Many objective optimization and complex network analysis

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Stellingen

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Many Objective Optimization and Complex Network Analysis

1. In the optimization world, more objective functions to be optimized simultaneously, automatically increases the algorithm complexity. Reducing complexity is a high-dimensional optimization problem. Community detection is an appropriate method to deal with this problem, Chapter 3.

2. The epistatic variables of a gene with some index i can be adjacent with respect to the index i (local interactions) or their choice can be random (global interactions). This has a significant impact on the behavior of the trait-correlation function, Chapter 4

3. Understanding the complexity of the system is important, since it can provide insights for choosing a strategy for problem solving. Modeling it with specific methods can sometimes provide solvable approaches based on the structure of a system, Chapter 4.

4. Network data becomes increasingly available but also complicated due to the omnipresence of data measurement and inquiry as a recent trend. Clustering techniques that detect groups of nodes in the complex network have therefore become an essential part of the research, Chapter 5

5. In the many-objective optimization of multiplex network analysis, clustering a multiplex network in one-layer helps to understand the effect to the clustering of the network in some other different layers, Chapter 5.

6. We consider the optimization of network centrality in different layers (edge sets) as the objective functions. Optimizing simultaneously several (2;3) objectives can be addressed by multi-objective optimization and many (> 3) objectives by many-objective optimization. The high dimensional Pareto front obtained by the second approach requires qualitatively different methodologies, Chapter 6.

7. Finding the most important node in the network is a conventional approach in network analysis. Instead of finding a single important node in the network, it is often a more realistic problem to find an important set of nodes in the network, Chapter 6.

8. The eigenvalue drop is a useful measure for the impact of an immunization strategy because the maximum eigenvalue is inversely proportional to the epidemic threshold which determines how fast a virus spreads in the network and how long it lingers in the network; it should be optimized directly and not be replaced by a proxy-measure, Chapter 7.

9. Immunization of nodes can be enforced by controlling or removing a subset of nodes from a network. If the cost of removal is considered, this problem becomes a combinatorial multi-objective optimization problem, Chapter7.

10. Complexity of the system is multi-interpretable; understanding of it needs the art of thinking.