DTS2018 ESSEN

UNIVERSITÄT DUISBURG ESSEN

Open-Minded

14. Doktorand*innentreffen Stochastik

01.-03. August 2018

[v1.2.1 – 31/07/18]

RTG 2131 HIGH-DIMENSIONAL PHENOMENA IN PROBABILITY

FG STOCHASTIK

d-fine

	Wednesday		Thursday		Friday	
9:00-9:30			Link	Otto	Pieper	Hufnagel
9:30-10:00			Bröker	Musielak	Wapenhans	Kettner
10:00-10:30			Schmitz	Dahmani	Kersting	Lübbers
10:30-11:00			Coffee		Coffee	
11:00-11:30	Registration & Snacks		Caraceni plenary		Rojas	Henning
11:30-12:00					Knichel	Kolesnikov
12:00-12:30	Opening		Lunch		Bussmann	Meißner
12:30-13:00	Nolte	Kloodt			Closing	
13:00-13:30	Huebner	Schulmann				
13:30-14:00	Neumann	Amro				
14:00-14:30	Coffee		Schepers	Leimcke		
14:30-15:00	Sohr	Alhorn	Ehlert	Wiesel		
15:00-15:30	Ramzews	Jakubzik	Matzke	Liebrich		
15:30-16:00	Zou	Reuber	Betken			
16:00-16:30	Coffee					
16:30-17:00	Chudjakow (d-fine)					
17:00-17:30						
17:30-18:00	Coffee		Tour Zollverein			
18:00-18:30	Caraceni (Univ. Bath)					
18:30-19:00						
19:00-19:30	Exhibition opening					
19:30-END	Food, Drinks, Exhibition		Dinner			

Contents

Program

Sessions

The main part of the program consists of 2×6 sessions of talks of 20-25 minutes and one plenary talk by Alessandra Caraceni.

Important: If you are giving a talk, please make sure to provide your slides *before* the session begins. Each room is equipped with a beamer, laptop, presenter and blackboards.

Special program

Wednesday afternoon we have prepared a special program focused on women in mathematics. Despite being focused on women, this part of the program is aimed at at *all* particitpants.

There will be two plenary talks by Dr. Tatjana Chudjakow from d-fine and by Dr. Caraceni Alessandra from the University of Bath. Both speakers will share their experiences with a career in the industry and in academia respectively.

The program is concluded in the evening with a reception at the opening of the photo exhibition *Women of Mathematics throughout Europe. A gallery of portraits*.

Social events

On Thursday we have planned a tour to the UNESCO world heritage site *Zeche Zollverein*. After the tours we will meet at the restaurant *die kokerei* close to Zeche Zollverein for a conference dinner.

Wednesday 01. August

11:00-12:00	**Registration and Snacks** **Room** WSC-S-U-3.02

12:00-12:30	**Opening** **Room** WSC-S-U-4.02

	Optimal Control **Chair** Marvin Kettner **Room** WSC-S-U-3.03	**Statistical Inference** **Chair** Sebastian Kersting **Room** WSC-S-U-3.01
12:30-13:00	**Sascha Pascal Nolte** 27 *Robust optimal stopping without time-consistency*	**Nick Kloodt** 19 *Testing in Transformation Models*
13:00-13:30	**Tobias Huebner** 15 *Solving stopping-problems with an empirical dual optimization approach*	**Viktor Schulmann** 33 *Inference of Stopping Times with Application to Particle Lifetime Estimation*
13:30-14:00	**Berenice Anne Neumann** 26 *Solution techniques for mean field games with finite state and action spaces*	**Lubna Amro** 10 *Multiplication-Combination Tests for Incomplete Paired Data*

14:00-14:30	**Coffee** **Room** WSC-S-U-3.02

	Problems in Probability **Chair** Roland Meizis **Room** WSC-S-U-3.03	**Statistics** **Chair** Viktor Schulmann **Room** WSC-S-U-3.01
14:30-15:00	**Tobias Sohr** 34 *How to Break Impulse Control Problems Down into Something Easier*	**Kira Alhorn** 9 *Optimal designs for frequentist model averaging*
15:00-15:30	**Leon Ramzews** 29 *Unlabelled Set Partitions*	**Mirko Alexander Jakubzik** 17 *Applications of a minimum distance estimator for specific self-exciting point processes*
15:30-16:00	**Christina Zou** 36 *The construction of Root's solution to Skorokhod embedding*	**Matthias Reuber** 30 *Modellierung der Abhängigkeitsstruktur stündlicher Strahlungsdaten mithilfe von Copula basierten Zeitreihenmodellen*

16:00-16:30	**Coffee** **Room** WSC-S-U-3.02

	Special Program: Women in Math **Room** WSC-S-U-4.02
16:30-17:30	**Tatjana Chudjakow** Plenary Talk
17:30-18:00	**Coffee** WSC-S-U-3.02
18:00-19:00	**Alessandra Caraceni** Plenary Talk
19:00-19:30	**Women in Math Exhibition** Opening
19:30	**Women in Math Exhibition** Snacks and Drinks

Thursday 02. August

	Stochastic Analysis **Chair** Anselm Hudde **Room** WSC-S-U-3.03	**Calculus of Stocastic Processes** **Chair** Nicole Hufnagel **Room** WSC-S-U-3.01
9:00-9:30	**Robert Link** 23 *Existence and uniqueness of solutions of infinite dimensional Kolmogorov equations*	**Moritz Otto** 28 *Functional Poisson approximation of thinned Poisson processes*
9:30-10:00	**Yannic Bröker** 11 *Central limit theorem and localization for the stochastic heat equation in $d \geq 3$*	**Kevin Musielak** 25 *Studying Markov Processes through its Symbol*
10:00-10:30	**Lars Schmitz** 32 *About the front of the inhomogeneous Fisher-KPP equation and its linearisation, the parabolic Anderson model*	**Zoubir Dahmani** 13 *Mixed operators of fractional calculus and applications*

