Double layers Susceptible-Infected-Recovery

In order to describe the dynamics of multiple systems interacting with each other, a multilayer network with 2 layers is considered, representing the different relationships among the agents. The dynamics of opinion formation is considered in layer A, which is called the opinion layer. In layer B, the dynamics of information or disinformation propagation in online social systems is studied, which follows the classical SIR propagation model and is referred to as the information layer.

In layer A, each node may be in one of 2 states: (+) opinion state or (-) opinion state. These two states can be transformed into each other, driven by the influence of neighbors on the one hand, and on the other hand, each node has a certain chance to change its mind spontaneously (implemented using the Noisy Voter model). The rate at which these two states spontaneously transition to each other is denoted by v; the degree to which a node is influenced by its neighbors is denoted by h.

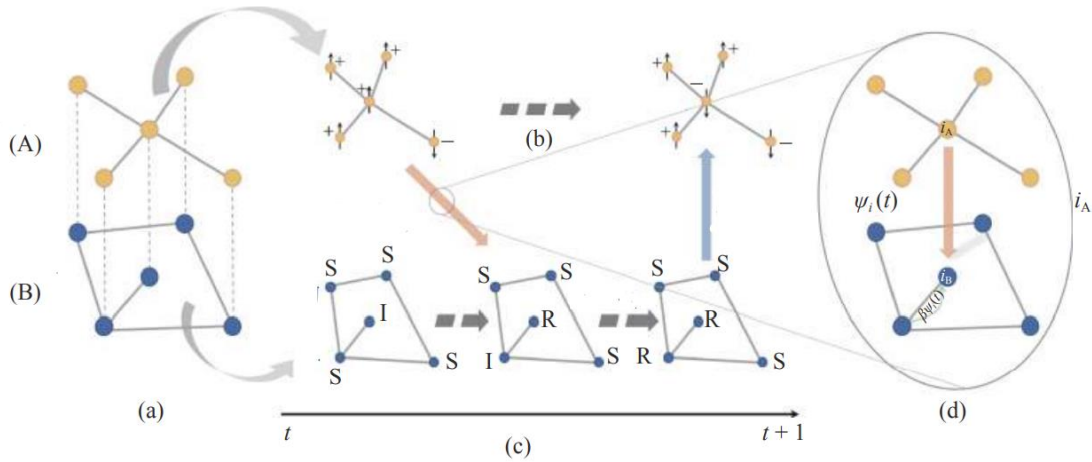The SIR model used in the B layer is the same as the one annotated in the code I uploaded earlier.

Fig.1 NV-SIR coupling model

It is assumed that the dynamics process on layer B network evolves faster than layer A, i.e., the update rate of voting layer is much smaller than that of message layer, and every time the state of layer A network is updated, the dynamics of layer B network evolves to a stable or terminal state. Therefore, for layer A, only the final situation of message diffusion on layer B will be affected.