N neighbor particles. These densities are used in the calculation of the cluster function. The numerical results and mathematical predictions are compared finally. The numerical model is made in MATLAB by using the Metropolis algorithm. The main goals are graphical comparisons of the probability densities and the cluster functions.

Key words: Cluster Function, Composite Potential, Headway-Distribution, Particle Ensembles, Thermodynamic Systems

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Ultrasonic Characterization of CFRP Anisotropy

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Abstract

The knowledge about an elastic anisotropy is very important in materials characterisation. In this paper, we present results of a new method for composite material (CFRP) anisotropy measurement. This material is composed of carbon fabric - epoxy layers with different orientation, which makes material stronger and lighter. These specific properties are useful in aerospace and automotive industry and our results can arouse interest in these sectors. Measurements were done with a special multi-directional ultrasonic probe with eight piezoelectric elements used for elastic wave propagation measurement. CFRP anisotropy is shown in two ways: the first method is based on determination of the wave propagation velocities in different directions, and the second way uses the spectral non-linearity between harmonic ratios and signal amplitude, which is a parameter important for detection of defects. Both experimental data are statistically validated. The method was also used for in vivo anisotropy characterization of a human skin. Acknowledgement: Authors gratefully acknowledge institutional support RVO:61388998.

Key words: Anisotropy, composite material, Ultrasonic testing

Proof of Wigner semicircle law

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Abstract

Wigner semicircle law is the fundmental result in the random matrix theory. Briefly, it claims that the distribution of the mixture of the eigenvalues of a Wigner random matrix converges in law to a semicircle distribution when the dimension of the matrix goes to infinity. In other words the distribution of the mixture of corresponding eigenvalues can be approximated by a semicircle distribution for matrices of a high dimension. Such a fact could be used for example to accurately approximate unfolding based on strong theoretical result instead of estimating unfolding statistically and numerically. Note that except for self-adjacency of the random matrix and identity, independence and finiteness of the second moments of its elements there are no other assumptions. Thus, the theorem is quite general and shows the power and universality of the eigenvalues of large random matrices.

Even thought the theorem describes one of the basic properties of random eigenvalues its proof is on the other hand quite long and demanding. Some advanced results from different mathematical areas are necessary to be applied. In the presentation two most famous methods of proving Wigner semicircle law are shown. Specifically, the method of moments and the method of Stieltjes transform. The first mentioned method is more standard and it was actually the first one used to accomplish the prove. Therefore, the major part of the presentation will be focused on this method. At the end of the presentation some other kinds of ensembles of random matrices are discussed as well.

Key words: random matrix, eigenvalue, semicircle, method of moments, Stieltjes transform

Stochastic epidemic models based on human demography

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Abstract

Mathematical models of a spread of an epidemic are nowadays very important topic thanks to the epidemic of Ebola in 2014. If the spread of a disease is known, precautions can be made and optimal

vaccination strategy can be found. First, basic SIR model will be presented. Next, more realistic models describing demographical evolution using Austin-Brewer model are proposed. First hitting time problem for an epidemic outbreak and problem of optimal vaccination are formulated and solved numerically. Finally, regression analysis is carried out on the subjectively best model to examine the dependence between first epidemic hitting time and the parameters. Based on the above analyses, the model seems to be a good candidate for describing real epidemic.

Key words: SIR model, stochastic differential equations, demography, hitting time, optimal vaccination strategy

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Individual approach to evaluate density and flow in egress experiments

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Abstract

The macroscopic quantities as flow and density are basic properties of systems with socio-physical interactions. These quantities were originally defined for many particles systems (e.g. liquids, granular materials), where individual dynamic of a particle can be neglected. But in case of pedestrian dynamic, there is not unitary way how to evaluate them despite of their importance. The Voronoi approach to define both, individual density and individual flow, is presented. These methods are demonstrated by evaluation of the data measured during the egress experiment performed by our research group. Finally, results of Voronoi methods are compared to classic approach and benefits are discussed.