10:30-11:00	**Coffee** **Room** WSC-S-U-3.02

	Plenary Session **Room** WSC-S-U-4.02
11:00-12:00	**Alessandra Caraceni** 13 *The geometry of large planar maps: about random quadrangulations of the half-plane*

12:00-14:00	**Lunch**

	Probability on Graphs **Chair** Leonid Kolesnikov **Room** WSC-S-U-3.03	**Finance and Insurance** **Chair** Berenice Anne Neumann **Room** WSC-S-U-3.01
14:00-14:30	**Markus Schepers** 31 *The local clustering coefficient in hyperbolic random graphs*	**Gregor Leimcke** 22 *Optimal control in insurance mathematics under partial information*
14:30-15:00	**Johannes Ehlert** 14 *Existence of infinite random loops on trees*	**Johannes Wiesel** 35 *A unified framework to robust modelling of financial markets in discrete time*
15:00-15:30	**Kilian Matzke** 24 *The Triangle Condition for the Random Connection Model in High Dimensions*	**Felix-Benedikt Liebrich** 22 *Efficient allocations under probabilistic sophistication: a unifying approach*
15:30-16:00	**Carina Betken** 10 *Sedentary Random Waypoint*	*Cancelled*

17:30-19:30	**Tour Zollverein**

from 19:30	**Dinner**

Friday 03. August

	Probability Theory in Applications **Chair** Johannes Wiesel **Room** WSC-S-U-3.03	**Stochastic Processes** **Chair** Carina Betken **Room** WSC-S-U-3.01
9:00-9:30	**Daniel Pieper** 29 *Altruistic defense traits in structured populations: Many-demes limit in the sparse regime*	**Nicole Hufnagel** 16 *Girsanov's Theorem for Bessel processes*
9:30-10:00	**Alexander Wapenhans** 34 *The White Knight Model - Propagation of Malware on a D2D Network*	**Marvin Kettner** 18 *Persistence Probabilities of Autoregressive Processes*
10:00-10:30	**Sebastian Kersting** 18 *Estimation of an improved surrogate model in uncertainty quantification by neural networks*	**Jan-Erik Lübbers** 24 *Displacement of biased random walk in a one-dimensional percolation model*

10:30-11:00	**Coffee** **Room** WSC-S-U-3.02

	Limit Theorems **Chair** Yannic Bröker **Room** WSC-S-U-3.03	**Statistical Mechanics** **Chair** Lars Schmitz **Room** WSC-S-U-3.01
11:00-11:30	**Geronimo Rojas** 31 *On the rate of convergence of symmetric Feller processes on compact metric spaces via occupation time*	**Florian Henning** 14 *Gibbs-non-Gibbs transition in the fuzzy Potts model with a Kac-type interaction: Closing the Ising gap*
11:30-12:00	**Lukas Knichel** 20 *The Rate of Convergence to a Gamma Target on the Wiener Space*	**Leonid Kolesnikov** 21 *Critical 1-arm exponent for the Ising model on regular trees*
12:00-12:30	**Stephan Bussmann** 12 *Central limit theorems in a boolean model with dependencies*	**Daniel Meißner** 25 *Spin-flip dynamics for the Curie-Weiss-Potts model*

12:30-13:00	**Closing** **Room** WSC-S-U-4.02

Abstracts

Optimal designs for frequentist model averaging

WSC-S-U-3.01
Wed 14:30

Kira Alhorn

Technische Universität Dortmund

We consider the problem of designing experiments for the estimation of a target in regression analysis if there is uncertainty about the parametric form of the regression function. A new optimality criterion is proposed, which minimizes the asymptotic mean squared error of the frequentist model averaging estimate by the choice of an experimental design. Necessary conditions for the optimal solution of a locally and Bayesian optimal design problem are established. The results are ilustrated in several examples and it is demonstrated that Bayesian optimal designs can yield a reduction of the mean squared error of the model averaging estimator up to 45%.

WSC-S-U-3.01
Wed 13:30

Multiplication-Combination Tests for Incomplete Paired Data

Lubna Amro
Universität Ulm

We consider statistical procedures for hypothesis testing of real valued functionals of matched pairs with missing values. In order to improve the accuracy of existing methods, we propose a novel multiplication combination procedure. Dividing the observed data into dependent (completely observed) pairs and independent (incompletely observed) components, it is based on combining separate results of adequate tests for the two sub datasets. Our methods can be applied for parametric as well as semi- and nonparametric models and make efficient use of all available data. In particular, the approaches are flexible and can be used to test different hypotheses in various models of interest. This is exemplified by a detailed study of mean- as well as rank-based approaches. Extensive simulations show that the proposed procedures are more accurate than existing competitors. A real data set illustrates the application of the methods.

WSC-S-U-3.03
Thu 15:30

Sedentary Random Waypoint

Carina Betken
Universität Osnabrück

We study three fundamental problems in a probabilistic model for large random networks. More specifically we look at an extension of the random waypoint mobility model, in which we assign a site to each participant around which the participant's movements are centered and to which the walker returns now and then. We are interested in the following three questions: detection (the time until some target point gets in contact with a node of the network),

coverage (the time until a certain region has been completely discovered by the nodes of the network) and percolation (the time until a given node first belongs to the infinite component of the network).

Central limit theorem and localization for the stochastic heat equation in $d \geq 3$

WSC-S-U-3.03
Thu 9:30

Yannic Bröker
Universität Münster

We consider the spatially smoothened stochastic heat equation (SHE)

$$\mathrm{d}u_{\varepsilon,t} = \frac{1}{2}\Delta u_{\varepsilon,t}\mathrm{d}t + \beta\varepsilon^{\frac{d-2}{2}} u_{\varepsilon,t}\mathrm{d}B_{\varepsilon,t}$$

in $d \geq 3$. Here B is a space-time white noise and the parameter β, known as the inverse temperature, captures the strength of the noise. The Feynman-Kac formula relates the solution $u_{\varepsilon,t}$ to the partition function of the Brownian directed polymer in a random environment. In a recent work by Mukherjee, Shamov and Zeitouni, using techniques from Gaussian multiplicative chaos, it was shown that, for β small enough, the solution $u_{\varepsilon,t}$ of the SHE converges as $\varepsilon \to 0$ in distribution to a strictly positive random variable, while for β large, these converge in probability to zero. We investigate the behavior of the actual polymer measure, show that, for β small, the endpoint of the polymer satisfies an almost sure (quenched) central limit theorem, while for β large, the endpoint is localized in random regions of the space. The methods of our proof are based on the translation-invariant compactification theory developed by Mukherjee and Varadhan. This is a joint work with my supervisor Chiranjib Mukherjee.

