Interference-free Walks in Time: Temporally Disjoint Paths

Nina Klobas
Durham University, UK
nina.klobas@durham.ac.uk
George B. Mertzios
Durham University, UK
george.mertzios@durham.ac.uk
Hendrik Molter
Ben-Gurion University of the Negev, Be'er Sheva, Israel
molterh@post.bgu.ac.il
Rolf Niedermeier
TU Berlin, Germany
rolf.niedermeier@tu-berlin.de
Philipp Zschoche
TU Berlin, Germany
zschoche@tu-berlin.de

We investigate the computational complexity of finding *temporally disjoint* paths or walks in temporal graphs. There, the edge set changes over discrete time steps and a temporal path (resp. walk) uses edges that appear at monotonically increasing time steps. Two paths (or walks) are temporally disjoint if they never use the same vertex or edge at the same time; otherwise, they interfere.

We show that on general graphs the problem is computationally hard. The "walk version" is W[1]-hard when parameterized by the number of routes. However, it is polynomial-time solvable for any constant number of walks. The "path version" remains NP-hard even if we want to find only two temporally disjoint paths. On the other extreme, restricting the underlying graph to be a path, we find a polynomial-time algorithm for a relevant special case while the problem remains NP-hard in general (for both paths and walks).