



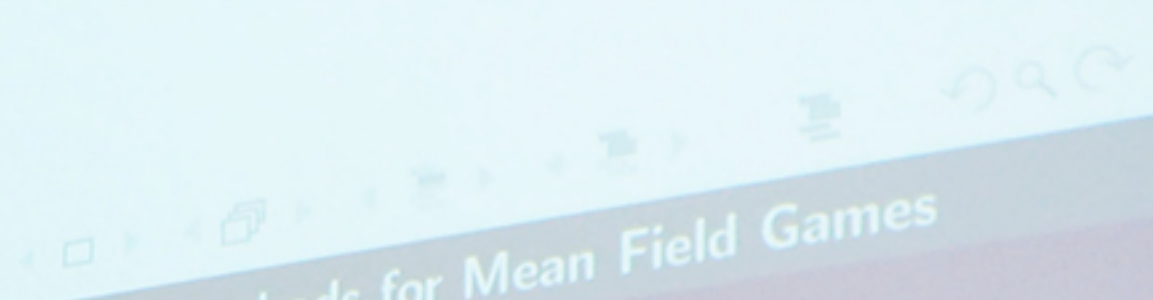


Time continuation method
Time continuation method II

Probabilistic numerical methods for Mean Field Games

J-F Chassagneux (UPD)
joint works with
F. Delarue (Nice), D. Crisan (ICL), A. Angiuli (UCSB),
C. Graves (Princeton) & H. Li (UPD)

6th NUS-USPC Workshop on Machine Learning and FinTech,
National University Singapore, 18-19 April 2018



J-F Chassagneux

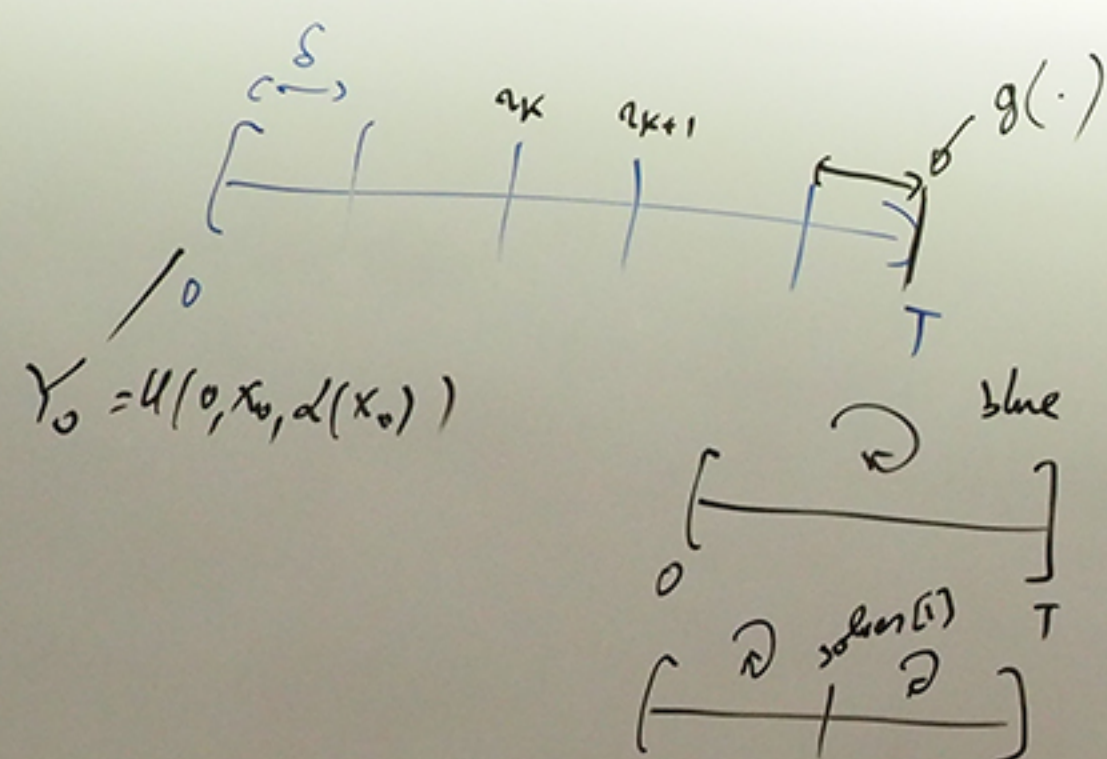
Probabilistic numerical methods for Mean Field Games