WSC-S-U-3.03
Fri 12:00

Central limit theorems in a boolean model with dependencies

Stephan Bussmann

Universität Osnabrück

A boolean model usually consists of random compact sets assigned to Poisson points in $\mathbb{R}^n$. In existing literature the distribution of the sets is independent from the distribution of the points, which is an unrealistic assumption in many applications.
We try to remedy that by introducing a random map generator. The sets are then chosen according to the positions of the points on the generated map.
We build on the work of [1] and [2] and try to apply their results in our setting.

References

[1] Günter Last and Mathew Penrose. *Lectures on the Poisson Process*. Cambridge University Press, 2017.

[2] Raphaël Lachièze-Rey and Giovanni Peccati. *New Berry-Esseen bounds for functionals of binomial point processes* . The Annals of Applied Probability, 2017.

The geometry of large planar maps: about random quadrangulations of the half-plane

Plenary
WSC-S-U-4.02
11:00

Alessandra Caraceni
University of Bath

The investigation of large random combinatorial objects has spawned a very active research field centred around local and scaling limits for different classes of *random planar maps*. After an introduction which will get us acquainted with some fundamental and fascinating objects in the field, such as the Continuum Random Tree and the Brownian Map, we shall focus on the Uniform Infinite Quadrangulation of the Half-Plane (UIHPQ), which arises as a local limit of random quadrangulations with a boundary whose size and perimeter are sent to infinity. Using tools from both combinatorics and stochastic analysis, a wide range of results can be obtained about different features of the UIHPQ's geometry, some of which have interesting implications for an annealed model of self-avoiding walks on large random quadrangulations.

Mixed operators of fractional calculus and applications

WSC-S-U-3.01
Thu 10:00

Zoubir Dahmani
University of Mostaganem

In this talk, we establish new mixed integral operators that generalise some recent results on fractional calculus. We prove some of their properties, then we discuss some of their applications.

WSC-S-U-3.03
Thu 14:30

Existence of infinite random loops on trees

Johannes Ehlert
Technische Universität Darmstadt

We consider a model of random loops on graphs that generalizes the Random Interchange/Random Stirring Model and has connections to the Quantum Heisenberg Ferro- and Antiferromagnet as well as to the Quantum XY-Model.

An interesting question is, whether or not there is an infinite loop with positive probability. To resolve this problem we intend to find sufficient conditions depending only on the underlying parameters. Since on general graphs – and even on $\mathbb{Z}^d$ – this is quite challenging, we restrict ourselves to trees. The talk will give insights on how we can exploit the additional properties of loops in this situation.

WSC-S-U-3.01
Fri 11:00

Gibbs-non-Gibbs transition in the fuzzy Potts model with a Kac-type interaction: Closing the Ising gap

Florian Henning
Ruhr-Universität Bochum

We complete the investigation of the Gibbs properties (with respect to the notion of sequential Gibbsianness) of the fuzzy Potts model on the d-dimensional torus with Kac-type interaction which was started by B. Jahnel and C. Külske. As our main result, we extend the previous sharpness result of mean-field bounds for the case of all fuzzy classes being of size at least three to cover all possible cases of fuzzy transformations, allowing also for the occurrence of Ising classes. The closing of this previously left open Ising-gap involves an analytical argument showing uniqueness

of minimizing profiles for certain non-homogeneous conditional variational problems.

Based on joint work with Richard Kraaij and Christof Külske

Solving stopping-problems with an empirical dual optimization approach

WSC-S-U-3.03
Wed 13:00

Tobias Huebner
Universität Duisburg-Essen

In this talk we give a new method to solve the standard-stopping problem

$$\sup_{\tau \in \mathcal{T}} \mathbb{E}\left[Z_\tau\right]$$

numerically.
The starting point is the well-known dual representation

$$\sup_{\tau \in \mathcal{T}} \mathbb{E}\left[Z_\tau\right] = \inf_{M \in \mathcal{A}} \mathbb{E}\left[\sup_{t \in [0,T]} \left(Z_t - M_t\right)\right] = \sup_{t \in [0,T]} \left(Z_t - M_t^*\right) \quad a.s.$$

Here, $\mathcal{A}$ denotes the set of all martingales starting in zero. M^* stands for the martingale part of the Doob-Meyer-decomposition of the Snell-Envelope of Z_t.
The task is to find a proper approximation of M^*.
One idea is to select a subclass $\mathcal{A}_\psi := \{M_\psi | \psi \in \Psi\} \subset \mathcal{A}$ of parameterized martingales for a proper estimation, based on a monte-carlo-type-method.
Here we present a refinement of the so called empirical dual optimization approach introduced in Belomestny [AAP 2013].
We give convergence rates depending on the space of parameter-functions Ψ and its entropy-numbers. Results of empirical-process-theory are used to calculate these convergence-rates.
Furthermore we give an outlook how to extend this method to

non-standard stopping-problems, where the ordinary conditional expectation is replaced by some non-linear functional. We are interested in problems where we cannot invoke the established dynamic programming principle to solve standard stopping-problems.

WSC-S-U-3.01
Fri 9:00

Girsanov's Theorem for Bessel processes

Nicole Hufnagel

Technische Universität Dortmund

Girsanov's Theorem for the Brownian motion plays an important role within the financial mathematics and for the construction of estimators for diffusions. This raises the question of transfering this result to Dunkl processes, which are generalizations of the Brownian motion. We can tackle this question by considering the absolute value of a Dunkl process, a continuous Bessel process. In particular, a Dunkl process is the unique martingale, whose absolute value is a Bessel process, which is helpful for statements about the original process.

