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论文

随机环境中的分枝随机游动的若干极限定理

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摘要:

假设$\{Z_n;n=0,1,2,\cdots\}$是一个随机环境中的分枝随机游动(即质点在产生后代的过程中,还作直线上随机游动), $\xi=\{\xi_0,\xi_1,\xi_2,\cdots\}$ 为环境过程. 记$Z(n,x)$为落在区间$(-\infty, x]$中的第n代质点的个数,$f_{\xi_n}(s)=\sum_{j=0}^{\infty} p_{\xi_n}(j)s^j$ 为第n代个体的生成函数, $m_{\xi_n}=f'_{\xi_n}(1)$. 证明了在特定条件下,存在随机序列$\{t_n\}$使得$Z(n,t_n)(\prod_{i=0}^{n-1} m_{\xi_i})^{-1}$均方收敛到一个随机变量.对于依赖于代的分枝随机游动,仍有类似的结论.

关键词: 分枝过程 随机环境中的分枝随机游动 依赖于代的分枝随机游动

Some limit theorems on branching random walks in random environments

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Abstract:

Suppose $\{Z_n;n=0,1,2,\cdots\}$ is a branching random walk in the random environment, and $\xi=\{\xi_0,\xi_1,\xi_2,\cdots\}$ is the environment process. Let $Z(n,x)$ be the number of the nth generation located in the interval $(-\infty, x]$, $f_{\xi_n}(s)=\sum_{j=0}^{\infty} p_{\xi_n}(j)s^j$ be the generating function of the distribution of the particle in the nth generation, and $m_{\xi_n}=f'_{\xi_n}(1)$. We show that under the specific conditions, there exists a sequence of random variables $\{t_n\}$, so that $Z(n,t_n)(\prod_{i=0}^{n-1} m_{\xi_i})^{-1}$ converges in L^2. For branching random walks in varying environments, we have similar results.

Keywords: branching process branching random walks in random environments branching random walks in varying environments

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参考文献:

[1] Joffe A, Moncayo A.R. Random variables, trees and branching process random walks [J]. Advan Math, 1973, 10: 401-416.

[2] Stam A J. On a conjecture by Harris [J]. Z Wahrscheinlichkeitsth, 1965, 5: 202-206.

[3] Gnedenko V B, Kolmogorov A N. Limit Distirbution for sums of independent Random Variables [M]. Addison-Wesley, Reading,Mass, 1954:210.

[4] Klebaner C F. Branching random walk in varying environments [J]. Adv Appl Prob,1982, 14: 359-367.

[5] Dean H Fearn. Galton-Walson processes with generation dependent //Proc 6th Berkeley Symp Math Statist.Prob4.1972:158-172.

[6] Harris T E. The theorem of branching processes
[M]. Berlin:Springer-Verlag, 1963.

[7] D’Souza J C, Biggins J D.The supercritical galton-walson process in varying environments
[J].Stochastic Processes and its Application, 1992, 42: 39-47.

[8] Krishna B, Athreya, Samuel Karlin. Branching processes with random environment I: Extinction probabilities
[J]. Ann Math Stat, 1971, 42(6): 1843-1858.

[9] Athreya K B. Ney P E. Branching processes
[M]. Berlin, Heideberg, New York:Spring-Verag, 1972.

[10] Norman Kaplan. Branching random Walks I
[J].Stochastic Process and their Application, 1976, 4: 1-13.

[11] Norman Kaplan. Branching random Walks II
[J].Stochastic Process and their Application, 1976, 4: 15-31.

[12] Robert B A. Real analysis and probability
[M]. New York, San Francisco, London: Academic Press,1972:336.

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