Approximation of quasi-stationary distributions for absorbed diffusions

Florian Villemonais

HAL Id: inria-00510297
https://inria.hal.science/inria-00510297

Submitted on 17 Aug 2010

Session : Processus stochastiques en temps long

Approximation of quasi-stationary distributions for absorbed diffusions

par **Florian Villemonais**

The theory of Markov processes with an absorbing state is commonly used in stochastic models of biological population, epidemics, chemical reactions and market dynamics. But, while the long time behavior of a recurrent Markov process is well described by its stationary distribution, the stationary distribution of an absorbed Markov process is concentrated on the absorbing states, which is of poor interest. In contrast, we will explain how the limiting distribution of the process conditioned to not being absorbed when it is observed can explain some complex behavior, as the mortality plateau at advanced ages, which leads to new applications of Markov processes with absorbing states in biology. As stressed by Nassel, such distributions are in most cases not explicitely computable. We present an approximation method for the quasi-stationary distribution of multidimensional diffusions defined on an open set D with absorbing boundaries. In particular, we allow the drift of the diffusion to be unbounded and the boundary of the open set D to be irregular, as in the stochastic Lotka-Volterra model studied by Cattiaux and Méléard. The main tool of this approximation is the study of a middle field interacting particle system, whose number of particles is going to infinity. We illustrate our results by numerical simulations and some considerations on the speed of convergence of the method.

Adresse :

Florian VILLEMONAIS
CMAP
École Polytechnique, route de Saclay, 91128 Palaiseau Cedex France
E-mail : `villemonais@cmapx.polytechnique.fr`