Key words: Voronoi density, Voronoi flow, pedestrian dynamics

Delayed time reversal in non destructive testing for ultrasound focusing

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Abstract

A scheme for shaping the focused ultrasonic wave energy in Non Destructive Testing will have initial validation by physical experiments in complex media. Ultrasonic wave energy can be focused in a pre-determined location using chirp-coded excitation with Time Reversal. Extending this to delayed Time Reversal will allow to shape and control the ultrasonic pulse in the focusing point. The physical experiments also show that a single delta-signal shaped focusing could be improved by delayed Time Reversal. The experiments have been conducted in glued aluminium sample and also Carbon Fibre Reinforced Polymer. The initial shape of the focused wave is of great importance in solitary wave propagation as it affects the evolution of the wave in a dispersive and nonlinear medium. Therefore the future prospects and applicability will be explored with nonlinear wave propagation in mind. The advances in arbitrary pulse shaping are promising for Non Destructive Testing of aeronautical materials and material diagnostics using solitary wave theory.

Key words: Delayed Time Reversal, Nonlinear elastic wave spectroscopy (NEWS), ultrasonics, carbon fibre reinforced polymer (CFRP), solitary waves

Numerical methods for near-optimal control and it's application to SIR model.

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Abstract

Optimal control theory is an interesting field of mathematics which finds applications in different parts of real life. The Optimal control problem and some basic facts are defined at the beginning. Then the sufficient and necessary conditions for near-optimal control are given. In the following part, a numerical iterative algorithm for solution of near-optimal control problem is given. Then the epidemiological SIR

model is introduced. Finally, the near-optimal control of SIR is solved numerically and properties of the solution are discussed.

Key words: Optimal control, numerical methods, differential equation.

Bayesian computation via empirical likelihood

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Abstract

In the most general model settings it is assumed that the parametric likelihood function is unknown. The Approximate Bayesian computational (ABC) methods form a class of methods that sample from the posterior distribution without the availability of the likelihood function. The empirical likelihood forms a nonparametric alternative to the classic likelihood function with well behaving asymptotic properties. We exploit the direct use of empirical likelihood in ABC methods as well as we study the properties of empirical likelihood in Bayesian settings.

Key words: Bayesian, nonparametric, estimation, Monte Carlo, Markov chain, empirical likelihood

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Crowd dynamics observations - multiple case study

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Abstract

Currently, most empirical observations of pedestrian behaviour are gained by specially designed crowd experiments where participants are instructed to follow set instructions. Such an approach has many advantages: predictable behaviour, easy experimental setup or usually clear results. However, one should notice that experimental setup often does not capture the complexity of real life cases. Moreover, pedestrians awareness of participating in an experiment can affect their behaviour.

Therefore, the authors notice the necessity of observation and analysis of real life cases of pedestrian and crowd dynamics. During the past recent years we conducted a number of crowd dynamics observations and analysis. Different types of situations had been observed? ranging from single pedestrian movement to normal condition egress of football stadium tribune.

We summarize our current experience in crowd dynamics observations. Issues such as: the influence of camera setup on data analysis, suitability of different devices in different situations, possible problems that can occur during observation, are also discussed. On the basis of exemplary observations we show the type of data that can be acquired from real case studies and how that data can be used to improve crowd dynamics models.

Key words: crowd dynamics, real life case, crowd observation, normal condition egrees

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Sequential estimation of mixtures in diffusion networks

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Abstract

We study the problem of sequential estimation of mixtures in diffusion networks whose nodes communicate only with their adjacent neighbors. The adopted quasi-Bayesian approach yields a probabilistically consistent and computationally non-intensive and fast method, applicable to a wide class of mixture models with unknown component parameters and weights. Moreover, if conjugate priors are used for inferring the component parameters, the solution attains a closed analytic form.

