Behaviour Recognition Algorithms In Temporal Graphs

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A temporal graph G is a sequence of static graphs indexed by a set of integers T representing time instants. Such a graph can be used to represent the interactions between given agents and the evolution of those interactions through time. Algorithms able to discern behaviours of those agents are therefore useful to characterize populations. We focus on two behaviour recognition problems, and the algorithmic solutions we devised for each one. The first one is called Δ-Module[1]. Given Δ an integer, a group of vertices A form a Δ-module if they have the same neighbourhood outside of A for at least Δ consecutive time instants. A solution to this problem permits the recognition of similarities of behaviour between multiple agents. The second one is called TemporalSubpathIsomorphism[2]. Given P a temporal graph called the pattern graph, P is subgraph isomorphic to G if there exists a bijection $f: V(P) \rightarrow V(G)$ such that, given t_0 a time instant of G, there is an edge between u and v, vertices of P, at time instant t if and only if there exists an edge between $f(u)$ and $f(v)$ at time instant $t+t_0$ in G. A solution to this problem permits the recognition of behavioural pattern between various agents. We present exact algorithms solving specific cases of both these problems.

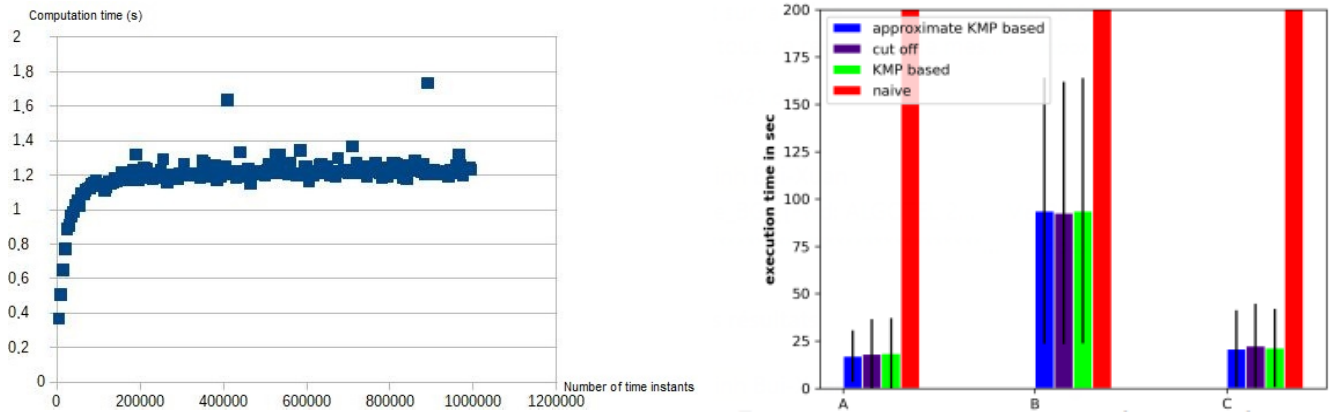

Figure 1: (Left) Computation time of Δ-modules of size 2. (Right) Computation time solving temporal subgraph isomorphism when pattern graph P is a temporal path.

Our implementations are available at *https://github.com/DaemonFire/deltaModules* and at *https://github.com/reihan35/temporal_subpath_isomorphism*.

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References

[1] B-M. Bui-Xuan, H. Hourcade, C. Miachon, *Computing Temporal Twins in Time Logarithmic in History Length*, International Conference on Complex Networks and Their Applications IX (2020) 651-663.

[2] F. Hamissi, *Subpath stream isomorphism in tree streams,* Master's thesis, Sorbonne Université, 2020.