

Timestamping Documents using GCNs

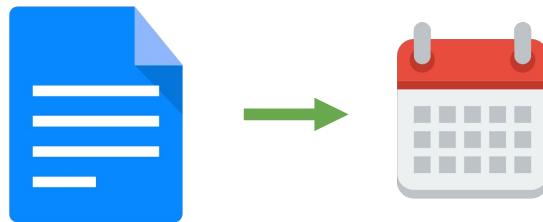
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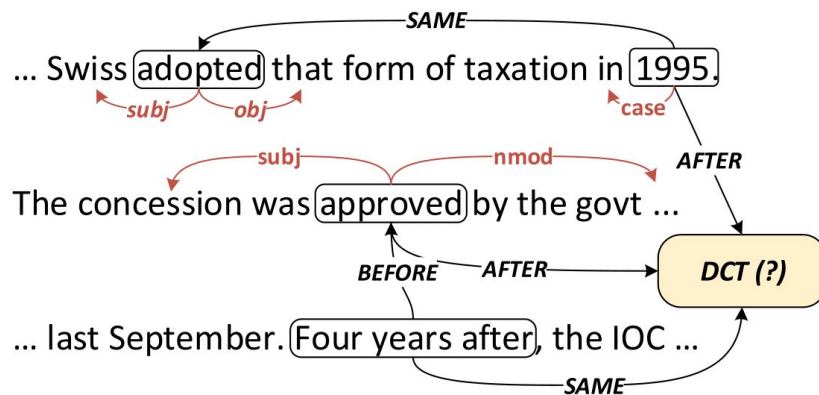
Document Dating (Time-stamping)

- Predicting the **creation time** of the document



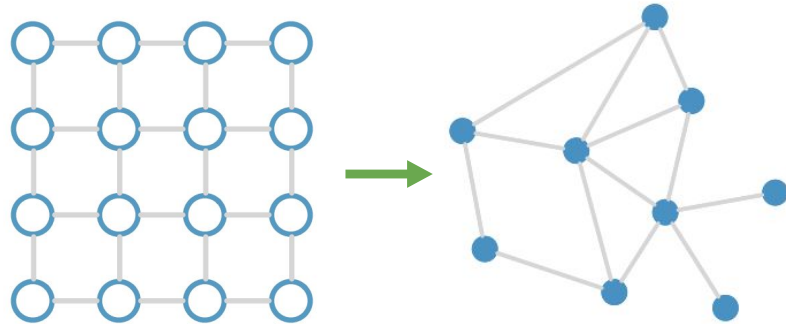
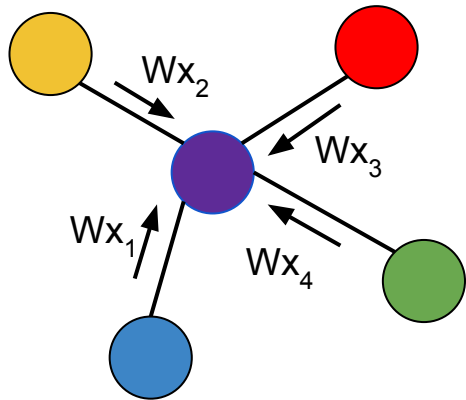
- **Applications:**

- Information Extraction
- Temporal reasoning
- Text Summarization
- Event detection ...



Graph Convolutional Networks

- Generalization of CNNs over Graphs.