Applications of a minimum distance estimator for specific self-exciting point processes

WSC-S-U-3.01
Wed 15:00

Mirko Alexander Jakubzik
Technische Universität Dortmund

In this contribution based on a paper by Kopperschmidt and Stute published in 2013 we study minimum distance estimation for self-exciting point processes. In a semi-parametric modelling approach we invoke the compensator of a counting process given by the Doob-Meyer decomposition to predict its qualitative behaviour. The introduced minimum distance estimator yields consistent and asymptotically gaussian distributed estimates for the parametric part of the predictor.

While the main results concerning these asymptotic properties are due to Kopperschmidt and Stute, we augment the range of applications by discussing models convenient for practical usage. This approach encompasses load-sharing systems commonly employed in civil engineering that also allow for damage accumulation. We derive formulae to explicitly compute the covariance matrix of the minimum distance estimator and establish the corresponding confidence sets in the case of specific self-exciting point processes, e.g. the class of shifted birth processes. Furthermore we provide simulation based methods to obtain approximate confidence sets whenever the exact covariance matrix can not be determined. In conclusion, prediction intervalls for the underlying counting process are deduced from these confidence sets and debated in view of simulation studies as well as real data obtained through a civil engineering experiment that took place at TU Dortmund University.

WSC-S-U-3.03
Fri 10:00

Estimation of an improved surrogate model in uncertainty quantification by neural networks

Sebastian Kersting
Technische Universität Darmstadt

Quantification of uncertainty of a technical system is often based on a surrogate model of a corresponding simulation model. In any application the simulation model will not describe the reality perfectly, and consequently the surrogate model will be imperfect. We propose a method to combine observed data from the technical system with simulated data from the imperfect simulation model in order to estimate an improved surrogate model consisting of multi-layer feedforward neural networks, and show that under suitable assumptions this estimate is able to circumvent the curse of dimensionality. Based on this improved surrogate model we show a rate of convergence result for density estimates. The practical usefulness of the newly proposed estimates is demonstrated by using them to predict the uncertainty of a lateral vibration attenuation system with piezo–elastic supports.

WSC-S-U-3.01
Fri 9:30

Persistence Probabilities of Autoregressive Processes

Marvin Kettner
Technische Universität Darmstadt

In this talk we consider a certain class of autoregressive processes and study the probability that such a process remains nonnegative up to time $N \in \mathbb{N}$, the so-called persistence probability. We are interested in the asymptotic behaviour of these probabilities. A recent result by Aurzada, Mukherjee and Zeitouni (2017) shows that under certain conditions this quantity decreases exponentially fast and that the rate of decay can be identified by the

largest eigenvalue of some integral operator. To date, this eigenvalue and hence the desired rate of decay could be computed only in a few particular examples. We present a perturbation argument to determine a series expansion of the eigenvalue (in the parameter of the autoregressive process) to deal with this problem.

Testing in Transformation Models

WSC-S-U-3.01
Wed 12:30

Nick Kloodt
Universität Hamburg

Almost every statistician is familiar with or at least has heard of regression models. One possible extension of such models consists in transforming the dependent variable in order to satisfy model assumptions or to improve the applicability for small sample sizes. Doing so leads to several new statistical questions such as existence, uniqueness or estimation of the so-called transformation function.

After a brief introduction into transformation models in general, a nonparametric estimating technique for transformation functions is given. Subsequently, this estimator is used to construct a test for the null hypothesis of a parametric transformation function. Although all estimators, test statistics and corresponding asymptotic results are presented, instead of a detailed elaboration it is rather given a rough idea of how to develop them.

WSC-S-U-3.03
Fri 11:30

The Rate of Convergence to a Gamma Target on the Wiener Space

Lukas Knichel

Ruhr-Universität Bochum

In 2005, Nualart and Peccati introduced the famous "fourth moment theorem", which states that a sequence of random variables inside a fixed Wiener chaos converges to a standard Gaussian random variable if and only if the fourth moments converge to 3 (the fourth moment of a standard Gaussian). The method of Gaussian analysis was later combined with Stein's method (Nourdin & Peccati 2009) to prove quantitative versions of the fourth moment theorem. In 2015, Nourdin and Peccati showed that the exact rate of convergence in total variation is determined by the third and fourth cumulants ("The optimal fourth moment theorem"). In particular, they were able to remove the square root from the upper bound in the result from 2009. In this talk, we consider the case where the target is distributed according to a (centered) Gamma distribution. Under certain technical conditions, we are able to remove the square root in the upper bound from the previous results, and even obtain a lower bound of the same order. This talk is based on the preprint arXiv:1806.03878.

Critical 1-arm exponent for the Ising model on regular trees

WSC-S-U-3.01
Fri 11:30

Leonid Kolesnikov

Ludwig-Maximilians-Universität München

We consider the ferromagnetic nearest-neighbor Ising model on regular trees (Bethe lattice), which is well-known to undergo a phase transition in the absence of an external magnetic field. The behavior of the model at critical temperature can be described in terms of various critical exponents; one of them is the critical 1-arm exponent ρ which characterizes the rate of decay of the (root) magnetization as a function of the distance to the boundary. The crucial quantity we analyze in this work is the thermal expectation of the root spin on a finite subtree, where the expected value is taken with respect to a probability measure related to the corresponding finite-volume Hamiltonian with a fixed boundary condition. The spontaneous magnetization, which is the limit of this thermal expectation in the distance between the root and the boundary (i.e., in the height of the subtree), is known to vanish at criticality. We are interested in a quantitative analysis of the rate of this convergence in terms of the critical 1-arm exponent ρ.

Optimal control in insurance mathematics under partial information

WSC-S-U-3.01
Thu 14:00

Gregor Leimcke
Karlsruher Institut für Technologie

We consider the surplus process of an insurance company with several insurance classes and we suppose that the insurance company is interested in an investment and reinsurance strategy which maximizes the expected exponential utility of terminal wealth. The claim arrivals of the insurance classes are modelled by a multivariate point process with interdependencies between the marginal point processes where the dependence modelling is reduced to the choice of thinning probabilities. We assume that the thinning probabilities are unobservable. This leads to a stochastic control problem under partial information. With the help of filter theory, it is possible to reduce this partially observable control problem to one with complete observation. Using stochastic control theory, we identify an optimal investment and reinsurance strategy.

