SMU SINGAPORE MANAGEMENT UNIVERSITY

School of Computing and Information Systems

Dynamic Topic Models for Temporal Document Networks

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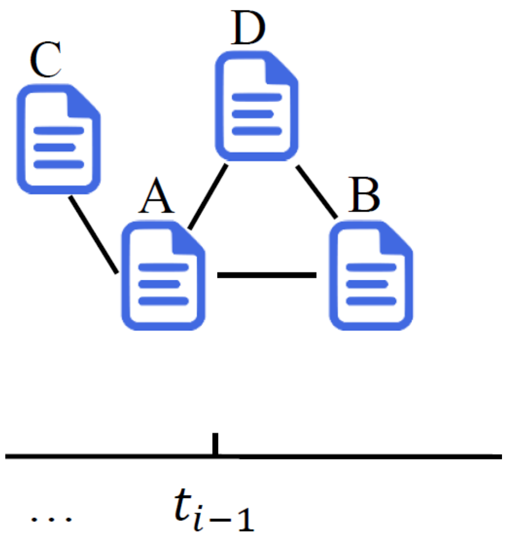
PREFERRED.AI

Motivation

- **Temporal Document Networks**
  - Examples: Paper citation network, Web page hyperlink network, etc.
  - Illustration:



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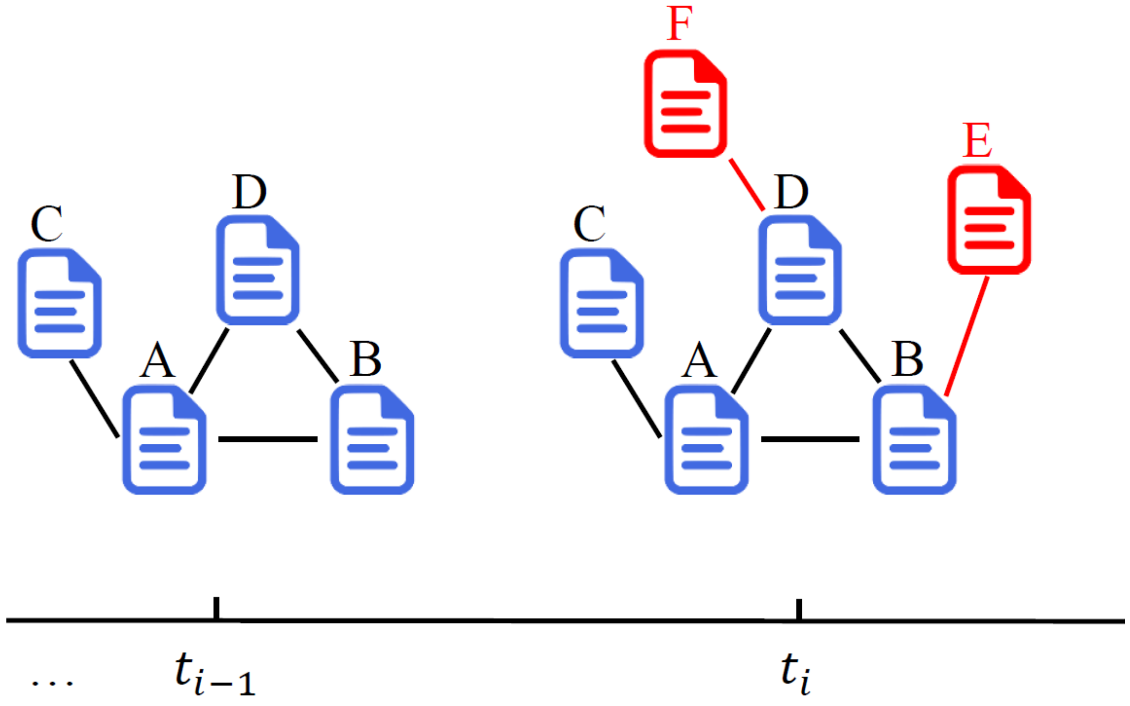

