Workshop CoTAppP

Contemporary Topics On Applied Probability

June 17–18, 2019
Besançon, France

Organized by

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Introduction

The Contemporary Topics in Applied Probability Workshop will be held in Besançon (France) from Monday 17th June afternoon to Tuesday 18th June 2019. Its aim is to bring researchers together for talks dedicated to applications of Probability to various fields (actuarial sciences, telecoms & queueing, genomics and population dynamics, etc. the list is by no means exhaustive).

Practical Informations

Date : Monday 17th June afternoon to Tuesday 18th June 2019

Place of the Workshop (Talks, Coffee Breaks and Lunches) : Centre Diocésain, Espace Grammont, 20 rue Mégevand, 25000 Besançon

Accommodation : Zénitude Hôtel-Résidences, Besançon - La City, 11 avenue Louise Michel, 25000 Besançon

Workshop Dinner : Restaurant 1802, 2 rue de Lacoré, Place Granvelle 25000 Besançon
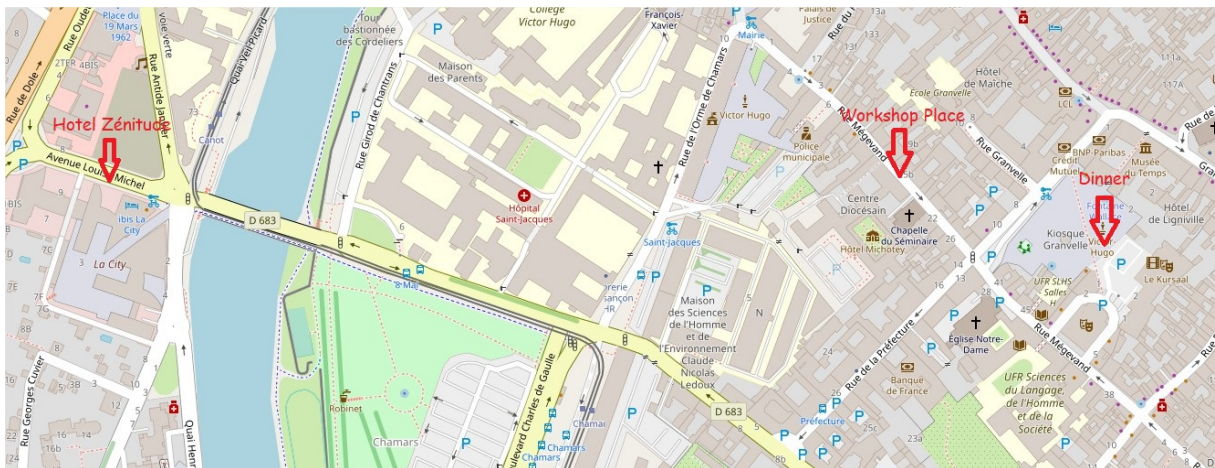
Monday June 17, 2019

$12:00 - 13:30$ Lunch

$13:30 - 14:10$ Pascal Moyal, *Topics on parallel server systems.*
$14:15 - 14:55$ Koen De Turck, *Discrete-time mean-field limits.*

$15:00 - 15:30$ Coffee Break

$15:30 - 16:15$ Pierre-Olivier Goffard,*For a few bitcoins more.*
$16:15 - 16:55$ Areski Cousin, *Kriging for arbitrage-free construction of financial term-structures.*

$19:30$ Workshop Dinner

Tuesday June 18, 2019

$9:30 - 10:10$ Stefan Thonhauser, *Dynamic reinsurance and QMC integration.*
$10:15 - 10:55$ Didier Rullière, *On a construction of multivariate distributions given some multidimensional marginals.*

$11:00 - 11:15$ Coffee Break

$11:15 - 11:55$ Sarah Dendievel, *An algorithm for non-skip-free GI/M/1/C queueing systems.*

$12:00 - 13:30$ Lunch

$13:30 - 14:10$ Lothar Breuer, *Moment distributions for bivariate phase-type random variables.*
$14:15 - 14:55$ Landy Rabehasaina, *Infinite server queues networks and incurred but not reported claims : exact and asymptotic results*

$15:00$ Workshop Closure - Last Coffee

Monday, $13:30 - 14:10$

Topics on parallel server systems

Pascal Moyal, Université de Lorraine

Monday, $14:15 - 14:55$

Discrete-time mean-field limits

Koen De Turck, Central Supelec

In this talk, I will cover stochastic models in which a large number of indistinguishable objects interact based on their own state and a statistical knowledge of the states of the other objects. For this class of models a meaningful mean-field limit can be defined, which offer a more parsimonious description of the original model with a less resource-intensive solution method. This is true to an even larger degree when we have on our hands a control problem instead of a mere performance model.

Models of this kind have found numerous and diverse applications over many different domains, such as biology, computer science, telecommunications and finance. We will illustrate the technique by means of a couple of examples in part taken from the field of wireless networks.