Efficient allocations under probabilistic sophistication: a unifying approach

WSC-S-U-3.01
Thu 15:00

Felix-Benedikt Liebrich
Ludwig-Maximilians-Universität München

The problem of optimising individual utilities or risks aggregated over a system of agents has been subject of extensive mathematical and economic research for decades. Particular attention has been paid to *probabilistically sophisticated* individual utilities, which means that they rank *Savage acts* — random variables — in a way which only depends on their distribution under a fixed reference probability measure. Under probabilistic sophistication

and mild further conditions the optimisation problem turns out to have solutions which are comonotone allocations of an aggregated quantity. The talk presents a unifying framework in which comonotone solutions to maximising aggregated probabilistically sophisticated individual utilities can be found. We strongly emphasise clear-cut meta results in our approach. (Joint work with Gregor Svindland)

Existence and uniqueness of solutions of infinite dimensional Kolmogorov equations

WSC-S-U-3.03
Thu 9:00

Robert Link
Universität Duisburg-Essen

It is well known from the Feynman-Kac formula that a classical solution of the Kolmogorov backward equation can be written as the expectation of the solution of the corresponding SDE. In 2015 M. Hairer, M. Hutzenthaler, and A. Jentzen gave a finite dimensional example of a Kolmogorov backward equation with globally bounded and smooth coefficients and a smooth initial function with compact support such that the unique viscosity solution is not locally Hölder continuous. Moreover, they proved in the finite dimensional case that under suitable assumption the Kolmogorov backward equation has a unique viscosity solution which can be represented as the expectation of the solution of the corresponding SDE.

In the talk I will generalize this result to infinite dimensional Hilbert spaces and SPDEs. Therefore I will use a more general notation of viscosity solution introduced by H. Ishii and show that under suitable assumptions the expectation of the solution of an SPDE is the unique viscosity solution of the corresponding Kolmogorov backward equation.

Displacement of biased random walk in a one-dimensional percolation model

WSC-S-U-3.01
Fri 10:00

Jan-Erik Lübbers
Technische Universität Darmstadt

Suppose an ant is placed in a randomly generated, infinite maze. Having no orientation whatsoever, it starts to move along according to a nearest neighbour random walk. Now furthermore, suppose the maze is tilted, such that the ant makes a step along the slope with higher probability than in the opposite direction. Tracking the ant's position, we are interested in the long-term behaviour of the corresponding random walk.
We study this model in the context that the maze is given by a one-dimensional percolation cluster. Depending on the bias parameter λ of the walk, its linear speed converges almost surely towards a deterministic value $\overline{v}$. This limit exhibits a phase transition from positive value to zero at a critical value of λ. We investigate the typical order of fluctuations of the walk around $\overline{v}$ in the ballistic speed regime, and the order of displacement from the origin in the critical and subballistic speed regimes.

The Triangle Condition for the Random Connection Model in High Dimensions

WSC-S-U-3.03
Thu 15:00

Kilian Matzke
Ludwig-Maximilians-Universität München

We consider the random connection model, which is a continuum percolation model. We discuss analogues to basic tools from discrete percolation theory to then adapt the lace expansion to fit the framework of the underlying continuum space Poisson point processes. This allows us to derive the triangle condition above the

upper critical dimension and furthermore to establish the infrared bound. From this, mean-field behavior of the model can be deduced.

Spin-flip dynamics for the Curie-Weiss-Potts model

WSC-S-U-3.01
Fri 12:00

Daniel Meißner
Ruhr-Universität Bochum

We study Gibbs-non-Gibbs transitions of the Curie-Weiss-Potts model under symmetric independent spin-flip. As usual this is related to the study of minimizers of a rate function of a constrained first layer model. Unlike in the respective Curie-Weiss setting numerical studies indicate the existence of bad points above the critical temperature of the initial model and possibly intermittent Gibbsian behaviour.

Studying Markov Processes through its Symbol

WSC-S-U-3.01
Thu 9:30

Kevin Musielak
Universität Siegen

Under reasonable assumptions (e.g. Feller), we can associate any Markov process with the semigroup given by

$$T_t u(x) = \mathbb{E}^x u(X_t).$$

The generator A given by

$$\lim_{t \searrow 0} \frac{T_t u - u}{t}$$

(defined on the domain where above limit exists strongly) is a pseudo-differential operator with a symbol q. It turns out that the symbol is given by

$$q(x,\xi) = -\lim_{t \searrow 0} \frac{\mathbb{E}^x \left(e^{i}(X_t - x)'\xi\right) - 1}{t}.$$

For a Lévy process the (space homogenous) symbol is simply the Lévy-Khintchine exponent. In this talk, we want to show possibilities to analyze some properties of the process (e.g. Hausdorff dimension, Hölder continuity, γ-variation, maximal inequalities) through its symbol. In the end, we present some generalizations to the time-dependent case.

Solution techniques for mean field games with finite state and action spaces

WSC-S-U-3.03
Wed 13:30

Berenice Anne Neumann
Universität Hamburg

Mean field games have been introduced by Lasry and Lions as well as Huang et al. as a model that describes dynamic games with a large number of players that incorporate explicit interaction, which has been extensively used since then for several socioeconomic applications. Up to now, the theoretical investigations where done for continuous action spaces with mostly continuous state spaces, but also finite action spaces have been considered. The methodology for solving these problems crucially relies on the standard assumption that for each population distribution the responding agent has a unique optimal control. If one considers finite action spaces this assumption will only hold for trivial models, that is the techniques used so far are no longer applicable. As many applications nonetheless require the choice between finitely many actions, we propose a model with finite state

and action space, show existence of stationary solutions given very mild assumptions and propose solution techniques that allow to compute all stationary mean field equilibria also those that are randomized.

