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Scenery Reconstruction for a Random Walk on Random Scenery with Adversarial Error Insertion

Abstract:

Consider a simple random walk on $\mathbb{Z}$ with a random coloring of $\mathbb{Z}$. Look at the sequence of the first $N$ steps taken and colors of the visited locations. From it, you can deduce the coloring of approximately $\sqrt{N}$ integers. Suppose an adversary may change $\delta N$ entries in that sequence. What can be deduced now? We show that for any $\theta < 0.5, p > 0$, there are $N_0, \delta_0$ such that if $N > N_0$ and $\delta < \delta_0$ then with probability $> 1 - p$ we can reconstruct the coloring of $> N^\theta$ integers.