

Figure 1. Running time (specifically, time spent per epoch run) and the number of parameters for each method of the mutualistic dynamics on grid network in the case of regularized sampling, i.e., the discrete case.

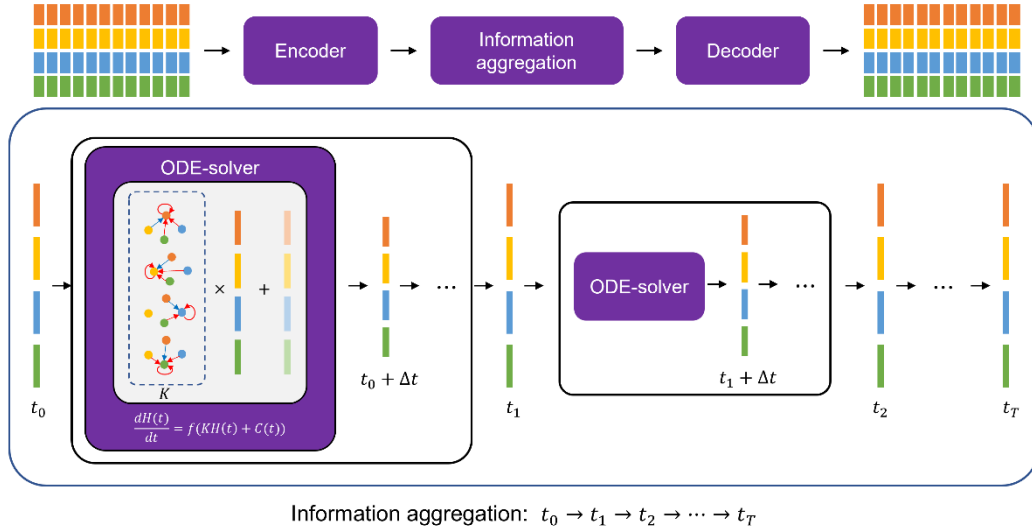


Figure 2: NDSG architecture. In the ODE solver for information aggregation, we use  $\mathbf{K}$  to describe the directed weight signed graph, the arrows from node  $i$  to node  $j$  indicate that node  $j$  receives information from node  $i$ , the thickness of the arrow indicates the size of the weight, and the color of the arrow indicates the positive or negative connection (red is positive, blue is negative).

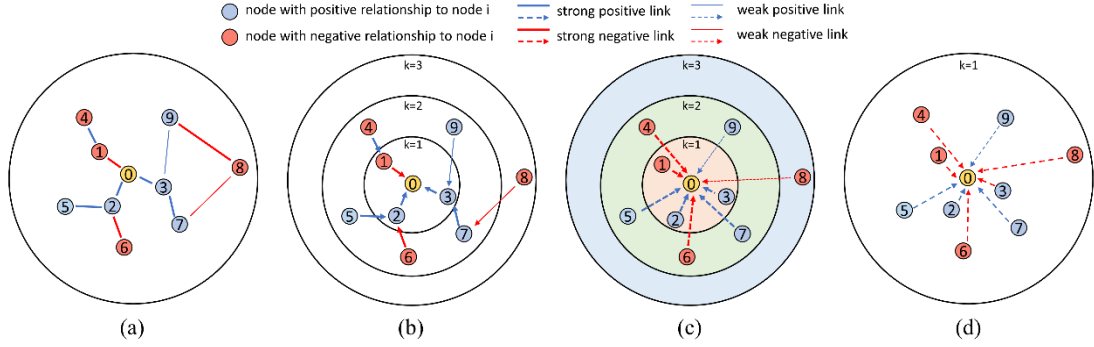


Figure 3. Illustration of signed network information aggregation. (a) A signed network with weights. (b) Information aggregation neighborhood approach of signed graph convolutional network. For node 0, other nodes are grouped into different layers based on order and the information is aggregated layer by layer. (c) Our proposed information aggregation method. The information of nodes in each layer is directly passed to node 0, and the information is extracted with the weight matrix of the corresponding layer, distinguished by different colors. (d) Approximate simplified information aggregation method. From the perspective of node 0, it is equivalent that all other nodes with non-zero edge weights are first-order neighbors.