Key words: Quasi-Bayesian mixture estimation, distributed estimation, sensor networks

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Wavelet processing of acoustic emission signals coming from seismic damage in reinforced concrete

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Abstract

Damage in reinforced concrete structures subjected to earthquake-type tests with the shaking table of the University of Granada (Spain) was assessed with acoustic emission (AE) method. The complex Morlet Continuous Wavelet Transform (CWT) was applied to the AE signals acquired by multiple sensors attached on the structure, which allowed reconstructing the filtered signal corresponding to a

particular scale-frequency band ascribed to concrete fracturing, thus trying to avoid the influence of secondary acoustic emission sources. Presentation will show the results of different tests carried out during the last years by our research group, in terms of the cumulative AE energy, which is showed to be strongly correlated with the deformation energy released by the specimen before the yielding moment of the steel used as reinforcement. Presentation will also introduce a new damage index that uses the wavelet energy, based on the Gutenberg-Richter index, traditionally called as b value in the context of the AE field. The behavior of this index is shown to be well correlated with the local macroscopic concrete fracturing of the specimen.

Key words: acoustic emission, damage, concrete, wavelet, Gutenberg Richter

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Statistical rigidity in the systems of interacting particles

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Abstract

In the systems of random variables among which interactions occur, we cannot often rely on the assumption of independence that is necessary for major probability formulas. The expected value may be influenced by the interactions and, therefore, it might differ from the mean (numerical average) value, leading to a distortion of the variance as well. My research paper elaborates on the theory of statistical rigidity which aims to compensate the variance in such situations. The typical systems having these characteristics are, for example, models of social systems or spectrums of random matrices. Using modern concepts such as unfolding or level spacing, general relations of statistical rigidity are derived in the paper. Furthermore, considering the system based on the model of Dyson gas, methods how to compute and aproximate, if necessary, presented formulas are examined. Additionally, the statistical rigidity of completely dependent, i.e. deterministic particles is also derived. Ultimately, being used to simulate the Dyson gas, the Metropolis-Hastings algorithm is tested with gained formulas in order to optimise the noise value. I will demnostrate the results of my research as well as upcoming challenges.

Key words: statistical rigidity, unfolding, level spacing, Dyson gas, cluster function

Occupancy time series forecasting

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Abstract

In past years the providers of public transport services have started to collect large amounts of raw data which needs to be analyzed. For example the occupancy forecast of the vehicles across certain parts of the route is desired. For this matter the time series theory is a suitable tool. We will go through the problem of analyzing a row ticket data and modeling the occupancy time series with ARIMA and Kalman filter space-state models.

Key words: Time series, real data, public transport analysis, Kalman filter

Lazy learning of environment model from the past

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Abstract

The project addresses a lazy learning approach applied to decision making (DM) problem described in fully probabilistic way. The key idea is to compare a current situation with the similar past instances and use results of the past evaluation to the current situation. The approach can decrease computation complexity and increase quality of learning when no rich alternative information is available.
The proposed approach selects the current local model based proximity of past and current situation. Kullback-Leibler divergence is chosen as the proximity measure. The implemented algorithm is verified on the real management data. The results show that the proposed approach improves prediction quality. The project also proposes a conceptual solution of the learning DM preferences.
The research was undertaken within the applied contract research performed in collaboration of Department of Mathematics, Faculty of Nuclear Engineering, Institute of Information Theory and Automation and a food and beverage company.

Key words: lazy learning, local modelling, prediction for optimisation

Genetic approach to top quark discrimination

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Abstract

Analysis of experimental data, especially the separation of signal from background, plays one of the most important roles in high energy physics. In particular, we aim to a Model Based Clustering method involving the estimation of distribution mixture parameters via the Expectation-Maximization algorithm. Due to the strong dependence of the algorithm on initialization, a new genetic optimization of the algorithm is proposed. It is based on parallel search of the parameter space by the population of individuals undergoing mutation process, which are associated with posterior probabilities of mixture components membership. In addition, the suggested method is tested in the top quark pair production search in lepton+jets channel using data samples collected by the DZero detector at the Tevatron proton-antiproton collider at Fermilab. The results of the analysis obtained by other state-of-the-art multivariate classification techniques are combined using ensemble learning in order to increase the separation efficiency.

