BRANCHING STRUCTURE FOR AN (L-1) RANDOM WALK IN RANDOM ENVIRONMENT AND ITS APPLICATIONS

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Abstract: There are intrinsic connections between Random Walk in Random Environment (RWRE) and Branching Process in Random Environment (BPRE). After revealing these connections, the corresponding BPREs could be used as powerful tools to prove some limiting laws of RWREs. In this paper, it is revealed that the branching structure for (L-1) RWRE (that is, the walk, in one unit of time, jumping at most L to the left and at most 1 to the right) corresponds to a multitype branching process with immigration in random environment. Then two applications are presented: firstly, by studying the underlying multitype branching process, a stable limit theorem of (L-1) RWRE is proved, generalizing the result of Kesten-Kozlov-Spitzer (1975) which dealt with the nearest neighbor setting; secondly, by analyzing the branching structure, the quenched mean of the first passage time could be calculated, leading naturally to an explicit "invariant density", which is the key element to prove the law of large numbers of RWRE by the method known as "the environment viewed from particles".