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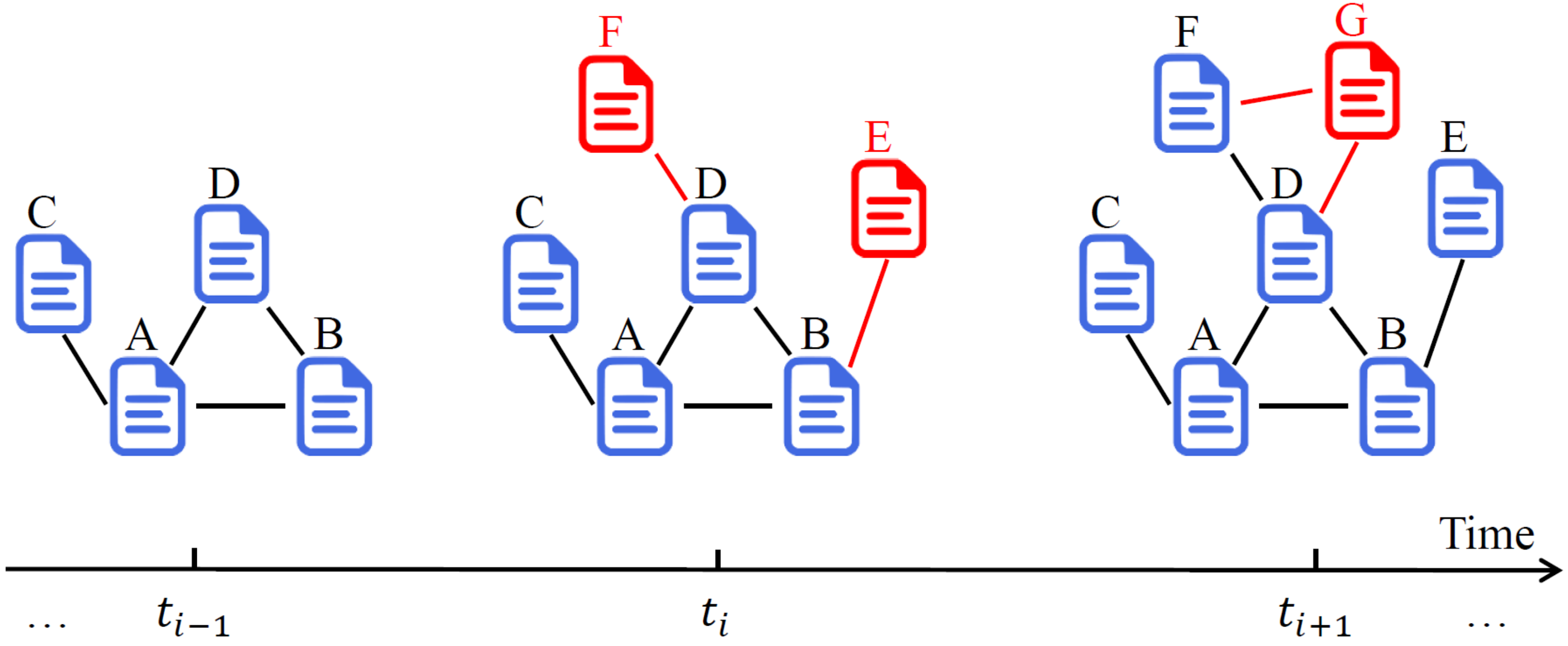