Mean-field models can be divided into 4 types, depending on whether the original model and the target mean-field model are formulated in discrete-time or in continuous-time. Regardless of the temporal category of the original model, the target model in the overwhelming number of cases appears to be in continuous-time.

In this talk I reevaluate this choice, and show the advantages and obstacles one encounters when both the original model as well as the target model is in discrete time. I will cover various aspects such as convergence, performance bounds, efficient solution methods, corresponding control problems and non-linear cost structures.

**For a few bitcoins more
Fraud risk assessment within blockchain transactions**

Pierre-Olivier Goffard, ISFA

The probability of successfully spending twice the same bitcoins is considered. A double-spending attack consists in issuing two transactions transferring the same bitcoins. The first transaction, from the fraudster to a merchant, is included in a block of the public chain. The second transaction, from the fraudster to himself, is recorded in a block that integrates a private chain, exact copy of the public chain up to substituting the fraudster-to-merchant transaction by the fraudster-to-fraudster transaction. The double-spending hack is completed once the private chain reaches the length of the public chain, in which case it replaces it. The growth of both chains are modeled by two independent counting processes. The probability distribution of the time at which the malicious chain catches up with the honest chain, or equivalently the time at which the two counting processes meet each other, is studied. The merchant is supposed to await the discovery of a given number of blocks after the one containing the transaction before delivering the goods. This grants a head start to the honest chain in the race against the dishonest chain.

Kriging for arbitrage-free construction of financial term-structures

Areski Cousin, Université de Strasbourg

In some situations where market information is incomplete or not reliable, building financial term-structures (interest-rate curves, credit curves, volatility surfaces, ...) may be associated with a significant degree of uncertainty. We propose a new arbitrage-free construction method that extends classical spline techniques by additionally allowing for quantification of uncertainty. The proposed method is based on a generalization of kriging regression models to linear equality constraints (market-fit conditions) and shape-preserving constraints (no-arbitrage conditions). Prices of illiquid instruments can also be incorporated when considered as noisy observations. We define the most likely response surface and show how to build confidence bands. The Gaussian process hyper-parameters under the construction constraints can be estimated using cross-validation techniques or maximum likelihood. Based on observed market quotes at different dates, we demonstrate the efficiency of the method by building curves/surfaces and their corresponding confidence bands for OIS discount rates, CDS implied default probabilities and implied volatilities.

Dynamic reinsurance and QMC integration

Stefan Thonhauser, Graz University of Technology

In this talk we will discuss dynamic reinsurance in the classical risk model and some resulting problems. A common procedure to derive a numerical solution to such stochastic optimization problems is based on the policy iteration method. Here one needs to solve certain integro-differential equations which are linked to expected values of PDMP type processes per iteration step. Motivated by the instability of naive approaches we study the applicability of quasi-Monte Carlo integration to the computation of such expected values.

Tuesday, $10:15 - 10:55$

On a construction of multivariate distributions given some multidimensional marginals

Didier Rullière, ISFA

We investigate the link between the joint law of a d-dimensional random vector and the law of some of its multivariate marginals. We introduce and focus on a class of distributions, that we call projective, for which we give detailed properties. This allows us to obtain necessary conditions for a given construction to be projective. We illustrate our results by proposing some theoretical projective distributions, as elliptical distributions or a new class of distribution having given bivariate margins. In the case where the data do not necessarily correspond to a projective distribution, we also explain how to build proper distributions while checking that the distance to the prescribed projections is small enough. (Joint work with Nabil Kazi-Tani)

Tuesday, $11:15 - 11:55$

An algorithm for non-skip-free GI/M/1/C queueing systems

Sarah Dendievel, University of Ghent

(Joint with H. Bruneel and D. Fiems)

Moment distributions for bivariate phase-type random variables

Lothar Breuer, Independent Researcher

Tuesday, 14 : 15 − 14 : 55

Infinite server queues networks and incurred but not reported claims : exact and asymptotic results

Landy Rabehasaina, Université de Franche-Comté

We consider in this talk an Incurred but Not Reported (IBNR) k dimensional process modelling the arrivals of claims at in insurance company which have occurred but have not yet been declared, which is also a general model for $G/G/\infty$ queues. In a first part, we will give asymptotics for joint moments as well as the limiting distribution of the $k$dimensional processes properly rescaled, in the case where interclaims are light tailed. In a second part, in the case when the successive claims amounts are modelled by a finite Markov chain and arrive according to a Poisson process with intensity λ we will show, when the delays are fat tailed with index α, that three phenomena occur when we re-scale the intensity by a factor n^{γ} and the delays by a factor n : Slow arriving, Fast arriving and Equilibrium cases when γ is respectively less, larger or equal to α. We will then exhibit three different limiting distributions for the process. This is joint work with J.K.Woo (Univ. of New South Wales).