Role of dimensionality in preferential attachment growth model with random fitness

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Scale-free networks are very popular nowadays. Several systems can be represented as a network presenting without scale properties, for example: the internet, citations networks, neurons networks, among others. In order to study these connected systems many models have been proposed, however, the most of them are just topological. The searches showed that there is a deep connection between the complex networks world and the nonextensive statistical mechanics one when the long-range interactions are present (and the Boltzmann-Gibbs statistical is not appropriated to describe this kind of system). In this work, we studied a d-dimensional geographically-located networks that grow and have the preferential attachment given by $\Pi_i \propto k_i \eta_i r_{ij}^{-\alpha_A}$. We verified that all the degree distribution P(k) ($\forall d$) are very well fitted by $P(k) = P(0)e_q^{-k/\kappa}$, where the q-exponential comes from the nonextensive statistical mechanics. We also verify that q and κ depends on α_A and d separately, however, in such way remarkable we observe that q and κ present universal behavior with respect to α_A/d variable. Others quantities (the exponent β and the average shortest path $\langle l \rangle$) are being studied and also present surprisingly the same universal behavior with respect to α_A/d.