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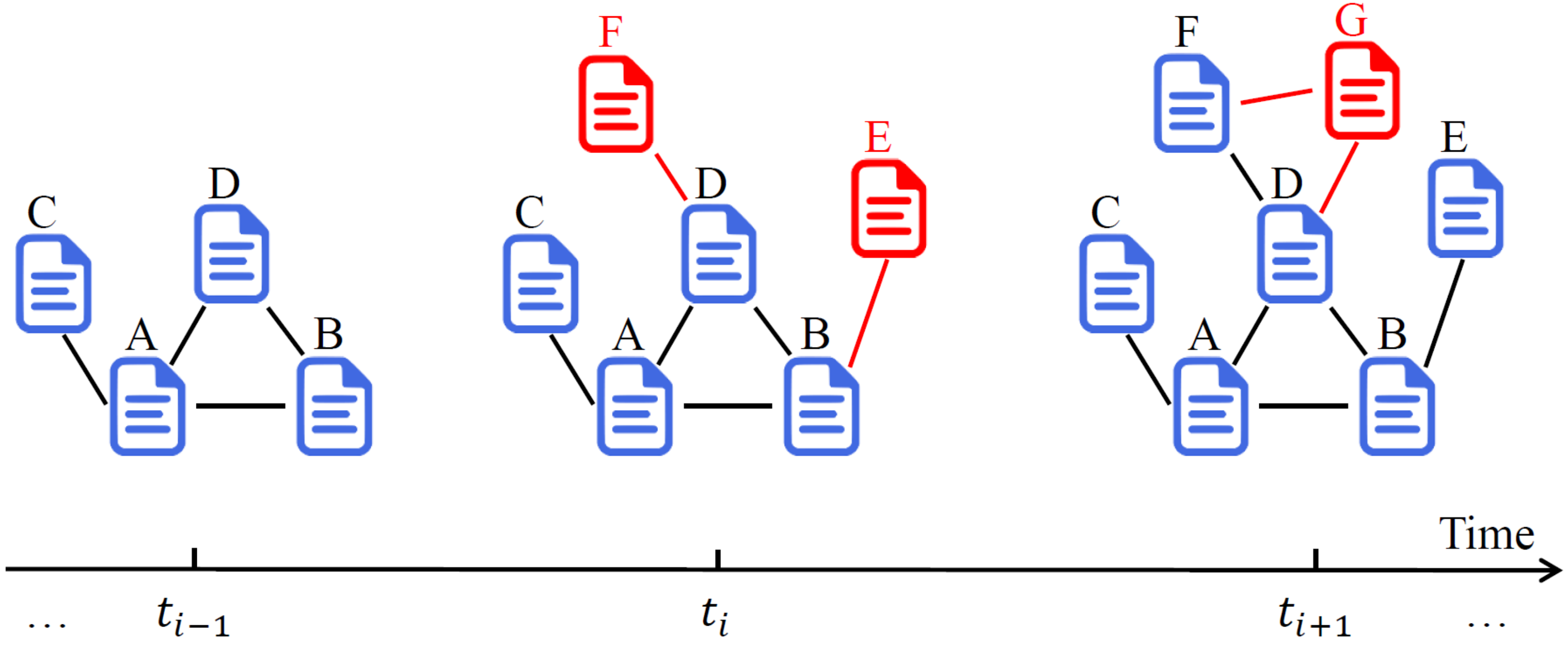
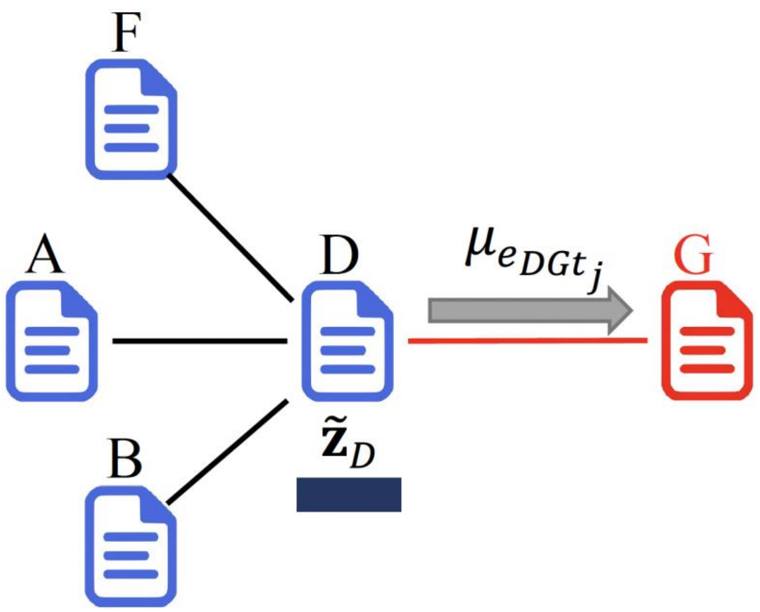


