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Nonhomogeneous multitype Markov branching stochastic processes as models of cell population dynamics

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We consider multitype Markov branching processes with immigration occurring at time points generated by Poisson random measures. Limiting behavior of the processes for different rates of the Poisson random measures in subcritical, critical and supercritical cases is investigated and various limiting distributions are obtained. In particular, results analogous to a strong LLN (Law of Large Numbers) and a CLT (Central Limit Theorem) are proved. These models find applications to study evolution of multitype cell populations in which new cells join the population according to a time-varying immigration mechanism. For instance, terminally differentiated cells and their progenitors are replaced by diffrrentiating stem cells. As another example, a four-type model can be formulated to study evolution of genetic variation within a cell population at a specific base position of the genome by letting each of the 4 types represents one of the four nucleotides: A, G, C, and T.

Keywords: branching processes, immigration, cell proliferation
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References

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