Robust optimal stopping without time-consistency

WSC-S-U-3.03
Wed 12:30

Sascha Pascal Nolte

Universität Duisburg-Essen

In the context of robust optimal stopping one aim is to prove minimax identities of the form

$$\inf_{\mathbb{Q}\in\mathcal{Q}} \sup_{\tau\in\mathcal{T}} \mathbb{E}_{\mathbb{Q}}[Y_\tau] = \sup_{\tau\in\mathcal{T}} \inf_{\mathbb{Q}\in\mathcal{Q}} \mathbb{E}_{\mathbb{Q}}[Y_\tau]$$

where Y is an adapted process on some filtered probability space, $\mathcal{T}$ is a set of stopping times and $\mathcal{Q}$ is a set of probability measures. Such minimax results play an important role in financial mathematics, especially in the characterization of arbitrage-free prices for American options.
Normally, the proof relies on the assumption that $\mathcal{Q}$ satisfies the property of "time-consistency" which can be regarded as an extension of the "tower property" for conditional expectations to the whole family of involved conditional expectations. The crucial point is that under this property it is possible to modify the dynamic programming principle which is one of the standard techniques to solve ordinary stopping problems.
Unfortunately, time-consistency is very restrictive. In this talk we present a different kind of conditions that ensure the desired minimax result. The key is to impose a compactness assumption on the set $\mathcal{Q}$.
Furthermore, we give a short outlook how to extend the method

to robust Dynkin games. In this context the question is for which sets $\mathcal{Q}$ and processes R the following identity holds

$$\inf_{\tau\in\mathcal{T}} \sup_{\sigma\in\mathcal{T}} \sup_{\mathbb{Q}\in\mathcal{Q}} \mathbb{E}_{\mathbb{Q}}[R(\tau,\sigma)] = \sup_{\mathbb{Q}\in\mathcal{Q}} \sup_{\sigma\in\mathcal{T}} \inf_{\tau\in\mathcal{T}} \mathbb{E}_{\mathbb{Q}}[R(\tau,\sigma)].$$

WSC-S-U-3.01
Thu 9:00

Functional Poisson approximation of thinned Poisson processes

Moritz Otto

Karlsruher Institut für Technologie

We consider stationary point processes that arise as a dependent thinning from a stationary Poisson process. Based on the assumption that the thinning depends only locally on the underlying Poisson process, we derive a result for Poisson process approximation of an appropriate scaling of the thinned process. In its proof we construct an adequate coupling between the thinned process and a Palm version of itself. We discuss implications of our result for the theory of extremes of random spatial structures and present an application in the context of random geometric graphs.

Altruistic defense traits in structured populations: Many-demes limit in the sparse regime

WSC-S-U-3.03
Fri 9:00

Daniel Pieper
Universität Duisburg-Essen

We discuss spatially structured Wright-Fisher type diffusions modelling the frequency of an altruistic defense trait. These diffusions arise as the limit of spatial Lotka-Volterra type models with a host population and a parasite population, where one type of host individuals (the altruistic type) is more effective in defending against the parasite but has a weak reproductive disadvantage. For the many-demes limit (mean-field approximation) hereof, we obtain a propagation of chaos result in the case where only a few diffusions start outside of an accessible trap. In this "sparse regime", the system converges in distribution to a forest of trees of excursions from the trap.

Unlabelled Set Partitions

WSC-S-U-3.03
Wed 15:00

Leon Ramzews
Ludwig-Maximilians-Universität München

We study combinatorial classes $\mathcal{G}$ which satisfy the multiset-construction in the unlabelled setting, i.e., any structure in $\mathcal{G}$ is composed of a multiset of unlabelled structures from an underlying class $\mathcal{C}$. For example, graphs can be viewed as a multiset of connected graphs. Let G_n be drawn uniformly at random from the set of all structures in $\mathcal{G}$ having size n. A central parameter in this setting is the distribution of the number of components $\kappa(G_n)$ – the number of elements in the multiset –, which is known to converge in distribution. Here we determine the *tails* of $\kappa(G_n)$, under the rather general assumption that the ordinary generating function of $\mathcal{C}$ is sub-exponential. Further, we prove a phenomenon,

which we call *extreme condensation*: when sampling an object of size n and with N components uniformly at random, it "typically" consists of one large component containing almost all atoms and $N - 1$ components of size $o(1)$.

Modellierung der Abhängigkeitsstruktur stündlicher Strahlungsdaten mithilfe von Copula basierten Zeitreihenmodellen

WSC-S-U-3.01
Wed 15:30

Matthias Reuber
Universität Siegen

Die weltweite Bedeutung von Strom aus erneuerbaren Energiequellen, wie z.B. Photovoltaik, ist in den vergangenen Jahren immer weiter angestiegen. In vielen Anwendungsbereichen ist insbesondere die Modellierung des stündlichen Ertrages von Interesse. Dabei besteht eine hohe Abhängigkeit zwischen Werten aufeinanderfolgender Stunden, besonders in den oberen Quantilen (Upper Tail Dependence). Wir betrachten stündliche Strahlungsdaten und stellen einen Ansatz vor, bei dem wir die multivariaten Abhängigkeiten mit geeigneten Copulas beschreiben. Die Randverteilungen der einzelnen Stunden modellieren wir mit Beta-Verteilungen. Dazu benötigen wir geeignete obere und untere Grenzen der stündlichen Strahlung, die wir durch eine Kombination von einer Quantil-Regression und Methoden der Extremwerttheorie erhalten. Mit Hilfe eines Event-based Scores evaluieren wir dann das Verhalten in den oberen Tails und stellen einen Vergleich zu einfachen Benchmark-Modellen an.

On the rate of convergence of symmetric Feller processes on compact metric spaces via occupation times

WSC-S-U-3.03
Fri 11:00

Geronimo Rojas
Universität Duisburg-Essen

We introduce a new distance in the space of càdlàg paths which induces the Skorohod topology. In contrast to the Skorohod distance which takes off from the supremum norm by simultaneously trying to match jumps points and their heights, our distance evaluates the occupation times until hitting balls. We will apply this new notion of distance to symmetric Feller processes with compact state space which can be associated with a resistance metric. This allows to obtain a bound on the speed of weak convergence in path space in terms of the Gromov-Hausdorff-Prohorov distance of the corresponding resistance metric measure spaces.

