Synchronous Dynamical Systems on Directed Acyclic Graphs (DAGs): Complexity and Algorithms

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Acknowledgment: This work was partially supported by NSF Grants IIS-1633028 (BIG DATA), CMMI-1745207 (EAGER), OAC-1916805 (CINES), CCF-1918656 (Expeditions) and IIS-1908530.

Our Main Contributions

- Discrete dynamical systems serve as formal models of diffusion phenomena in networks (e.g., diffusion of opinions).
- We consider synchronous dynamical systems on directed acyclic graphs (DAG-SyDSs).
- **Result 1:** Reachability problem for DAG-SyDSs remains **PSPACE**-complete even when each local function is symmetric.
- **Result 2:** Convergence Guarantee problem for DAG-SyDSs is **Co-NP**-complete even for DAGs with at most three levels.
- Results 1 and 2 extend those of [Chistikov et al., AAAI-2020] to DAG-SyDSs.
- **Result 3:** Reachability problem for DAG-SyDSs is efficiently solvable when each local function is monotone. (For general directed graphs, the problem is **PSPACE**-complete [Ogihara & Uchizawa, 2017].)

Thank You!