Name, Vorname	University/Institution	Title of the talk	Abstract	arXiv
Bartl, Daniel	Uni Wien	Monte-Carlo methods in convex stochastic optimization	We develop a novel procedure for estimating the optimizer of general convex stochastic optimization problems from an iid sample. This procedure is the first one that exhibits the optimal statistical performance in heavy tailed situations and also applies in high-dimensional settings. We discuss the results at hand of the portfolio optimization problem. Joint with Shahar Mendelson.	https://arxiv.org/abs/2101.07794v1
Bergault, Philippe	Ecole Polytechnique	Multi-asset optimal execution and statistical arbitrage strategies under Ornstein-Uhlenbeck dynamics	In recent years, academics, regulators, and market practitioners have increasingly addressed liquidity issues. Amongst the numerous problems addressed, the optimal execution of large orders is probably the one that has attracted the most research works, mainly in the case of single-asset portfolios. In practice, however, optimal execution problems often involve large portfolios comprising numerous assets, and models should consequently account for risks at the portfolio level. In this paper, we address multi-asset optimal execution in a model where prices have multivariate Ornstein-Uhlenbeck dynamics and where the agent maximizes the expected (exponential) utility of her P&L. We use the tools of stochastic optimal control and simplify the initial multidimensional Hamilton-Jacobi-Bellman equation into a system of ordinary differential equations (ODEs) involving a Matrix Riccati ODE for which classical existence theorems do not apply. By using *a priori* estimates obtained thanks to optimal control tools, we nevertheless prove an existence and uniqueness result for the latter ODE, and then deduce a verification theorem that provides a rigorous solution to the execution problem. Using numerical methods we eventually illustrate our results and discuss their implications. In particular, we show how our model can be used to build statistical arbitrage strategies.	https://arxiv.org/abs/2103.13773
Das, Purba	Mathematical Institute, University of Oxford	Quadratic variation and quadratic roughness	We study the concept of quadratic variation of a continuous path along a sequence of partitions and its dependence with respect to the choice of the partition sequence. We define the concept of `quadratic roughness' of a path along a partition sequence and show that, for Hölder-continuous paths satisfying this roughness condition, the quadratic variation along balanced partitions is invariant with respect to the choice of the partition sequence. Typical paths of Brownian motion are shown to satisfy this quadratic roughness property almost-surely along any partition with a required step size condition. Using these results we derive a formulation of Föllmer's pathwise integration	https://arxiv.org/abs/1907.03115

			along paths with finite quadratic variation which is invariant with respect to the partition sequence.	
Dayanikli, Gökce	Princeton University	Optimal incentives to mitigate epidemics: a Stackelberg mean field game approach	Motivated by models of epidemic control in large populations, we consider a Stackelberg mean field game model between a principal and a mean field of agents evolving on a finite state space. The agents play a non-cooperative game in which they can control their transition rates between states to minimize an individual cost. The principal can influence the resulting Nash equilibrium through incentives so as to optimize its own objective. We analyze this game using a probabilistic approach. We then propose an application to an epidemic model of SIR type in which the agents control their interaction rate and the principal is a regulator acting with non pharmaceutical interventions. To compute the solutions, we propose an innovative numerical approach based on Monte Carlo simulations and machine learning tools for stochastic optimization. We conclude with numerical experiments by illustrating the impact of the agents' and the regulator's optimal decisions in two models: a basic SIR model with semi-explicit solutions and a more complex model with a larger state space.	https://arxiv.org/abs/2011.03105
Hager, Paul	Technische Universität Berlin - Institut f. Mathematik	Optimal Stopping with Signatures	We propose a new method for solving optimal stopping problems (such as American option pricing in finance) under minimal assumptions on the underlying stochastic process. We consider classic and randomized stopping times represented by linear and non-linear functionals of the rough path signature associated to the underlying process, and prove that maximizing over these classes of signature stopping times, in fact, solves the original optimal stopping problem. Using the algebraic properties of the signature, we can then recast the problem as a (deterministic) optimization problem depending only on the (truncated) expected signature. By applying a deep neural network approach to approximate the non-linear signature functionals, we can efficiently solve the optimal stopping problem numerically.	https://arxiv.org/abs/2105.00778
Harang, Fabian	BI Norwegian Business School	Log-modulated rough stochastic volatility models	We will discuss a new class of rough stochastic volatility models obtained by modulating the power-law kernel defining the fractional Brownian motion (fBm) by a logarithmic term, such that the kernel retains square integrability even in the limit case of vanishing Hurst index H. The so-obtained log-modulated fractional Brownian motion (log-fBm) is a continuous Gaussian process even for H=0. As a	https://arxiv.org/abs/2008.03204

