Robust Multiobjective Controllability of Complex Neuronal Networks

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Abstract:
This paper addresses robust multiobjective identification of driver nodes in the neuronal network of a cat's brain, in which uncertainties in determination of driver nodes and control gains are considered. A framework for robust multiobjective controllability is proposed by introducing interval uncertainties and optimization algorithms. By appropriate definitions of robust multiobjective controllability, a robust nondominated sorting adaptive differential evolution (NSJaDE) is presented by means of the nondominated sorting mechanism and the adaptive differential evolution (JaDE). The simulation experimental results illustrate the satisfactory performance of NSJaDE for robust multiobjective controllability, in comparison with six statistical methods and two multiobjective evolutionary algorithms (MOEAs): nondominated sorting genetic algorithms II (NSGA-II) and nondominated sorting composite differential evolution. It is revealed that the existence of uncertainties in choosing driver nodes and designing control gains heavily affects the controllability of neuronal networks. We also unveil that driver nodes play a more drastic role than control gains in robust controllability. The developed NSJaDE and obtained results will shed light on the understanding of robustness in controlling realistic complex networks such as transportation networks, power grid networks, biological networks, etc.

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NSJaDE, robust multiobjective identification, robust multiobjective controllability, complex neuronal networks, nondominated sorting adaptive differential evolution

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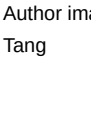
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