Random walks at random times

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Abstract

Kesten and Spitzer (1979) introduced random walks in random scenery (RWRS) which are collective reward processes where a random walker collects a random reward (or scenery) at each site it visits. If the walker visits a site N times, it collects the same reward N times thus leading to correlations in the collective reward process. Cohen and Samorodnitsky (2006) studied a certain renormalization of RWRS and proposed self-similar, symmetric alpha-stable processes, which generalize fractional Brownian motion, as their scaling limits. The limiting processes have self-similarity exponents $H > 1/\alpha$.

We consider a modification of RWRS in which a sign associated to the reward (scenery) alternates upon successive visits of the random walk. The resulting process is what we call a random walk at random time, and it generalizes the so-called iterated random walk. We will discuss renormalizations of this discrete process, and in particular, show that the alternating scenery can lead to limiting processes which have self-similarity exponents $H < 1/\alpha$.