			consequence, the resulting super-rough stochastic volatility models can be analysed over the whole range 0≤H<1/2 without the need of further normalization. We obtain skew asymptotics of the form log(1/T)^p T^(H−1/2) as T→0, H≥0, so no flattening of the skew occurs as H→0. This talk is based on a joint work with Christian Bayer (WIAS Berlin) and Paolo Pigato (University of Rome Tor Vergata)	
Iseri, Melih	University of Southern California	Set Values for Mean Field Games	When a mean field game satisfies certain monotonicity conditions, the mean field equilibrium is unique and the corresponding value function satisfies the so called master equation. In general, however, there can be multiple equilibriums, and in the literature one typically studies the asymptotic behaviors of individual equilibriums of the corresponding N-player game. We instead study the set of values over all (mean field) equilibriums, which we call the set value of the game. We shall establish two crucial properties of the set value: (i) the dynamic programming principle; (ii) the convergence of the set values from the N-player game to the mean field game. We emphasize that the set value is very sensitive to the choice of the admissible controls. For the dynamic programming principle, one needs to use closed loop controls (not open loop controls) and it involves some very subtle path dependence issue. For the convergence, one has to restrict to the same type of equilibriums for the N-player game and for the mean field game. The talk is based on a joint work with Jianfeng Zhang.	https://arxiv.org/abs/2107.01661
Leutscher, Marcos	CREST, ENSAE, Institut Polytechnique de Paris	Control and optimal stopping Mean Field Games: a linear programming approach	We develop the linear programming approach to mean-field games in a general setting. This relaxed control approach allows to prove existence results under weak assumptions, and lends itself well to numerical implementation. We consider mean-field game problems where the representative agent chooses both the optimal control and the optimal time to exit the game, where the instantaneous reward function and the coefficients of the state process may depend on the distribution of the other agents. Furthermore, we establish the equivalence between mean- field games equilibria obtained by the linear programming approach and the ones obtained via the controlled/stopped martingale approach, another relaxation method used in a few previous papers in the case when there is only control.	https://arxiv.org/abs/2011.11533

Molitor, Alexander	Goethe-Universität Frankfurt	Semimartingale price systems in models with transaction costs beyond efficient friction	A standing assumption in the literature on proportional transaction costs is efficient friction. Together with robust no free lunch with vanishing risk, it rules out strategies of infinite variation, as they usually appear in frictionless markets. In this talk, we show how the models with and without transaction costs can be unified. The bid and the ask price of a risky asset are given by cadlag processes which are locally bounded from below and may coincide at some points. In a first step, we show that if the bid-ask model satisfies no unbounded profit with bounded risk for simple strategies, then there exists a semimartingale lying between the bid and the ask price process. In a second step, under the additional assumption that the zeros of the bid-ask spread are either starting points of an excursion away from zero or inner points from the right, we show that for every bounded predictable strategy specifying the amount of risky assets, the semimartingale can be used to construct the corresponding self-financing risk-free position in a consistent way. Finally, the set of most general strategies is introduced, which also provides a new view on the frictionless case.	https://arxiv.org/abs/2001.03190
Nendel, Max	Bielefeld University	Separability vs. robustness of Orlicz spaces: financial and economic perspectives	We investigate robust Orlicz spaces as a generalisation of robust Lp-spaces. We show that separability of robust Orlicz spaces or their subspaces has very strong implications in terms of the dominatedness of the set of priors and the lack of order completeness. We apply the results to norm closures of bounded continuous functions as considered in the G-framework. As a second application, we show that the topological spanning power of options is always limited under nondominated uncertainty.	https://arxiv.org/pdf/2009.09007.pdf
Neumann, Berenice Anne	University of Trier	Competition versus Cooperation: A class of solvable mean field impulse control problems	We discuss a class of explicitly solvable mean field type control problems/mean field games with a clear economic interpretation. More precisely, we consider long term average impulse control problems with underlying general one-dimensional diffusion processes motivated by optimal harvesting problems in natural resource management. We extend the classical stochastic Faustmann models by allowing the prices to depend on the state of the market using a mean field structure. In a competitive market model, we prove that, under natural conditions, there exists an equilibrium strategy of threshold-type and furthermore characterize the threshold explicitly. If the agents cooperate with each other, we are faced with the mean field type control problem. Using a Lagrange-type argument, we prove that the optimizer of this non-standard impulse control problem is of	https://arxiv.org/pdf/2010.06452.pdf

