Maximal entropy random walk

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We review two canonical ways of defining random walk on a graph, which have different statistics and hence different entropy: generic random walk (GRW) that is in correspondence with the field-theoretical formalism, and maximal entropy random walk (MERW), introduced by us in a recent work, that is motivated by the Feynman path-integral formulation of QM. GRW maximizes entropy locally (neighbors are chosen with equal probabilities), in contrast to MERW which does so globally (all paths of given length and endpoints are equally probable). The stationary distribution for MERW is given by the ground state of a quantum-mechanical problem where nodes whose degree is smaller than average act as repulsive impurities. We investigate static and dynamical properties GRW and MERW in a variety of examples in one and two dimensions. The most spectacular difference arises in the case of weakly diluted lattices, where a particle performing MERW gets eventually trapped in the largest nearly spherical region which is free of impurities. We put forward a quantitative explanation of this localization effect in terms of a classical Lifshitz phenomenon.