Optimizing Temporal Motif Mining On A GPU

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Temporal Graph

• Edge timestamps record the time of interaction between set of nodes

• *E.g.*, email exchange network – timestamp records time for sending/receiving an email from one user to another
Mining Temporal Motifs

- Temporal motifs – chronologically-ordered edge sequences that happen within a time window.
- Temporal Motifs Mining – mining all occurrences of a temporal motif in a temporal graph.
Applications Of Mining Temporal Motifs

Information Flow Analysis
Social Media Networks

Detection of Financial Fraud

Identifying Insider Threats

Monitoring Electrical Power Grids

Kovanen et al. [JSM 2011], Lahiri et al. [CIDM 2007], Mackey et al. [Big Data 2018], Kumar and Cladders [VLDB 2018]
Characterization for a baseline GPU implementation

Instruction Count Distribution
- Others: 11.1%
- Fetching: 6.6%
- Bookkeeping: 8.2%
- Checking: 27.2%
- Searching: 46.9%

Stall Distribution
- Others: 8.2%
- Fetching: 3.7%
- Bookkeeping: 8.4%
- Checking: 26.2%
- Searching: 53.5%

Sub-optimal performance due to excessive search operations
Search Result Memoization

Context

+=

[Beg 0 | End 0) | Base Ptr
[Beg 1 | End 1) | Base Ptr

Performance Improvement

Datasets

em | mo | ub | su | wt | so | geo-mean

Baseline | Memoization

Speedup (x)
Thank You