Existing research [1] considers network connectivity only, ignoring document dynamics.

[1] Chang, J., & Blei, D. (2009, April). Relational topic models for document networks. In Artificial Intelligence and Statistics (pp. 81-88).

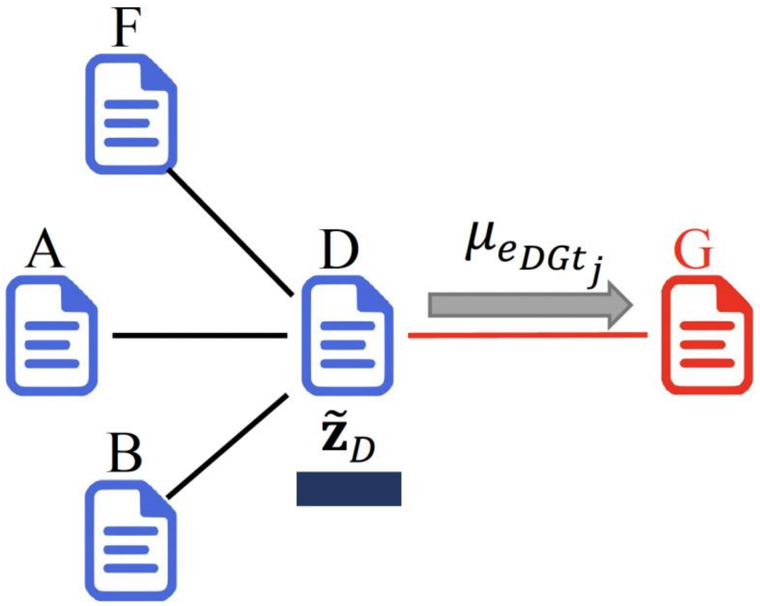
Model Architecture



Model Architecture

- We design a Time-Aware Optimal Transport to predict each link.

$$d_{\mathbf{C}}(\tilde{\mathbf{z}}_i, \mathbf{d}_j, t_i, t_j) = \min_{\mathbf{P} \in U(\tilde{\mathbf{z}}_i, \mathbf{d}_j, t_i, t_j)} \sum_{t=t_i}^{t_j} \sum_{k=1}^{K} \sum_{w=1}^{|\mathcal{V}|} p_{tkw} c_{tkw}$$



