HyperTwitter: A Hypergraph-based Approach to Identify Influential Twitter Users and Tweets

Lulwah AlKulaib, Abdulaziz Alhamadani, Shailik Sarkar, and Chang-Tien Lu

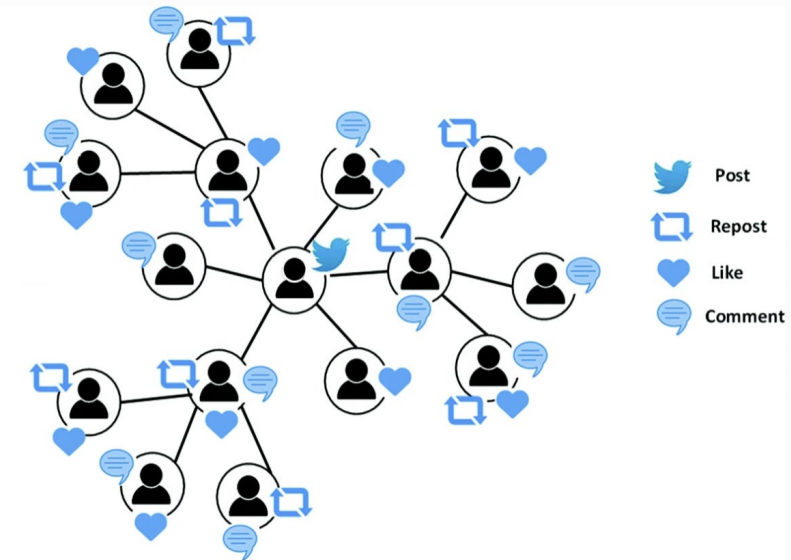# Introduction: Influential Users and Tweets

❑ Influential Users and Tweets

❑Topic-Specific Influence

RACHEL MADDOW

POLITICS

GRETA THUNBERG

CLIMATE CHANGE

❑Why is it important to identify influential users or tweets in certain topics?

- 🐦 Post
- 🔁 Repost
- ❤ Like
- 💬 Comment

AlKulaib L. et al., HyperTwitter: A Hypergraph-based Approach to Identify Influential Twitter Users and Tweets, IEEE BigData, 2022

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Motivation

❑Twitter influence is measured by follower count only and didn't consider topics.

❑Influence differs from topic to another.

❑Influence detection focused on users only.

❑Challenges:

   ❑How to utilize short-text data in achieving accurate topic distribution?

   ❑How to measure influence based on composite features?

Name	Twitter Handle	Followers*
Barack Obama	@BarackObama	133,3M
Elon Musk	@elonmusk	118,2M
Justin Bieber	@justinbieber	113,8M
Katy Perry	@katyperry	108,9M
Rihanna	@rihanna	107.3M
Cristiano Ronaldo	@Cristiano	105.1M
Taylor Swift	@taylorswift13	91,9M
Donald J Trump	@realDonaldTrump	87.6M
Lady Gaga	@ladygaga	84.9M
Narendra Modi	@narendramodi	84.5M
Youtube	@youtube	77.2M

