Title:	Robustness of selfoorganised criticality in the presence of random links
Authors:	Dasgupta, Rajarshi
Keywords:	Robustness selfoorganised presence of random
Issue Date:	Apr-2022
Publisher:	IISER Mohali
Abstract:	Dynamical systems are often seen to evolve to a state which is out of equilibrium, and characterized by power-law scaling. Such states are called self-organised critical states. In this thesis we wish to investigate the robustness of self-organised criticality in the presence of random spatial links. In particular, we consider the simple model of biological evolution proposed by Bak-Sneppen, which is known to attain a self-organised state after transience and exhibits features of punctuated equilibrium. We propose a variant of this well-known model, by introducing random links in the network of biological niches using the 'small- world' algorithm. We find that the randomly rewired system also attains a self-organised critical state, for probability p of random rewiring ranging from p □ 0 (i.e. close to a ring as in the Bak-Sneppen model) to p □ 1 (where the underlying connection graph is almost completely random). The robustness of the self-organized state under random links is reflected in the power-law scaling of the frequency of mutation distances, irrespective of the extent of randomness in the network of niches. To characterize the changes in the system we propose the notion of an activity graph and we find that the structure of this activity graph is significantly different from the network of the niches. Interestingly we find that the emergent activity network has a small characteristic size, independent of the system size. We also observe that the size of the activity network increases with the probability of random rewiring p. Lastly, we introduce another variant of the Bak-Sneppen model, where mutations occur with a probability that is a function of local conditions. We find that this variant too exhibits self-organised criticality.
URI:	http://hdl.handle.net/123456789/4135
Appears in Collections:	MS-17