Designing Stable Coins

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$$Y_t = U(t, X_t, d(X_t))$$



The Value of Informational Arbitrage

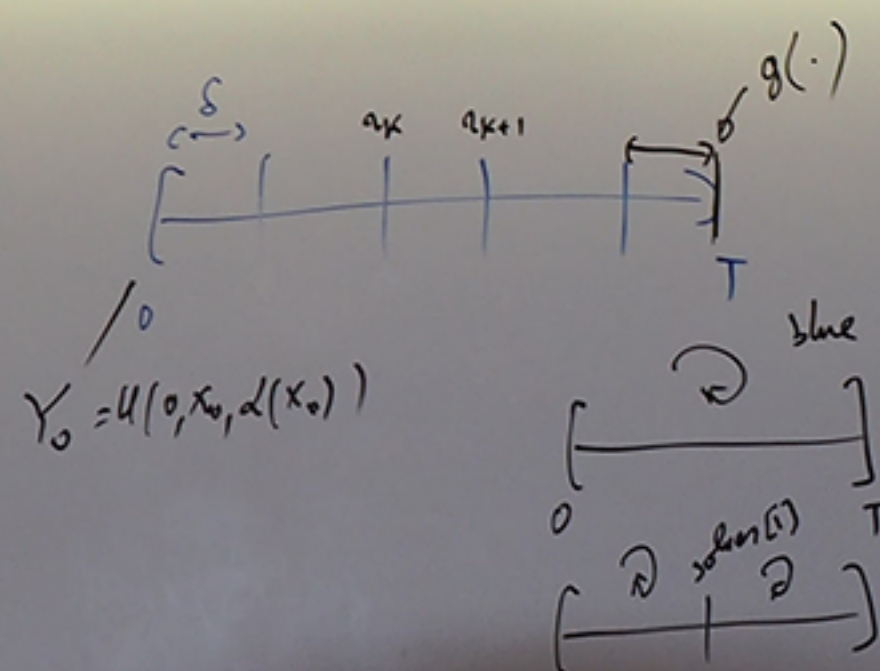
Claudio Fontana

(based on joint work with H. N. Chau and A. Cosso)

LPSM - Paris Diderot University (Paris 7)