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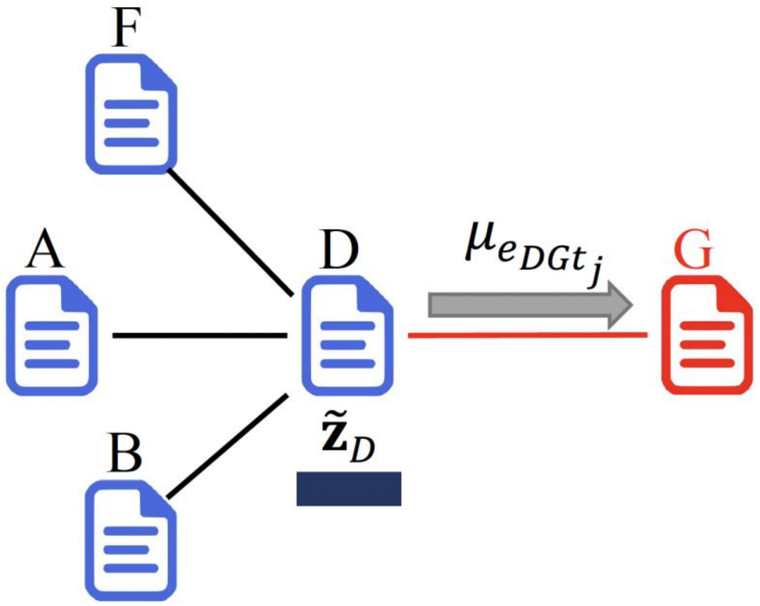
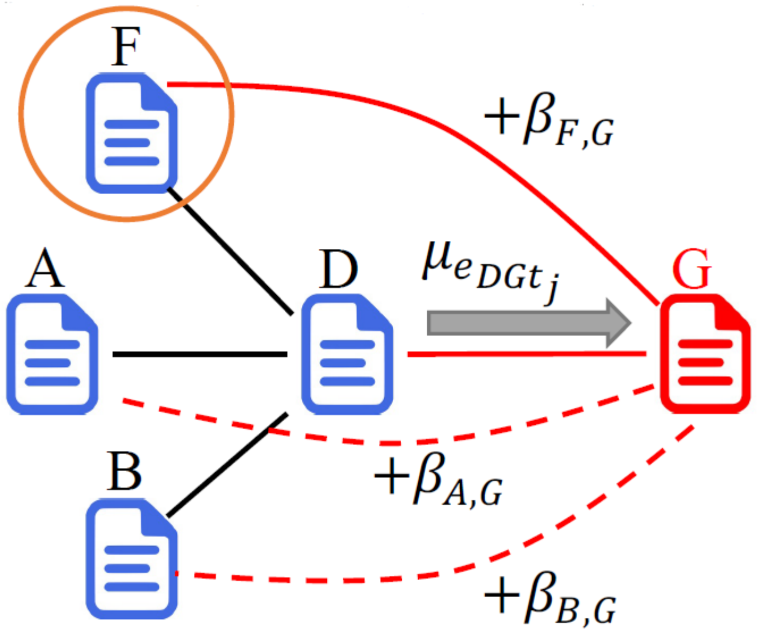
Time dimension



Model Architecture

- We further introduce Hawkes Process to capture higher-order neighbors.

$$\lambda_{e_{ijt}} = \underbrace{\mu_{e_{ijt}}}_{\text{semantic modeling}} \underbrace{+\eta_{HP} \sum_{p \in \mathcal{N}_t(i)} \beta_{pj} a_{ip}}_{\text{network modeling}}$$



