Workshop on Stochastic Processes, Stochastic Optimal Control, and their Applications

(on the occasion of the 60th birthday of Marco Fuhrman)

Sala del Consiglio – Department of Mathematics - Politecnico di Milano

Scientific Program

Thursday, 26 September

15:00 – 15:30: Registration.

15:30 – 15:40: Opening.

Chair: Luciano Campi

15:40 – 16:25:

Jean Jacod (Université Paris VI)

Title: ***High Frequency Returns Sign-Based Robust Inference.***

Abstract:

We derive the limit of infill asymptotic distribution for the sum of positive returns of prices or log-prices in a given period of time. The framework is multivariate and quite general: it allows for the presence of leverage effects and jumps with finite activity. In a second step, the results are used to estimate the drifts (or rather, the Sharpe ratios) of the continuous part of the processes.

16:25 – 17:10:

Huyên Pham (Ecole Polytechnique)

Title: ***An optimal interpolation diffusion approach to generative modeling of time series***.

17:10 – 17:30: Coffee break.

17:30 – 18:15:

Federica Masiero (Università degli Studi di Milano-Bicocca)

Title: ***Stochastic control problems with delay: solution through partial smoothing.***

Abstract:

In this talk we consider controlled stochastic differential equations with delay in the state or in the control.   It is well known that the Ornstein-Uhlenbeck transition semigroup doesn't have regularizing properties, such as the strong Feller property. So in general, the associated Hamilton-Jacobi-Bellman (HJB) equation cannot be solved in mild sense by a classical fixed point argument. We present a result of existence of regular solutions for the HJB equations related to a stochastic controlled equation with delay in the control and in the case when, as it often occurs in applications, the objective function depends only on the "present" of the state and control variable. The result is based on partial regularization results for the associated Ornstein-Uhlenbeck semigroup.   In analogy, we investigate partial regularizing properties in the case of delay in the state and with a special dependence on the past trajectory, and we solve in mild sense the associated HJB equation and the stochastic controlled problem related.

18:15 – 19:00:

Marco Campi (Università degli Studi di Brescia)

Title: ***Probability, Agnosticism, and Guarantees in Inductive Learning Processes.***

Abstract:

How can knowledge be created out of lack of knowledge in the light of observations? In this talk, we explore this problem and provide answers within a so-called "consistent" framework. Two key concepts, Complexity and Risk, are shown to universally go hand in hand according to precise mathematical quantifications. Risk represents the reliability of a decision and is not directly observable, while Complexity is a measurable statistic derived from the data. This establishes a bridge between the visible and the invisible in inductive learning processes and opens interesting scenarios of investigation. This is joint work with Algo Carè and Simone Garatti.

Friday, 27 September

09:00 – 09:45:

François Delarue (Université Côte d'Azur)

Title: ***Mean Field Control Approach to Stable Solutions of Deep ResNets.***

Abstract:

We address an ideal deep neural network as an optimal control problem for an ordinary differential equation, in which the controls are probability measures on the parameter space and the cost involves an additional entropy penalty. We show that, for many initial inputs (in terms of the initial distribution of the features), there is a unique and stable global minimizer for the control problem. Furthermore, we prove that stable minimizers satisfy certain local Polyak-Lojasiewicz conditions and that the (continuous analog) of the gradient descent converges exponentially fast when initialized near a stable minimizer. Joint work with Samuel Daudin (Paris)

09:45 – 10:30:

Ying Hu (Université de Rennes)

Title: ***Dual Representation of Unbounded Dynamic Concave Utilities.***

Abstract:

In several linear spaces of possibly unbounded endowments, we represent the dynamic concave utilities (hence the dynamic convex risk measures) as the solutions of backward stochastic differential equations (BSDEs) with unbounded terminal values, with the help of our recent existence and uniqueness results on unbounded solutions of scalar BSDEs whose generators have a linear, super-linear, sub-quadratic or quadratic growth. The Legendre-Fenchel transform (dual representation) of convex functions, the de la vallée-Poussin theorem, and Young's and Gronwall's inequalities constitute the main ingredients of these representation results. This is a joint work with Shengjun Fan and Shanjian Tang.

10:30 – 11:00:   Coffee break.

11:00 – 11:45:

Gianmario Tessitore (Università degli Studi di Milano-Bicocca)

Title: ***Nonlinear random perturbations of PDEs depending on a small parameter.***

Abstract:

In this study, we investigate a class of quasi-linear parabolic equations defined on a separable Hilbert space, with a small parameter in front of the nonlinear second-order term. Our primary focus is on the asymptotic behaviour of the solutions as the small parameter vanishes. We demonstrate that a large deviations principle applies and explicitly characterise the associated action functional. The nonlinear SPDE is approached using either direct probabilistic methods or analytical techniques. This work extends Freidlin and Koralov's (PTRF 2010) results to an infinite-dimensional setting. Joint work with Sandra Cerrai University of Maryland and Giuseppina Guatteri Politecnico di Milano.

11:45 – 12:30:

Fausto Gozzi (LUISS University)

Title: ***Optimal Control and Differential Games for Pollution Management and Climate Agreements.***