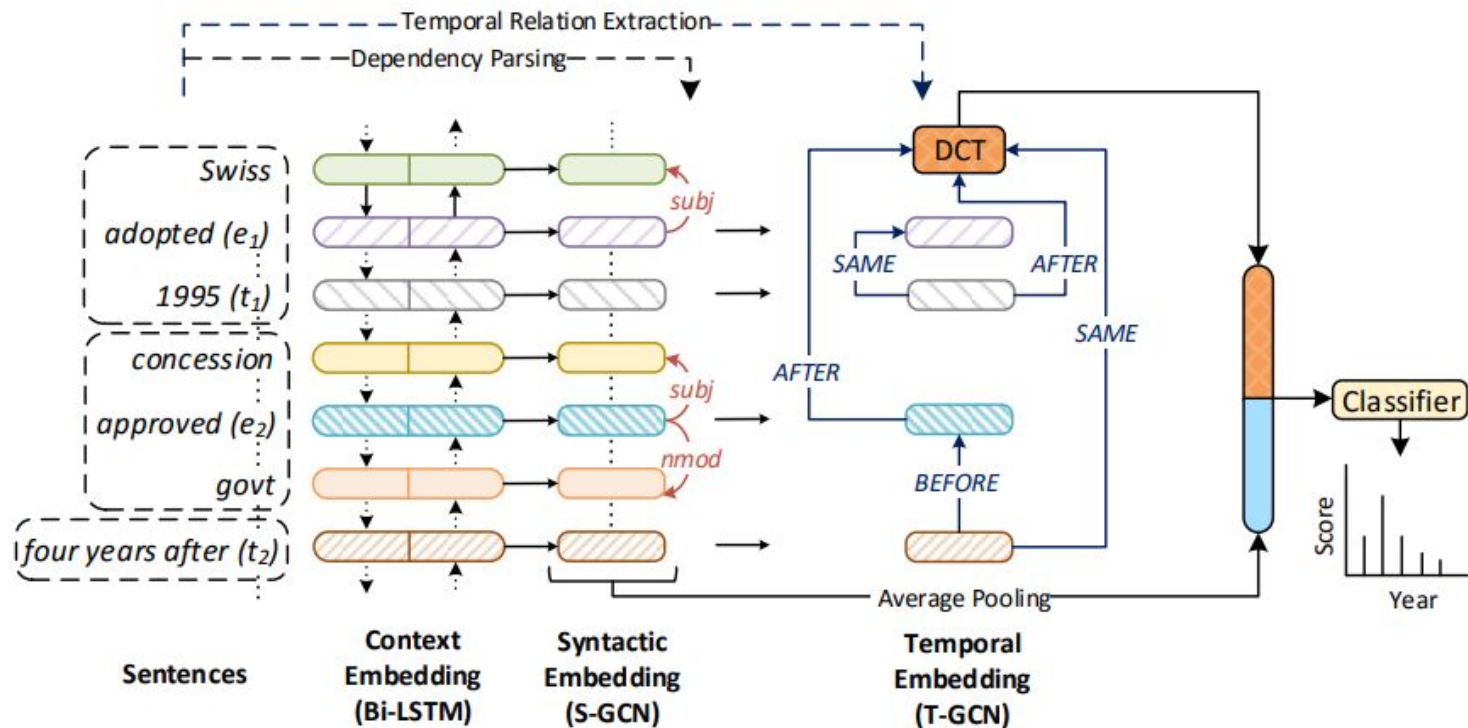


$$h_v = f \left(\sum_{u \in \mathcal{N}(v)} (Wx_u + b) \right), \quad \forall v \in \mathcal{V}$$

Contributions

- NeuralDater, a **Graph Convolution Network (GCN)-based** approach for document dating. **First application of GCN** for document dating problem.
- Performs **reasoning over syntactic** as well **temporal structure** of the document, all within a principled joint model.