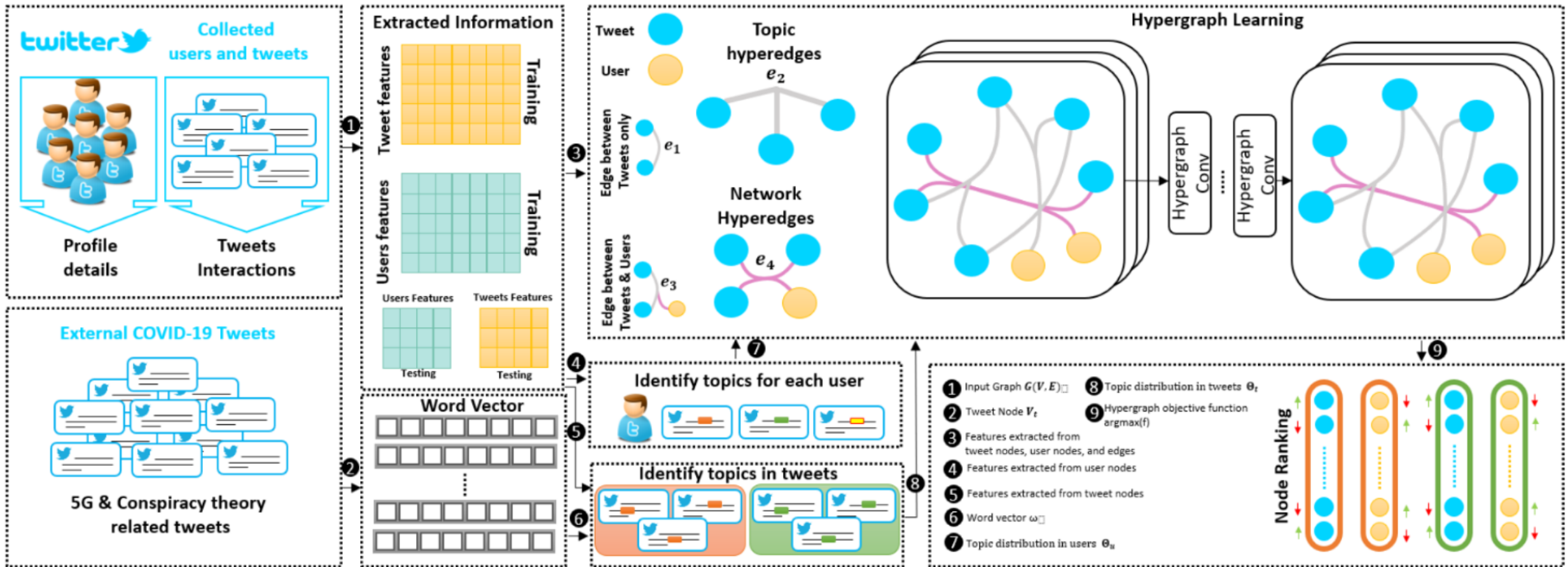*Info updated the 22nd of November 2022
www. tweetbinder.com

Challenges we address

❑ Existing Studies focused on:

   ❑ The largest number of followers

   ❑ A combination of numerical network features

❑ None of these studies investigated:

   ❑ User topic-specific influence

   ❑ Tweet topic-specific influence

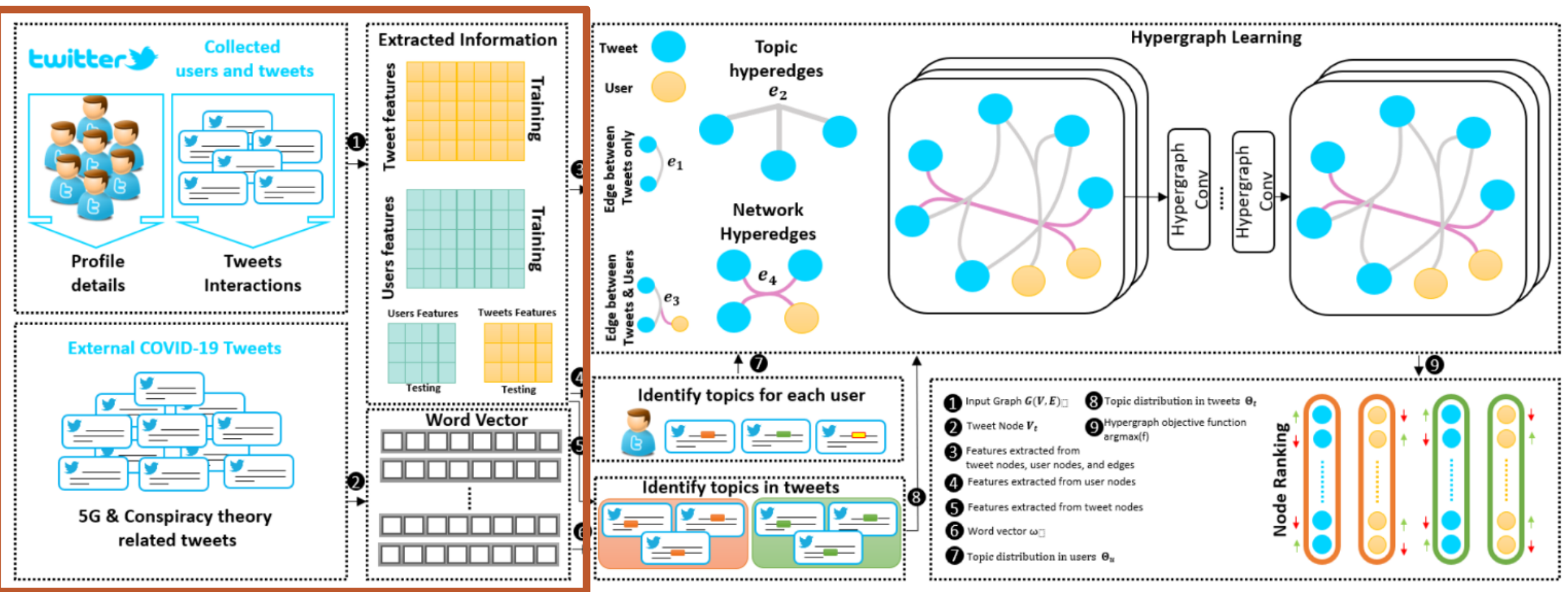## Combine

❑ Consider user, network and text features to measure user influence
❑ Measure user topic-specific influence
❑ Measure tweet topic-specific influence

