

# Matthieu Latapy, Clémence Magnien et Mehdi Naima : Efficient computation of betweenness centrality in stream graphs

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In graph theory *betweenness centrality* is a measure to assess the importance of nodes in a graph. This centrality measure is widely used in network theory for example in telecommunications and community detection.

*Stream graph* [LVM18] is a formalism for dynamic graphs that generalizes graph concepts in order to cope with both the structural and temporal interactions of a network. The formalism allows for continuous time, dynamic on the nodes and edges of the graph. The authors presented an extension of classical betweenness centrality. Let  $V$  be a set of nodes, and  $T$  a set (countable or uncountable) of time instants, then the betweenness of a temporal node  $(t, v) \in T \times V$  is defined as  $B(t, v) = \sum_{s, z \in V} \int_{i, j \in T} \frac{\sigma_{(i, s), (j, z)}(t, v)}{\sigma_{(i, s), (j, z)}} di dj$ , where  $\frac{\sigma_{(i, s), (j, z)}(t, v)}{\sigma_{(i, s), (j, z)}}$  is the fraction of all shortest fastest paths from node  $s$  at time  $i$  to node  $z$  at time  $j$  that involve  $v$  at time  $t$  if there is a path from  $(i, s)$  to  $(j, z)$  and 0 otherwise. Recently, in [SML21] the authors presented an algorithm for the betweenness centrality of a temporal node that works on link streams which are a constrained version of stream graphs (node dynamic was excluded). Moreover, their algorithm had no precise complexity study.

In this work we present a *Brandes like algorithm* to compute betweenness centrality in stream graphs. Compared to the state of the art algorithm, our algorithm works on the general model of stream graphs, it computes the betweenness centrality of all temporal nodes and more importantly our algorithm is faster with a precise complexity measure.

## Références

- [LVM18] Matthieu Latapy, Tiphaine Viard, and Clémence Magnien. Stream graphs and link streams for the modeling of interactions over time. *Social Network Analysis and Mining*, 8(1) :1–29, 2018.
- [SML21] Frédéric Simard, Clémence Magnien, and Matthieu Latapy. Computing betweenness centrality in link streams. *arXiv preprint arXiv :2102.06543*, 2021.