			threshold-type as well and characterize the optimal threshold. Furthermore, we compare the solutions.	
Primavera, Francesca	University of Vienna	Lévy type signature models	Signature models have recently entered the field of Mathematical Finance. However, despite the presence of jumps in financial data, the signature models for asset prices proposed so far have only dealt with the continuous-path setting. Based on recent results on the signature of càdlàg paths, we define signature-based models which include jumps. The approach that we follow consists of parameterizing the model itself or its characteristics as linear functions of the signature of an augmented Lévy process, interpreted as market's primary underlying process. We discuss the validity of first principles like absence of arbitrage and solve the hedging problem by adopting a local risk minimization approach. Finally, we prove that the signature of a generic multivariate Lévy process is a polynomial process on the extended tensor algebra and derive its expected value via polynomial technology. We show that this result, when applied to the market's primary process, is efficient in terms of calibration to market data. The talk is based on an ongoing joint work with Christa Cuchiero and Sara Svaluto-Ferro.	
Shi, Xiaofei	Columbia University	Equilibrium with Transaction Costs: Theory and Numerics	In a risk-sharing economy we study how the price dynamics of an asset depends on its "liquidity". An equilibrium is achieved through a system of coupled forward-backward SDEs, whose solution turns out to be amenable to an asymptotic analysis for the practically relevant regime of large liquidity. These tractable approximation formulas make it feasible to calibrate the model to time series of prices and trading volume, and we also discuss how to leverage deep-learning techniques to obtain numerical solutions. (Based on joint works in progress with Agostino Capponi, Lukas Gonon, Johannes Muhle-Karbe and Chen Yang).	https://arxiv.org/abs/1905.05027
Stockinger, Wolfgang	University of Oxford	Numerical methods for high-dimensional mean-field	In this talk, we discuss numerical methods for mean field control (MFC) problems, which seek optimal control of McKean--Vlasov dynamics whose coefficients involve mean field interactions both on the state and actions. We propose an iterative PDE based algorithm, which solves the control problem along a flow of measures and does	

		control problems	not require to solve the first order optimality, arising from the stochastic maximum principle, explicitly. We also propose a version of our method based on a deep neural network approach which is applicable for high-dimensional control problems.	
Svaluto-Ferro, Sara	University of Vienna	Universality of affine and polynomial processes and application to signature processe	Already in the well studied finite dimensional framework, affine and polynomial processes are two fascinating classes of models. This is mostly due to the so-called affine transform formula and moment formula, respectively. In several recent works we could show that many models which are at first sight not recognized as affine or polynomial can nevertheless be embedded in this framework via infinite dimensional lifts. For instance, many examples of rough stochastic volatility models in mathematical finance can be viewed as infinite dimensional affine or polynomial processes. This suggests an inherent universality of these model classes. In this talk we perform a further step in that direction, showing that generic classes of diffusion models are projections of infinite dimensional affine processes (which in this setup coincide with polynomial processes). The final part of the talk is dedicated to applications. We first show how to apply the introduced mechanism to one-dimensional diffusion processes with analytic coefficients, and which type of formulas can be obtained in that framework. Then, we consider the so-called signature process and explain the advantages to use the obtained formulas in the context of the corresponding signature based models.	
Talbi, Mehdi	École polytechnique	Dynamic programming equation for the mean field optimal stopping problem	We study the optimal stopping problem of McKean-Vlasov diffusions when the criterion is a function of the law of the stopped process. A remarkable new feature in this setting is that the stopping time also impacts the dynamics of the stopped process through the dependence of the coefficients on the law. Thanks to an appropriate notion of viscosity solutions, we characterize the problem by a dynamic programming equation (DPE), which is an obstacle problem on the Wasserstein space, and is obtained by means of a general Itô formula for flows of marginal laws of càdlàg semimartingales. We also study the corresponding N-particles problem, that we also characterize by a DPE, and prove that the viscosity solution of this DPE converges to the viscosity solution of the DPE of the mean field problem as N goes to infinity.	https://arxiv.org/abs/2103.05736