Key words: supervised learning, distribution mixtures, genetic optimization, ensemble learning.

Method of Records for Stochastic independence Testing (MRIT)

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Abstract

We present an interesting statistical tool for independence testing in random sequences $(X_1, X_2, \ldots, X_n)$. We show that the expected number of records achieved in i.i.d. sequences of n variables grows very slowly and that the variance of the records number is of the logarithmic type. We illustrate how it can be used for independence testing and we produce the Monte-Carlo simulation for finding out the distributional quantiles needed for that testing at given significance level $\alpha \in (0, 1)$. Also, two examples

of real data will be treated through the Method of Records for Independence Testing (MRIT) and the results will be compared with classical statistical tests of independence.

Key words: i.i.d. sequences, records, tests of independence

Necessary stochastic maximum principle for dissipative systems on infinite time horizon

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Abstract

In the first part of the talk, a general stochastic control problem will be formulated and the approach to the solution using stochastic maximum principle will be presented. In the second part, some concrete control models will be considered (mainly discounted control problem and problem with ergodic cost) and some recent results (based on a joint work with Carlo Orrieri) will be exposed.

Key words: Stochastic maximum principle, stochastic control problem, control models

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News and highlights in Multijet HEP analyses

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Abstract

We present the latest results on multijets top quark properties measured at Tevatron. We improve multivariable analysis techniques and present the measurement of the inclusive top pair production cross section in proton-antiproton collider at a center-of-mass energy 1,96TeV for all RunII data collected with the D0 detector. We consider the final state of the top quark pair containing at least four jets and no lepton. We also give a brief summary of D0 history and main particle discoveries.

Key words: Tevatron, D0, Top Quark, Multijets channel

Numerical results on stochastic control of tumour growth

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Abstract

Pontryagin's maximum principle is widely used tool when dealing with control problem for stochastic differential equations (SDEs). However, this approach does not always leads to result, if one wants to find an analytical expression of optimal control. We will present application of Pontryagin's principle on SDE describing the growth of a cancer tumour, which is governed by Gompertz differential equation generalized to a stochastic case, limits of analytical formulae and numerical solution to the control problem via so-called Forward-Backward numerical scheme.