The local clustering coefficient in hyperbolic random graphs

WSC-S-U-3.03
Thu 14:00

Markus Schepers
University of Groningen

The local clustering coefficient of a vertex of a graph measures the ratio of adjacent neighbours among all pairs of neighbours. Hyperbolic random graphs are given by a collection of points distributed uniformly in a hyperbolic disk with edges between nearby vertices. This model was invented by Krioukov et al. and has been suggested as a suitable model for real-world networks such as the Internet. In this project we study the local clustering coefficient averaged over all vertices of degree k in the hyperbolic

random graph in the probabilistic limit (convergence in probability) as the number of vertices n tends to infinity. We consider both the case of a fixed degree k, as well as a sequence of degrees (k_n) tending to infinity. In the first case, we derive an exact analytic expression, in the second case, we determine the leading term (including the multiplicative constant). (joint work with: Nikolaos Fountoulakis, Pim van der Hoorn, Tobias Müller)

About the front of the inhomogeneous Fisher-KPP equation and its linearisation, the parabolic Anderson model

WSC-S-U-3.03
Thu 10:00

Lars Schmitz
Universität zu Köln

We consider the discrete-space, one-dimensional version of the inhomogeneous Fisher-KPP equation

$$\frac{\partial}{\partial t}v(t,x) = \frac{1}{2}(\triangle_d v)(t,x) + \xi(x)\cdot v(t,x)(1-v(t,x)), \qquad (t,x)\in(0,\infty)\times\mathbb{Z},$$
$$v(0,x) = 1_{(-\infty,0]}(x),$$

(where $(\triangle_d f)(t,x) := f(t,x-1) - 2f(t,x) + f(t,x+1)$ is the discrete Laplacian) and its linearisation (i.e. $\xi\cdot v$ instead of $\xi\cdot v(1-v)$), the parabolic Anderson model (PAM). We randomize the model by assuming $(\xi(x))_{x\in\mathbb{Z}}$ to be a field of i.i.d. positive random variables on some probability space $(\Omega,\mathcal{F},\mathbb{P})$, uniformly bounded away from 0 and $+\infty$. We will look at the front of the solution $m(t) := \sup\left\{x\in\mathbb{Z} : v(t,x)\geq\frac{1}{2}\right\}$. Motivated by results in the non-random, homogeneous setting (i.e. $\xi\equiv 1$), we conjecture that there exists a deterministic constant $C>0$ (probably depending on the distribution of ξ), such that for $\mathbb{P}$-almost all realisations

of ξ, the distance of both fronts is at most $C \cdot \log t$ for all $t \geq t_0(\xi)$. Both equations have a solution, which can be expressed in terms of branching random walks.

Inference of Stopping Times with Application to Particle Lifetime Estimation

WSC-S-U-3.01
Wed 13:00

Viktor Schulmann

Technische Universität Dortmund

Let $X = (X_t)_{t \geq 0}$ be a known Markov process and T an unknown random time with a smooth Lebesgue density and independent of X. We present an estimator for the density of T based on i.i.d. samples of X_T. For a Brownian motion X or, more generally, a Lévy process on $\mathbb{R}$ such an estimator was given in Belomestny and Schoenmakers (2015) and Belomestny and Schoenmakers (2016) using the Mellin and Laplace transforms. Applying their techniques we study this problem for Bessel processes or, more generally, Lévy processes on certain noncompact commutative hypergroups. We calculate the convergence rates of our estimators and show their asymptotic normality in some cases. An application to the estimation of a lifetime for certain particle models is discussed. [1] D. Belomestny, J. Schoenmakers (2016). Statistical inference for time-changed Lévy processes via Mellin transform approach. Stochastic Processes and their Applications 126, 2092–1222. [2] D. Belomestny, J. Schoenmakers (2015). Statistical Skorohod embedding problem: Optimality and asymptotic normality. Statistics & Probability Letters 104, 169–180.

How to Break Impulse Control Problems Down into Something Easier

WSC-S-U-3.03
Wed 14:30

Tobias Sohr
Universität Hamburg

The purpose of impulse control problems usually is to shift down a stochastic process, say a Lévy process or a diffusion, countable many times in order to maximize a payoff depending on the values of the process before and after each shift. These problems are used for example to find the optimal way to manage a portfolio or to economize natural resources in a sustainable way. Something easier (in this context) is an optimal stopping problem. The most famous of these probably is the sectretary problem, but they appear in noumerous fields of stochastics, ranging from option pricing over game theory to sequential analysis. This talk will give an short heuristic introduction to both stopping and impulse control problems, thereafter emphasize how to use suitable stopping problems to characterize the value and the optimal strategy of some impulse control problems and close with some prospects in the very new field of statistics for impulse control problems.

The White Knight Model - Propagation of Malware on a D2D Network

WSC-S-U-3.03
Fri 9:30

Alexander Wapenhans
Weierstraß-Institut für Angewandte Analysis und Stochastik

The use of D2D technology in future telecommunication systems presents a great opportunity to increase connectivity as well as capacity in networks under the pressure of accelerating demand for faster and larger volume services. On the other hand, D2D systems present their own set of vulnerabilities, essentially coming from the lack of operated infrastructure. In this talk I want

to present a proximity based infection process on a network,build by users of an urban infrastructure driven D2D network.
As the propagation of malware is not desirable, it is necessary to devise appropriate countermeasures.
I will present one possible countermeasure – the White Knight model – and analyse it's efficiency: How many White Knights are necessary and how fast do they have to counter the malware to keep the city safe?

Let $X \subset \mathbb{R}$ be the set of users and denote by $\xi(t,x) \in \{\mathrm{S},\mathrm{I},\mathrm{G}\}$. the state of user $x \in X$ at time $t \in [0,\infty)$. Users are either **S**usceptible to the malware, **I**nfected or have "**G**oodware" installed.
If we denote by $I(t)$ the set of infected user, how fast does the interaction between Goodware and malware has to be, such that

$$\mathbb{P}\left(\inf_{t\in\mathbb{R}^+}\{t|I(t)=\emptyset\}<\infty\right)=0,$$

e.g. the malware dies out almost surely?