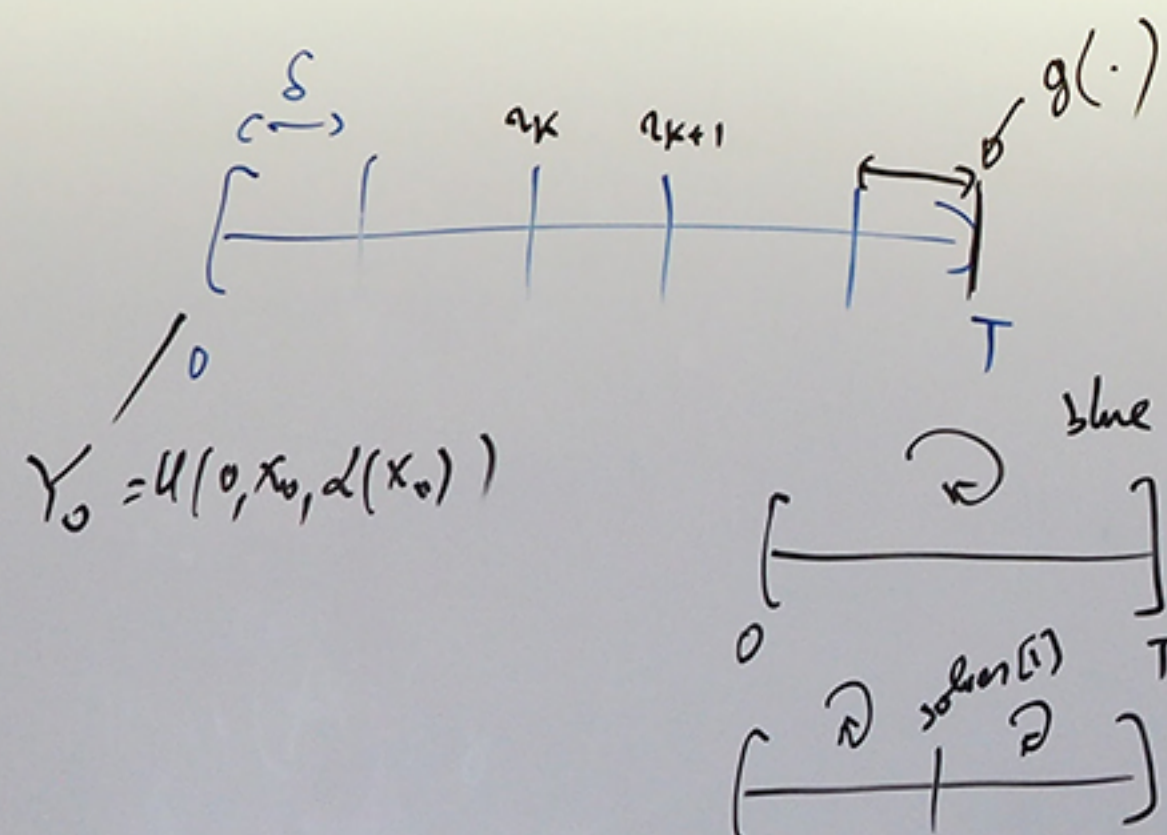
<http://sites.google.com/site/fontanaclaud>

6th NUS - USPC Workshop on Machine Learning and FinTech
Singapore, 18-19 April 2018



$$Y_t = U(t, X_t, \lambda(X_t))$$





$$Y_t = U(t, X_t, d(X_t))$$



Interpretable forecasts of financial time series with deep learning

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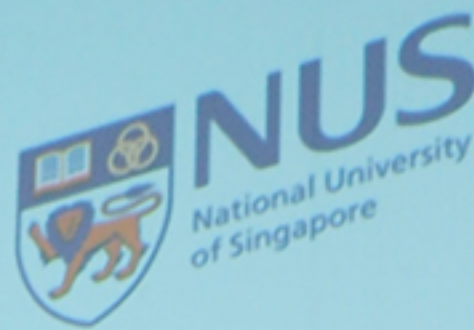
Ladislav von Bortkiewicz Chair of Statistics

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Sparse-Group Network Autoregressive for Bitcoin Blockchain

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Unsupervised Probabilistic Topic Modelling

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Robo-Advising:
A Dynamic Mean-Variance Approach

Min Dai
National University of Singapore

with
John (Oxford), Steven Kou (NUS), Yuhong Xu (Soochow U)

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Deep learning algorithms for stochastic control problems (Part 1)

Huyên PHAM*

*University Paris Diderot, LPSM

Joint work (in progress) with
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C. Huré, University Paris Diderot, LPSM
N. Langrené, CSIRO, Data61, Risklab Australia

6th NUS-USPC Workshop on Machine Learning and FinTech
Singapore, April 18-19, 2018