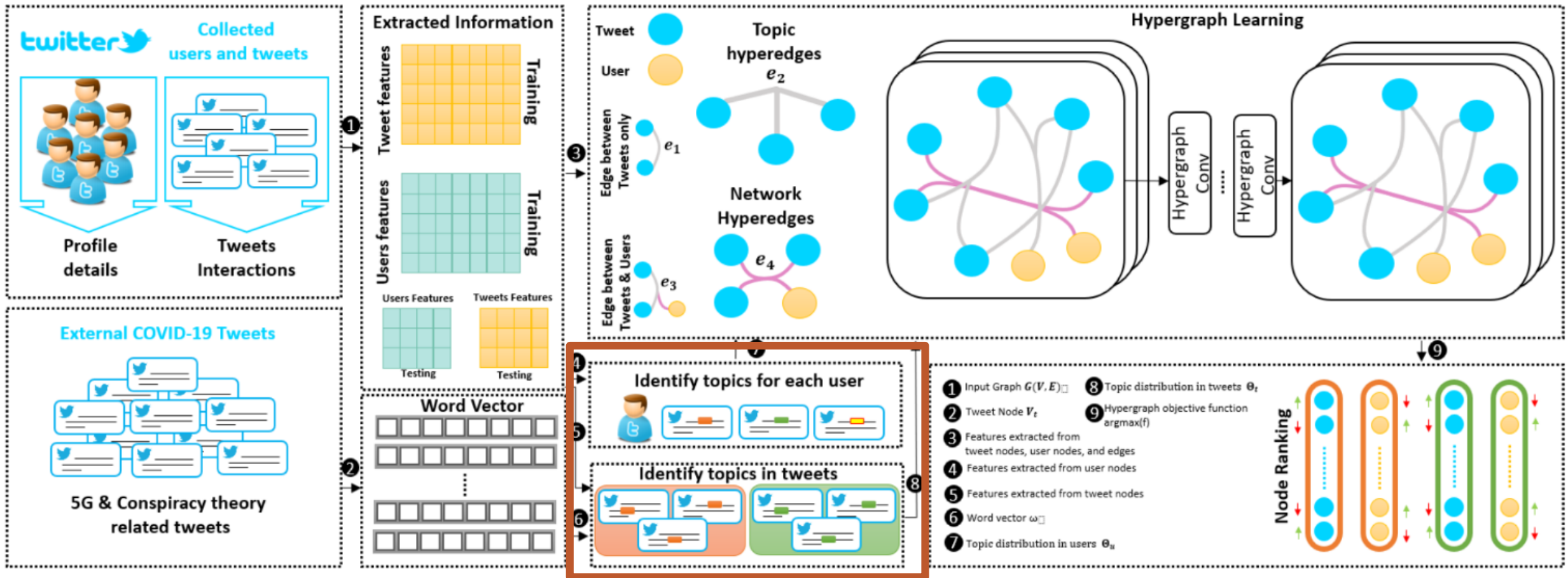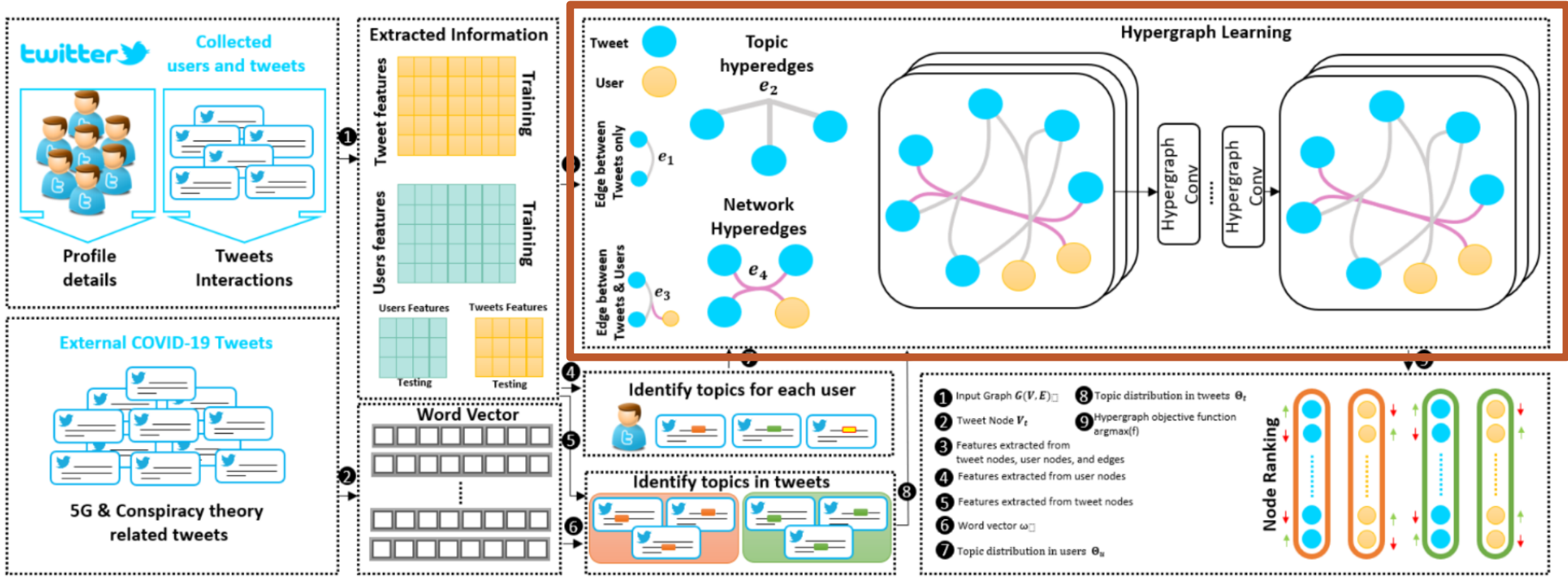# Proposed Model