A unified framework to robust modelling of financial markets in discrete time

WSC-S-U-3.01
Thu 14:30

Johannes Wiesel
University of Oxford

We prove a Fundamental Theorem of Asset Pricing as well as a Superhedging Theorem in discrete time, which comprises the pathwise and quasisure formulation of [BN15] and [BFH+16]. Furthermore we explain how to extend an $\mathcal{M}$-quasisure superhedging duality result on a set Ω to a pathwise duality without changing the superhedging price.

WSC-S-U-3.03
Wed 15:30

The construction of Root's solution to Skorokhod embedding

Christina Zou
University of Oxford

A classical problem in stochastic analysis is the Skorokhod embedding problem: Given a Brownian motion and a probability measure, the task is to stop the trajectories of the process such that the terminal points are distributed according to the given measure. One approach in order to determine a solution for the problem is to construct it as a first hitting time of some set, e.g. the Root barrier. Rost proved in 1976 that Root's solution has the minimal variance among the solutions to Skorokhod embedding problem using methods from potential theory. We are going to investigate sufficient conditions such that such an embedding can be made and provide a more explicit characterization of Root's solution for a more general class of Markov processes using the solution of an obstacle problem.

Exhibition: Women of Mathematics

We are happy that we could bring the photo exhibition *Women of Mathematics throughout Europe. A gallery of portraits* to Essen.

The following description of the project is from the homepage of the project Women of Mathematics womeninmath.net.

About the project

Entering the field of mathematics can be tough, and women often encounter specific obstacles. The exhibition offers a glimpse into the world of mathematics through photographs (by Noel Tovia Matoff) and excerpts of interviews (by Sylvie Paycha and Sara Azzali) of thirteen women mathematicians throughout Europe. This website provides a platform for contact, exchange and mutual assistance.

This touring exhibition, whose starting point is the 7th ECM held in July 2016 in Berlin, stems from the observation that nowadays, women still find it difficult to embrace a career in the mathematical academic world and the disparity between the proportion of men and that of women among professional mathematicians is still shamefully large.

The thirteen women mathematicians portrayed here share with us their experience, thus serving as role models to stimulate young women scientists to trust their own strength. In presenting mathematics through women mathematicians' perspectives and samples of their life stories, we hope to highlight the human aspects of producing mathematics, making this discipline more

tangible and therefore more accessible to outsiders or newcomers.

Following the opening in Berlin, the exhibit has been traveling to more than sixty cities in and out of Europe, including South America, Australia and Africa. This touring format originally is envisaged as a networking opportunity and for which the project was awarded with the Humboldt Alumni Award 2015, has indeed proved to reinforce collaborations and exchanges between mathematicians in different European countries, and stimulate dialogue around the themes of the exhibition between the general public and mathematicians. The present exhibition has further triggered other similar projects leading to extended versions of the exhibition in various cities (Cambridge, Aachen, Kaiserslautern, Heidelberg and even other continents, in Chile) where Portraits of Mathematicians (and computer scientists in the case of Heidelberg) where will be added to the existing 14 panels.

About the creators

The exhibition and the catalogue (publishing house: Verlag am Fluss) are the result of the joint efforts of the photographer Noel Tovia Matoff and four mathematicians by Sylvie Paycha, Sara Azzali, Alexandra Antoniouk, Magdalena Georgescu, with the precious help of Maria Hoffmann-Dartevelle, who translated into German and Sara Munday, who proofread the interviews and, last but not least, our two inspired graphic designers Wenke Neunast/eckedesign (exhibition) and Gesine Krüger (catalogue).

Bringing this exhibition project to life turned out to be much more difficult than expected, for a project centered around women issues does not find much support in a mathematical world still very much dominated by men. We have learned a lot from overcoming the many obstacles on the path to its realization.

Sponsors

The following organizations sponsored the exhibition

- Alexander von Humboldt Foundation
- Bosch Foundation
- Maecenia Frankfurt Foundation
- University of Potsdam
- Berlin Mathematic School
- European Women in Mathematics
- TU Berlin
- TU Mathematics library
- French Embassy in Germany
- London Mathematical Society

Organizations which supported the project

- 7th European Congress of Mathematics
- European Mathematical Society

Further information

Adresses

Venue

Universität Duisburg-Essen
Fakultät für Mathematik
Thea-Leymann-Str. 9
45127 Essen

Hotel

Holiday Inn Express Essen
Thea-Leymann-Str. 11
45127 Essen

Excursion

Zeche Zollverein
Gelsenkirchener Str. 181
45309 Essen

Dinner

die kokerei cafe&restaurant
UNESCO-Welterbe Zollverein
Kokereiallee 71
45141 Essen

Organizers

Fabian Gerle
Anselm Hudde
Robert Link
Sara Mazzonetto
Roland Meizis
Luis Osorio
Clemens Printz
Geronimo Rojas

Weblinks

DTS2018 www.uni-due.de/dts2018

Fachgruppe Stochastik www.fg-stochastik.de

RTG2131 sites.google.com/site/rtg2131

d-fine www.d-fine.com

Fakultät für Mathematik www.uni-due.de/mathematik

die kokerei www.die-kokerei.de

Zeche Zollverein www.zollverein.de

Women of Mathematics womeninmath.net

Map of Essen
with annotations
tiny.cc/dts_map

Latest version
of this program
tiny.cc/dts_program

Participants

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Wiesel	Johannes	University of Oxford
Yaseen	Saad	TU Dortmund
Zou	Christina	University of Oxford

DTS 2018

Food

- 1 Make a Break
- 2 Subway
- 3 Mensa
- 4 Café
- 5 Eiscafé
- 6 Mr. Nam
- 7 Various food
- 8 Kiosk

Places

- 1 Entrance A
- 2 Hotel
- 3 Entrance B
- 4 Lecture halls