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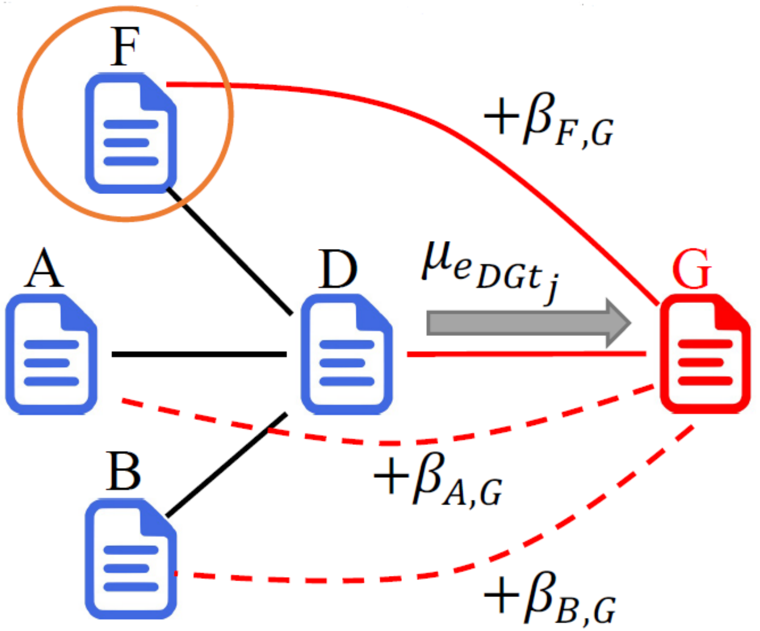
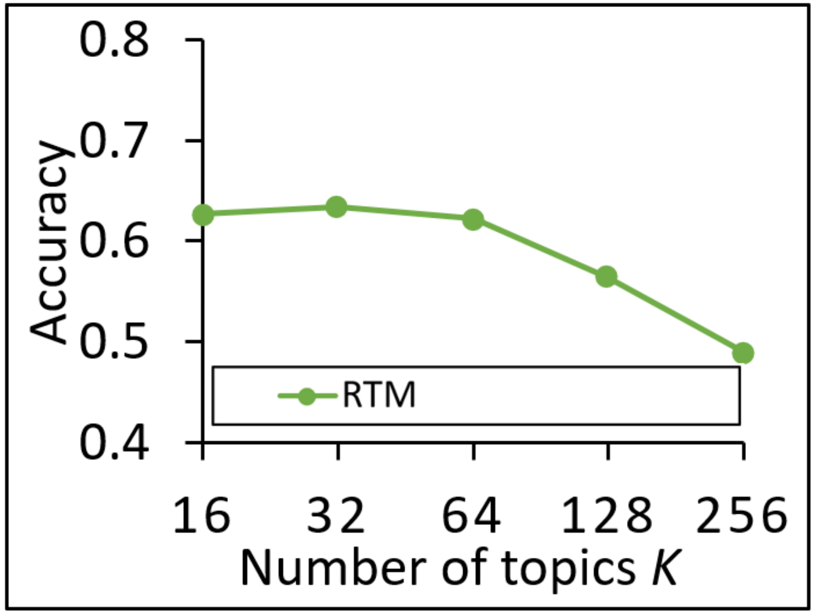
Influence of higher-order neighbors



Experiments

- Document classification against RTM, a static model.



(a) Classification accuracy on A corpus

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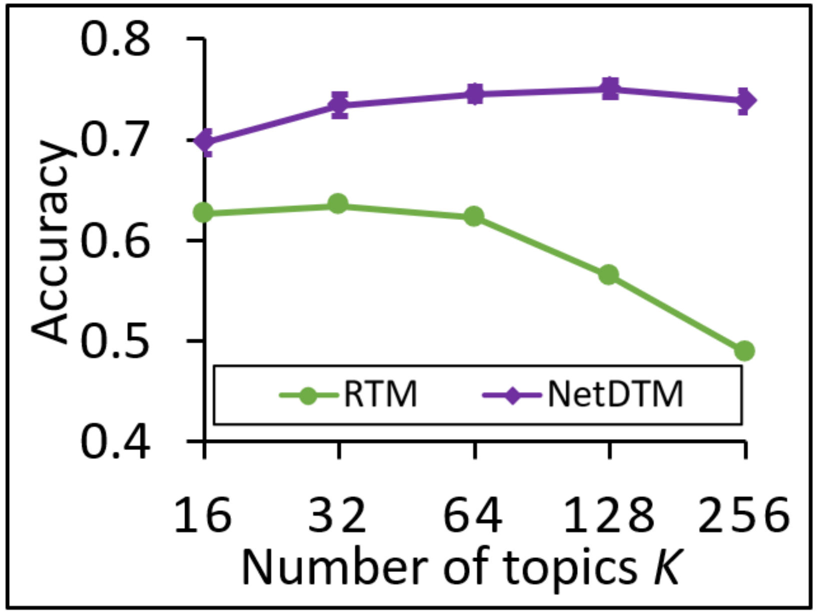
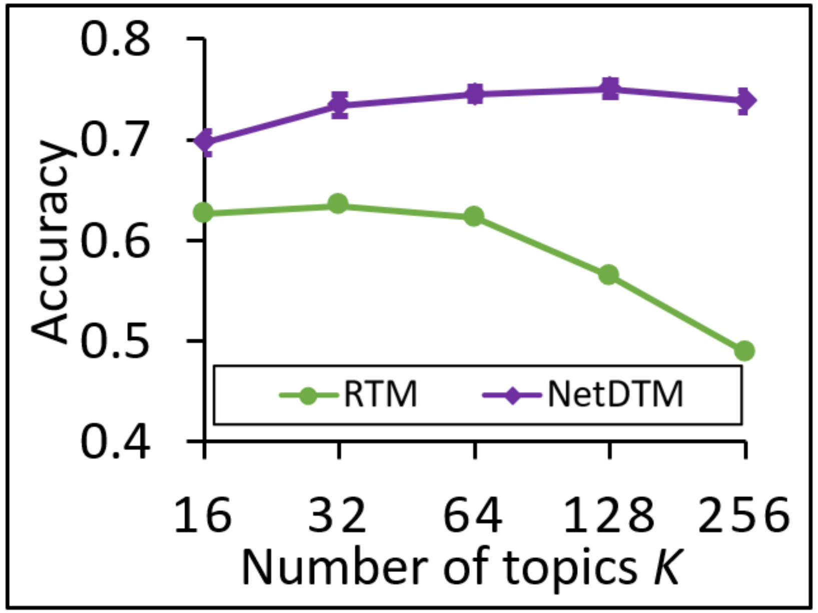