Proposed Model

Proposed Model

Proposed Model

Experiments: Dataset

	5G	Other
Initial tweets and users	406	596
Total # of retweets	18588	32015
Total # of Users	14792	38095
Total # of Likes	26,023	68,504
Topics	Cell towers, Radiation weakens immunity, Effects on oxygen	Bill Gates, Chinese Government, Contaminated ventilators
Tweets for Word Vector	2.8M	2.4M

Corpus created from 14 datasets related to COVID-19 conspiracy theories

Twitter Network COVID-19 Conspiracy Datasets

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TABLE III
TOPIC-SPECIFIC INFLUENCER DETECTION PERFORMANCE

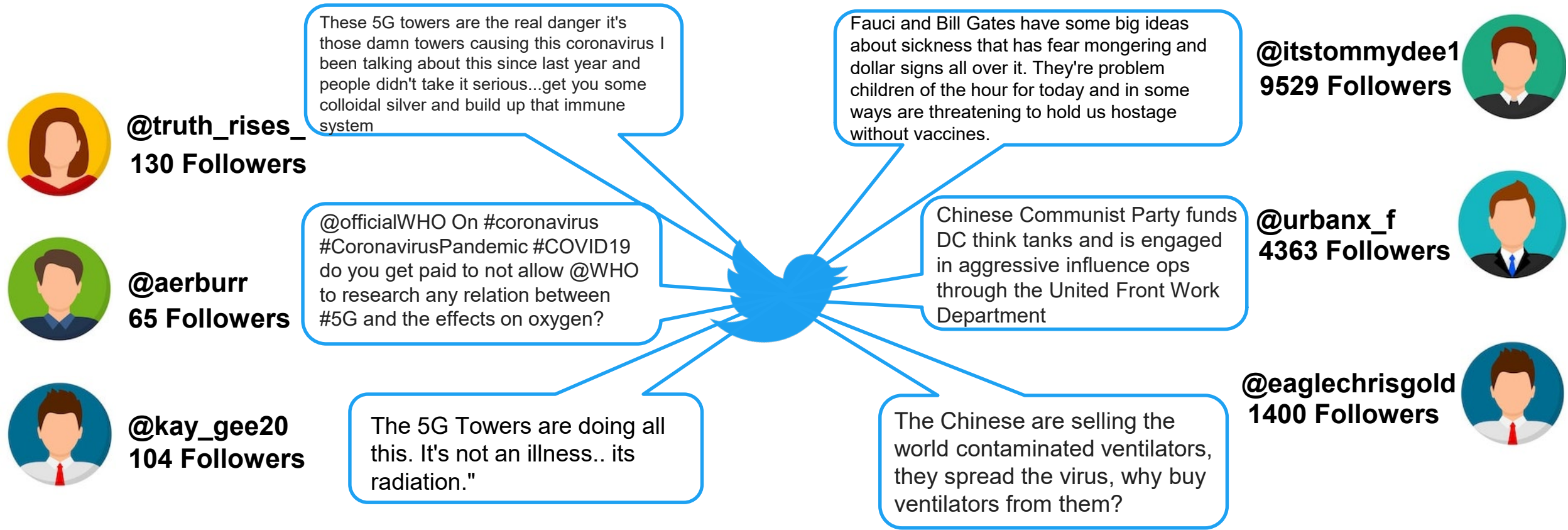| Methods	5G				Other Conspiracies			
	F1	AUC	NDCG	MAP	F1	AUC	NDCG	MAP
Twitter Rank	0.207	0.573	0.079	0.566	0.366	0.645	0.182	0.727
TS-SRW	0.141	0.667	0.055	0.445	0.244	0.733	0.094	0.543
GCN	0.290	0.480	0.238	0.428	0.374	0.513	0.296	0.512
CoupledGNN	0.443	0.515	0.325	0.570	0.475	0.560	0.362	0.604
DID	0.647	0.783	0.476	0.819	0.577	0.746	0.614	0.860
HyperTwitter	**0.952**	**0.984**	**0.832**	**0.989**	**0.927**	**0.973**	**0.827**	**0.976**