Wiesel, Johannes	Columbia University	Entropic Optimal Transport: Convergence of Potentials	We study the potential functions that determine the optimal density for ε-entropically regularized optimal transport, the so-called Schrödinger potentials, and their convergence to the counterparts in classical optimal transport, the Kantorovich potentials. In the limit ε→0 of vanishing regularization, strong compactness holds in L1 and cluster points are Kantorovich potentials. In particular, the Schrödinger potentials converge in L1 to the Kantorovich potentials as soon as the latter are unique. These results are proved for all continuous, integrable cost functions on Polish spaces. In the language of Schrödinger bridges, the limit corresponds to the small-noise regime.	http://arxiv.org/abs/2104.11720
Xu, Renyuan	University of Oxford	Scaling Properties of Deep Residual Networks	Residual networks (ResNets) have displayed im- pressive results in pattern recognition and, re- cently, have garnered considerable theoretical in- terest due to a perceived link with neural ordinary differential equations (neural ODEs). This link relies on the convergence of network weights to a smooth function as the number of layers increases. We investigate the properties of weights trained by stochastic gradient descent and their scaling with network depth through detailed numerical experiments. We observe the existence of scaling regimes markedly different from those assumed in neural ODE literature. Depending on certain features of the network architecture, such as the smoothness of the activation function, one may obtain an alternative ODE limit, a stochastic dif- ferential equation or neither of these. These find- ings cast doubts on the validity of the neural ODE model as an adequate asymptotic description of deep ResNets and point to an alternative class of differential equations as a better description of the deep network limit.	https://arxiv.org/pdf/2105.12245.pdf
Zhang, Jiacheng	Berkeley	Superposition and mimicking theorems for conditional McKean-Vlasov equations	We consider conditional McKean-Vlasov stochastic differential equations (SDEs), such as the ones arising in the large-system limit of mean field games and particle systems with mean field interactions when common noise is present. The conditional time-marginals of the solutions to these SDEs satisfy non-linear stochastic partial differential equations (SPDEs) of the second order, whereas the laws of the conditional time-marginals follow Fokker-Planck equations on the space of probability measures. We prove two superposition principles: The first establishes that any solution of the SPDE can be lifted to a solution of the conditional McKean-Vlasov SDE, and the second guarantees that any solution of the Fokker-Planck equation on the space of probability measures can be lifted to a solution of the SPDE.	https://arxiv.org/abs/2004.00099

			We use these results to obtain a mimicking theorem which shows that the conditional time-marginals of an Itˆo process can be emulated by those of a solution to a conditional McKean-Vlasov SDE with Markovian coefficients. This yields, in particular, a tool for converting open-loop controls into Markovian ones in the context of controlled McKean-Vlasov dynamics.	
Zhang, Yufei	University of Oxford	Reinforcement learning for linear-convex models with jumps via stability analysis of feedback controls	We study finite-time horizon continuous-time linear-convex reinforcement learning problems in an episodic setting. In this problem, the unknown linear jump-diffusion process is controlled subject to nonsmooth convex costs. We show that the associated linear-convex control problems admit Lipschitz continuous optimal feedback controls and further prove the Lipschitz stability of the feedback controls, i.e., the performance gap between applying feedback controls for an incorrect model and for the true model depends Lipschitz-continuously on the magnitude of perturbations in the model coefficients; the proof relies on a stability analysis of the associated forward-backward stochastic differential equation. We then propose a novel least-squares algorithm which achieves a regret of the order O((N ln N)^{1/2}) on linear-convex learning problems with jumps, where N is the number of learning episodes; the analysis leverages the Lipschitz stability of feedback controls and concentration properties of sub-Weibull random variables.	https://arxiv.org/abs/2104.09311