(a) Classification accuracy on A corpus

Experiments

- Document classification against RTM, a static model.
- Modeling both network structure and dynamics improves topic quality.



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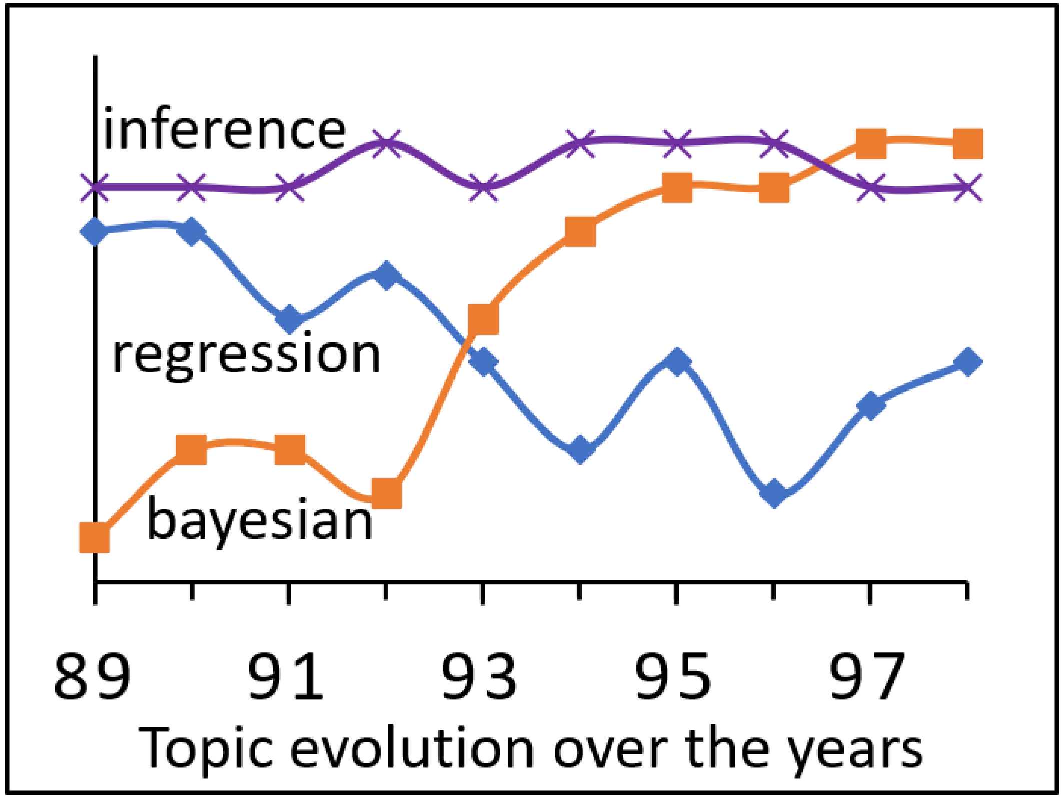
Topic "Bayesian Inference"