Key words: stochastic calculus, maximum principle, numerical methods

Challenges in modeling crowd dynamics

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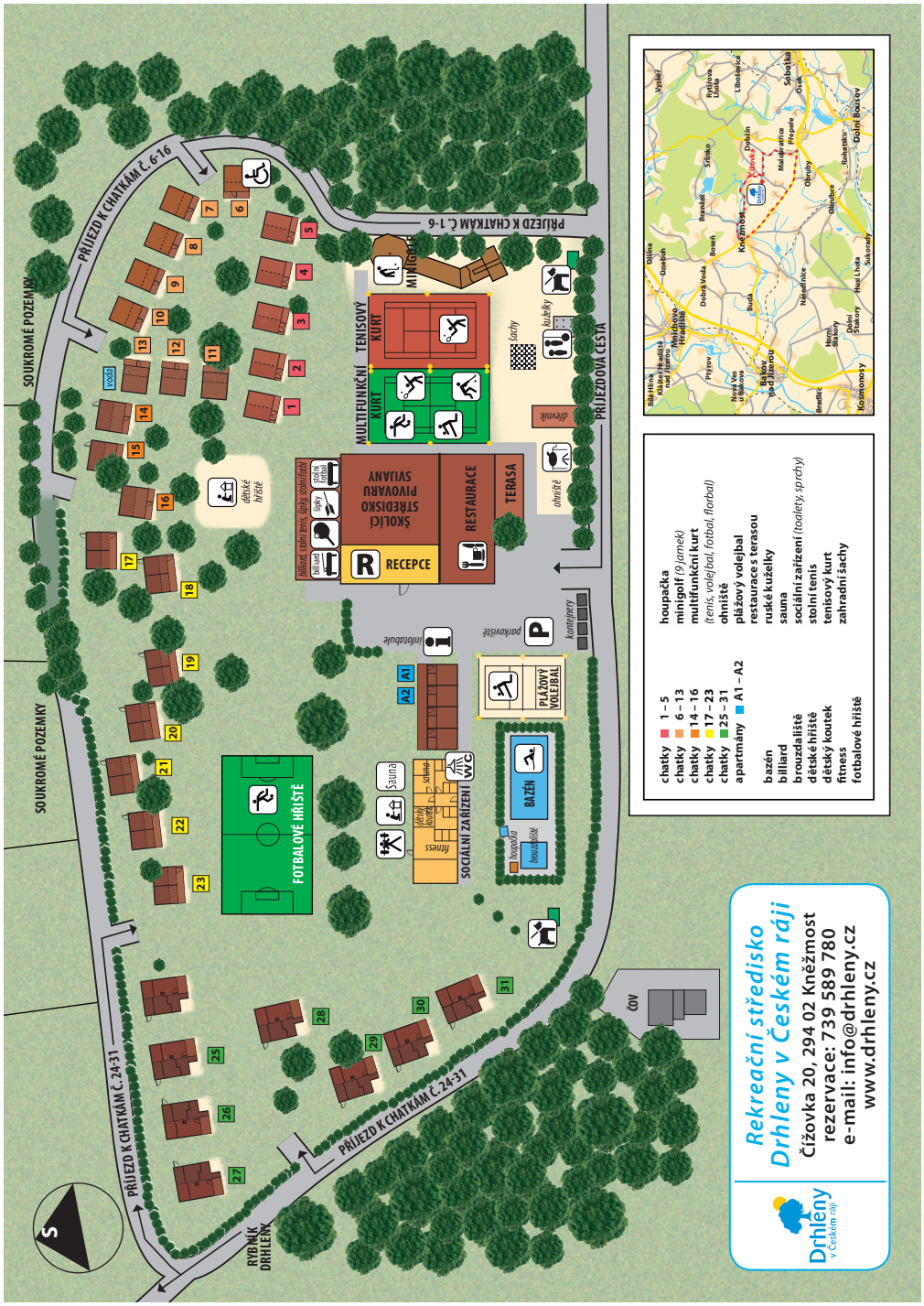
Abstract

One can observe growing interest in crowd dynamics modeling. Different levels of abstraction in pedestrians' decision-making are required for practical implementations. We will discuss some real use cases like "Allianz Arena Project" in the context of application of possible methodologies. We will also discuss issues of efficiency and reliability of different crowd models.

Key words: Agent-based modeling, Cellular Automata

Venue map


SOUKROMÉ POZEMKY
PŘÍJEZD K CHATKÁM Č. 6-16
PŘÍJEZD K CHATKÁM Č. 1-6
PŘÍJEZDOVÁ CESTA
MINIGOLF
MULTIFUNKČNÍ KURT
TENISOVÝ KURT
šachy
kuželky
dřevník
RECEPCE
ŠKOLÍCÍ STŘEDISKO PIVOVARU SVIJANY
RESTAURACE
TERASA
dětské hřiště
atletické hřiště
informace
parkoviště
kontejnery
FOTBALOVÉ HŘIŠTĚ
PLÁŽOVÝ VOLEJBAL
BAZÉN
houpačka
brouzdaliště
SOCIÁLNÍ ZAŘÍZENÍ
Sauna
fitness
WC
ČOV
PŘÍJEZD K CHATKÁM Č. 24-31
RYBNÍK DRHLENY
S
chatky 1 – 5
chatky 6 – 13
chatky 14 – 16
chatky 17 – 23
chatky 25 – 31
apartmány A1 – A2
bazén
billiard
brouzdaliště
dětské hřiště
dětský koutek
fitness
fotbalové hřiště
houpačka
minigolf (9 jamek)
multifunkční kurt
(tenis, volejbal, fotbal, florbal)
ohniště
plážový volejbal
restaurace s terasou
ruské kuželky
sauna
sociální zařízení (toalety, sprchy)
stolní tenis
tenisový kurt
zahradní šachy
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