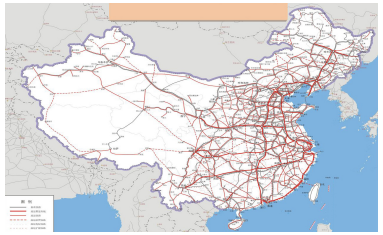
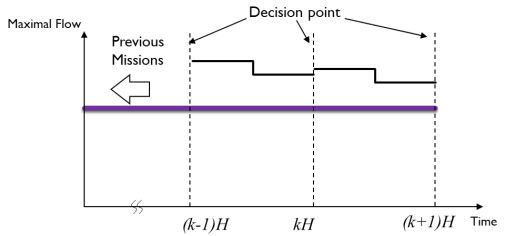
Maintenance policy optimization of infrastructure with complex network structure

Model-based methods

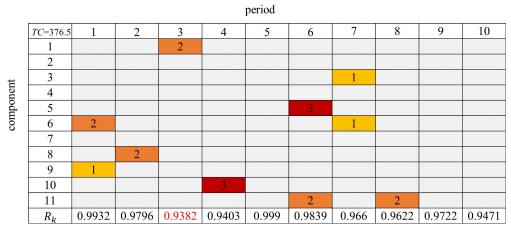
Define the system reliability as the probability that the maximal network flow between the source node and sink node is larger than a given demand.

Optimize the maintenance policy that decide when to repair which component in what level, without considering maintenance break during operation, under limited resource.



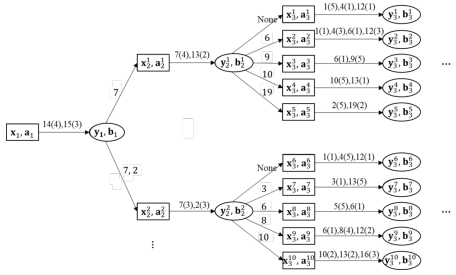


A heuristic-based algorithm to solve the bi-objective stochastic optimization problem.



Obtain a static multi-period policy

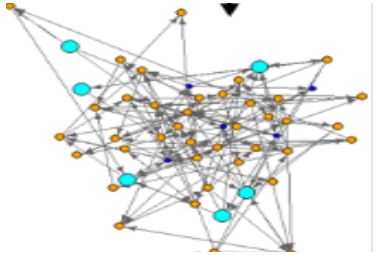
An approximate dynamic programming approach to overcome the dimension curse.



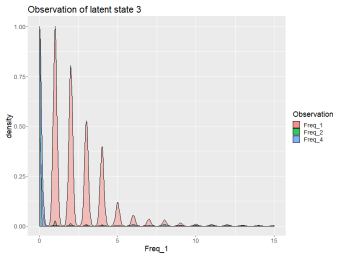
Obtain a dynamic policy

Data driven methods

For systems that are hard to define or calculate a metric to reflect the system performance, such as the complicated tele-communication network, constructing data driven models is an effective method to detect the anomaly state and then make the optimal decision. Deep learning is also a good tool for data analysis.



A low-rank state-space model to detect the anomaly state that with different data distribution from normal states.



A deep reinforcement learning approach to evaluate the network service reliability and optimize the maintenance policy.