Controlled branching processes: new result lines

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Controlled branching processes (CBP) are a class of discrete-time stochastic growth population models characterized by the existence of a random control mechanism for determining in each generation (non-overlapping generations) how many progenitors participate in the subsequent reproduction process. Once the number of progenitors is known, each one reproduces independently of the others according to the same probability law.

In general, the idea of branching has been relevant in the development of theoretical approaches to problems in applied fields such as, for instance, growth and extinction of populations, biology, epidemiology, cell proliferation kinetics, genetics and algorithm and data structures. In particular, the novelty of adding to the branching notion a mechanism that fixes the number of progenitors in each generation can allow to model a great variety of random migratory movements. Thus, a practical situation that can be modeled by this kind of process is the evolution of an animal population that is threatened by the existence of predators. In each generation, the survival of each animal (and therefore the possibility of giving new births) will be strongly affected by this factor, making the introduction of a random mechanism (a binomial control process) necessary to model the evolution of this kind of population. CBP can be also used to model the evolution of the number of individuals of a population in which the rate of growth not only depends on the current population size but also on the distance between this size and the carrying capacity of the environment, that is the maximum population size that the environment can admit in view of its resources.

In this work, it is the aim to research in deep the probabilistic behavior of these practical situations and to apply new procedures to deal with the inferential theory arising from this family of branching processes.

Keywords: Controlled branching processes; extinction probability; asymptotic behavior; Markov chain Monte-Carlo; Approximate Bayesian Computation.