Mapping dynamical systems onto complex networks

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A procedure to characterize discrete time dynamical systems is investigated, in which its evolution is mapped onto a complex network. In the proposed methodology, the phase space is first divided into boxes of arbitrary size, which correspond to the nodes of the network. Then, the links are defined by the sequence of visits in each of the boxes/nodes, which depends on the time evolution of the system. We search to establish a correspondence among the characteristics of the dynamical system, expressed by the Lyapunov exponent and fractal dimension of the attractor, with those of the obtained network, expressed by degree distribution, clustering coefficient, mean minimal path, assortativity coefficient and fractal dimension. The quadratic and Henon maps are used as examples to show the feasibility of the proposed scheme. We find remarkable distinctions when the system is at the edge of chaos (weak or polynomial divergence of trajectories) in comparison to the situation of positive Lyapunov exponents.