POST-DOCTORAL POSITION (6 months)

IN STATISTICS

- FEDER FUNDING -

Application deadline: August, 15, 2021

Starting date: October, 1, 2021

TITLE:

Efficient and robust processing information methods in dynamic stochastic logistics systems

PROJECT: *Future of merchandise: towards a "Global" logistics chain* (In French: Futur de la marchandise : vers une chaine logistique « Glocale »)

LABORATORY: Laboratory of Mathematics Raphaël Salem (LMRS) UMR 6085, University of Rouen Normandy, Avenue de l'Université, BP.12, 76801 Saint Étienne du Rouvray,France

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ABSTRACT: This postdoctoral topic concerns the nonparametric signal estimation problems for the logistic models defined through semi-Markov processes. The techniques we want to develop are based on the model selection approach which provides adaptive optimal estimation in sharp oracle inequality sense. Moreover, we think to develop model selection procedures which will be efficient as well in the asymptotic minimax sense for the robust quadratic risks. Finally we plan to make numerical studies through Monte - Carlo methods for developed procedures.

KEYWORDS: stochastic differential equations, signals and images processing, semi-Markov processes, model selection, oracle inequalities, non parameter estimation, robust estimation, efficient estimation

PROFILE OF THE CANDIDATE: The candidate will have a PhD in Statistics or equivalent, with knowledge in stochastic analysis. More specifically, he/she needs to have strong skills in stochastic processes, associated statistical techniques, stochastic differential equations, asymptotic statistical methods, non parametric statistics.

The research program that we propose within the project "*Future of merchandise: towards a "Global" logistics chain* " is a part of the research and innovation strategy of the French region Normandy. This is a research project in statistics within a multidisciplinary project that involves researchers from different fields: stochastic differential equations, nonparametric statistics, numerical simulations.

RESEARCH DIRECTIONS

The aim of this internship is to develop robust and efficient algorithms for the signals and images statistical processing in logistic systems with a complex structure described by stochastic differential equations on the basis of semi-Markovian processes. Based on the approach proposed by Barbu, Beltaief and Pergamenshchikov (2019), it is thought to develop adaptive model selection procedures for nonparametric signal processing problems observed on the conditionally fixed interval when the signal/noise fraction tends to zero. We are thinking of studying non-asymptotic optimality properties by the methods of sharp oracle inequalities for robust risks. Then, using the asymptotic lower bound methods for robust risks and the Pinsker weighted least squares methods developed by Pchelintsev, Povzun and Pergamenshchikov (2021) for Lévy processes, we plan to establish the asymptotic efficiency property for model selection procedures for semi-Markovian logistics systems. Then, using the Monte Carlo method we plan to study the developed algorithms numerically.

References.

Barbu, V., Beltaief, S. and Pergamenshchikov, S. M. (2019) Robust adaptive efficient estimation for semi -Markov nonparametric regression models. - *Statistical inference for stochastic processes*, **22 (**2), 187–231.

Barbu, V., Beltaief, S. and Pergamenshchikov, S. M. (2019) Robust adaptive efficient estimation for a semi-Markov continuous time regression from discrete data. - *Theory of Probability and Its Applications (SIAM)*, **64** (1), 156 --157.

Beltaief, S., Chernoyarov O. and Pergamenshchikov, S. M. (2020) Model selection for the robust efficient signal processing observed with small Levy noise. - *Annals of the Institute of Statistical Mathematics*, **72**, 1205 - 1235

Pchelintsev, E., Povzun, M. and Pergamenshchikov, S.M. (2021) Efficient estimation methods for non-Gaussian regression models in continuous time. - *Annals of the Institute of Statistical Mathematics*, 2021,

DOI 10.1007/s10463-021-00790-7, *https://doi.org/10.1007/s10463-021-00790-7*

PLANNING

- Understanding specific problems in nonparametric signals and images estimations (1 month);

- Study the main properties of model selection procedures (1 month);

- Developing model selection algorithms for the signal estimation problem for the semi-Markov processes (1 months);

- Developing analytical tool to study the main optimality properties for the constructed procedures (2 months) ;

- Numerical studies for the model selection procedures (1 month).