Huyên PHAM

Deep learning algorithms for stochastic control





DNN Regression Monte Carlo

$\hat{Y}_N^m = g(X_N^m)$

for $n = N-1, \dots, 0$ do

REGRESS

by neural network, to get $\mathbb{E}[\hat{Y}_{n+1}^m | X_n^m, I_n^m] \simeq \Phi_n(X_n^m, I_n^m)$

MAXIMIZE

$\hat{\pi}_n(X_n^m) = \arg \max_a \{f_n(X_n^m, a) + \Phi_n(X_n^m, a; \hat{\theta}_n^M)\}$

UPDATE values $\hat{Y}_n^m$, using optimal policy $\hat{\pi}_n$

end

Deep learning algorithms for stochastic control problems on finite horizon
with control randomization



Computation of optimal transport and related problems via penalization and neural networks

MICHAEL KUPPER

Universität
Konstanz



with STEPHAN ECKSTEIN and MATHIAS POHL

6th NUS-USPC Workshop
Singapore



$L_1, \dots, L_6$

Neural Network Hedging

Michael Kupper

April 2018

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Calibration of financial models with neural networks

Christa Cuchiero

joint work with Andres Hernandez, Wahid Khosrawi-Sardroudi and
Josef Teichmann

University of Vienna

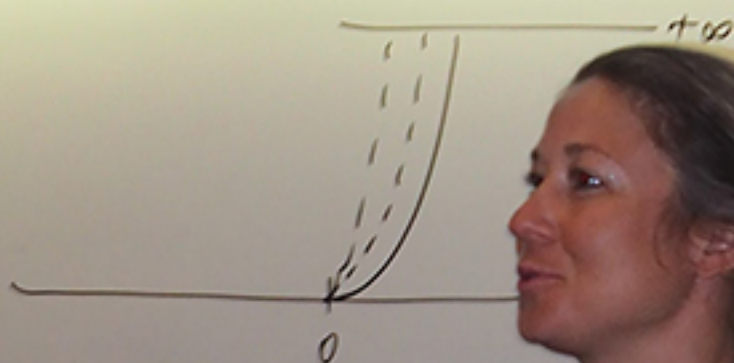
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Christa Cuchiero (University of Vienna)

Calibration with NN

Singapore, April 2018

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Best
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Optimal Transport

Monge's Problem



Gaspard Monge (1781)

Monge's problem:

$$\inf \left\{ \int_X c(x, T(x)) d\mu(x) \mid T_{\#}(\mu) = \nu \right\}$$

April, 2018

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I Guo, G Loeper (Monash CQFIS)

Optimal transport and volatility calibration

The Institute for
acknowledges

Hong Leong
Lee Foundation
Far East

towards the



PDE formulation

Dual formulation

By applying the Fenchel-Rockafellar duality theorem, we can derive the problem that is equivalent to the dual formulation in the probabilistic settings.

PDE dual formulation

$$V(\rho_0, \rho_1) = \sup_{\phi} \int \rho_1 \phi(1, x) - \rho_0 \phi(0, x) dx$$

subject to

$$\partial_t \phi + F^* \left(\nabla_x \phi, \frac{1}{2} \nabla_{xx} \phi \right) \leq 0.$$

The supremum is therefore taken over ϕ supersolutions of $\partial_t \phi + F^* \left(\nabla_x \phi, \frac{1}{2} \nabla_{xx} \phi \right) = 0$. Formally one can assume equality.

Consider the
Dupire's formula allows us to express the
option prices,

$$\sigma(T, K) = \sqrt{\frac{2\partial_T C(T, K)}{\partial_{KK} C(T, K)}}$$

- Requires vanilla option prices across all strikes and maturities.
- Industry practice is to construct a price or implied volatility surface by interpolating and extrapolating from a sparse set of option prices.
- This is not entirely satisfactory as
 - The interpolation/extrapolation process may produce "bad" prices.
 - It can lead to unstable local volatilities (either $\sigma = 0$ or $+\infty$).
- Dupire's formula still it is used extensively by option traders.