NeuralDater Architecture



Results

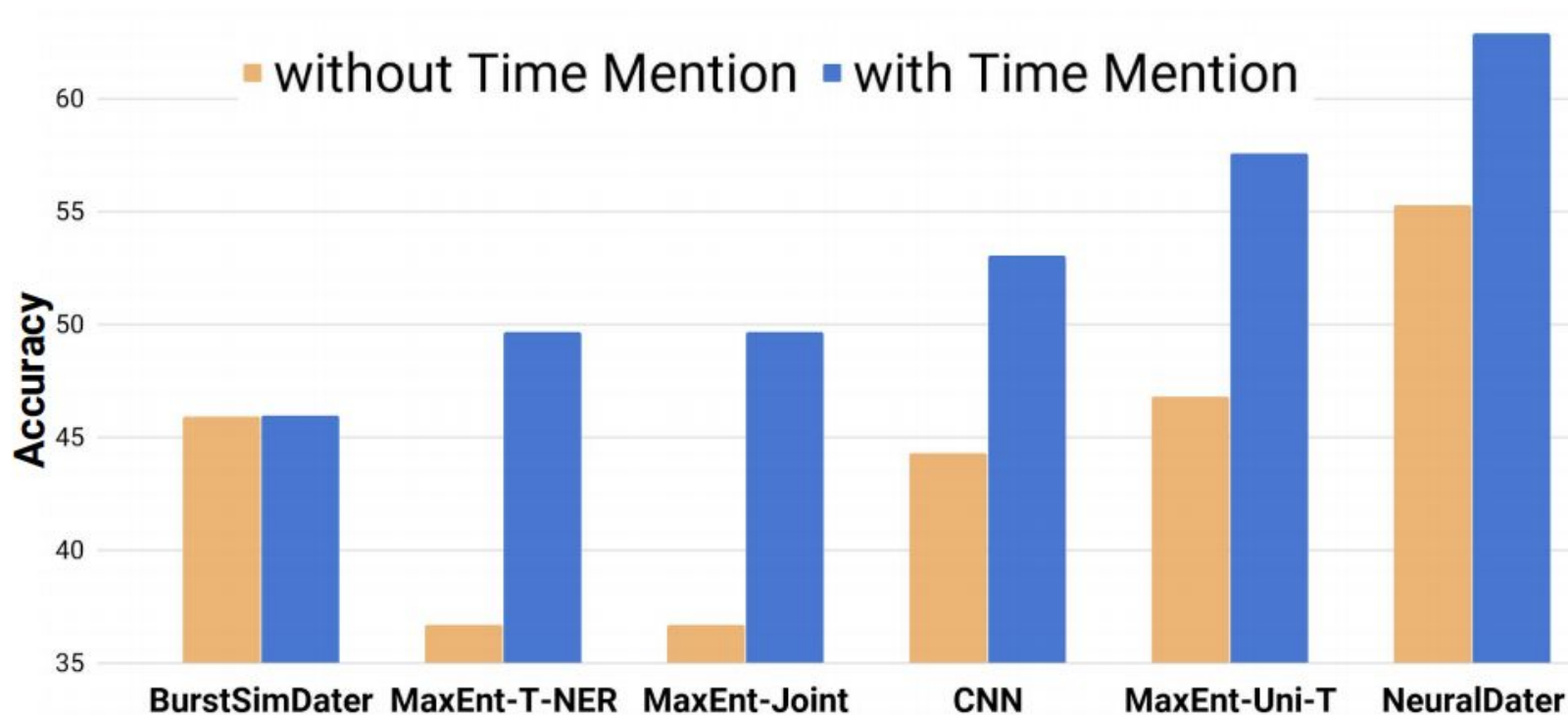
Method	APW	NYT
BurstySimDater	45.9	38.5
MaxEnt-Time+NER	52.5	42.3
MaxEnt-Joint	52.5	42.5
MaxEnt-Uni-Time	57.5	50.5
CNN	56.3	50.4
NeuralDater	64.1	58.9

**NeuralDater
outperforms others in
Document Time
stamping**

Ablation Results

Method	Accuracy
T-GCN	57.3
S-GCN + T-GCN ($K = 1$)	57.8
S-GCN + T-GCN ($K = 2$)	58.8
S-GCN + T-GCN ($K = 3$)	59.1
Bi-LSTM	58.6
Bi-LSTM + CNN	59.0
Bi-LSTM + T-GCN	60.5
Bi-LSTM + S-GCN + T-GCN (no gate)	62.7
Bi-LSTM + S-GCN + T-GCN ($K = 1$)	64.1
Bi-LSTM + S-GCN + T-GCN ($K = 2$)	63.8
Bi-LSTM + S-GCN + T-GCN ($K = 3$)	63.3

Performance with Time mentions



Questions?

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Source code and data are available
github.com/mallabiisc/NeuralDater



- **References:**

- Kotsakos, Dimitrios, et al. "A burstiness-aware approach for document dating." Proceedings of the 37th international ACM SIGIR conference on Research & development in information retrieval. ACM, 2014.
- Vashishth, Shikhar, et al. "Dating documents using graph convolution networks." *arXiv preprint arXiv:1902.00175* (2019).. <https://arxiv.org/abs/1902.00175>
- Mirza, Paramita, and Sara Tonelli. "Catena: Causal and temporal relation extraction from natural language texts." *The 26th international conference on computational linguistics*. ACL, 2016.
- Lappas, Theodoros, et al. "On burstiness-aware search for document sequences." *Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining*. ACM, 2009.