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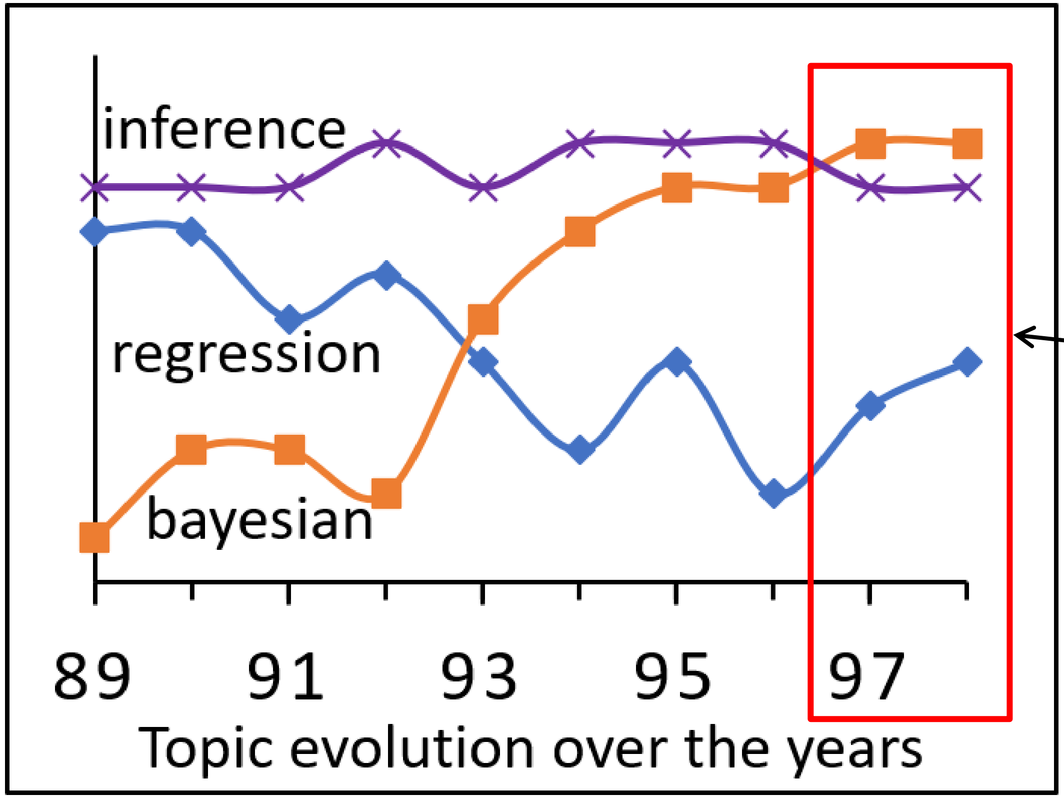

The most recent topic popularity

Delvin Ce Zhang is looking for a postdoc place!

- **Graduation date: July 2023**
- **Research interests (Data Mining and Machine Learning)**
  - Graph Representation Learning, Graph Neural Networks
  - Text Mining
  - Recommender Systems
- **First-authored publications**
  - ICML-22, KDD-22, AAAI-20, CIKM-21, 2 × ECML/PKDD-21
  - NeurIPS (being reviewed), TKDE (being reviewed)
- **PC member**
  - NeurIPS, ICML, KDD, ACL, WWW, etc.
- **Homepage:** delvincezhang.com
- **Email:** cezhang.2018@smu.edu.sg