HyperTwitter outperforms existing baselines on both datasets across all conventional metrics

TABLE VI
ABLATION STUDY

Methods	5G				Other Conspiracies			
	F1	AUC	NDCG	MAP	F1	AUC	NDCG	MAP
HyperTwitter	**0.952**	**0.984**	**0.832**	**0.989**	**0.927**	**0.973**	**0.827**	**0.976**
HyperTwitter -network hyperedges	0.819	0.847	0.757	0.900	0.797	0.885	0.753	0.888
HyperTwitter -topic hyperedges	0.895	0.925	0.782	0.930	0.872	0.915	0.778	0.917

HyperTwitter benefits from both types of hyperedges and removing either type lowers the performance

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VIRGINIA TECH.

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Experiments: Influential Users and Tweets

Experiments: Topic Modeling

Topics	Related Tweets		
cellular radiation network impact 5g absorbed system oxygen immune towers replication molecules	**Account @user1** — If you have NO 5G you will have no death from Coronavirus The 5G Towers frequency weaponises the Coronavirus making it deadly Without 5G it's just Flu	**Account @user2** — Impact of #5G radiation on the immune system of the body and suggestion that 5G radiation may also increase the replication of #coronavirus	**Account @user3** — When you hit oxygen molecules with 60 GHz millimeter wave emissions it affects the orbital properties of the electrons of the oxygen molecules. The 60 GHz range is known as the Oxygen Absorption Band. At 60GHz, 98% of electromagnetic energy is absorbed by O2.
bill gates china chinese used wuhan pathogens government ventilators contaminated virus profit outbreak origin	**Account @user4** — Bill Gates makes computer viruses and then tells everyone they need anti-virus software to get rid of them. Bill Gates makes human viruses. He partners with #BigPharma to release pathogens. Then they profit off ""cures.""	**Account @user5** — Sources believe coronavirus outbreak originated in Wuhan lab as part of the Chinese government efforts to compete with US	**Account @user6** — Should we trust the Chinese to sell us uncontaminated ventilators ? Or will they repackage and sell us used ones? I'd rather buy BRITISH ventilators made by our great manufacturers.

TABLE V
TOPIC-MODELING PERFORMANCE

Dataset	5G		Other	
Model	**Accuracy**	**F1**	**Accuracy**	**F1**
LDA	0.621	0.546	0.633	0.557
T-BTM	0.657	0.578	0.670	0.589
GPU-DMM	0.710	0.624	0.724	0.637
GPU-PDMM	0.732	0.644	0.746	0.657
Tweet-DMM	**0.875**	**0.831**	**0.910**	**0.882**

Our proposed topic modeling method outperforms existing baselines.

Conclusion

❑ We proposed HyperTwitter, a framework to detect top influential users and tweets in a specific topic.

   ❑ To the best of our knowledge, this is the first hypergraph framework that detects both influential users and tweets.

❑ HyperTwitter utilizes a Twitter network consisting of users, tweets, and interaction information to construct a hypergraph and performs topic modeling on the user and tweet levels.

   ❑ The hypergraph learns topic distributions for tweet and user nodes and performs topic-based influence ranking on those nodes to detect influencers.

❑ The experiments conducted using the proposed framework shows superior performance compared to existing baselines.

Thank you

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