Abstract. In this work, the disease spreading under SIR framework (susceptible-infected-recovered) agent-based model was investigated via magnetic spin model, stochastic Monte Carlo simulation, and Neural Network analysis. The defined systems were two-dimensional lattice-like, where the spins (representing susceptible, infected, and recovered agents) were allocated on lattice cells. The lattice size, spin density, and infectious period were varied to observe its influence on disease spreading period. In the simulation, each spin was randomly allocated on the lattice and interacted with its first neighbouring spins for disease spreading. The subgroup magnetization profiles were recorded. From the results, numbers of agents in each subgroup as a function of time was found to depend on all considered parameters. Specifically, the disease spreading period slightly increases with increasing system size, decreases with increasing spin density, and exponentially decays with increasing infectious period. Due to many degrees of freedom associated, Neural Network was used to establish complex relationship among parameters. Multi-layer perceptron was considered, where optimized network architecture of 3-19-15-1 was found. Good agreement between predicted and actual outputs was evident. This confirms the validity of using Neural Network as supplements in modelling SIR disease spreading and provides profound database for future deployment.