Do We Trust What They Say, or What They Do? A Multimodal User Embedding Provides Personalized Explanations

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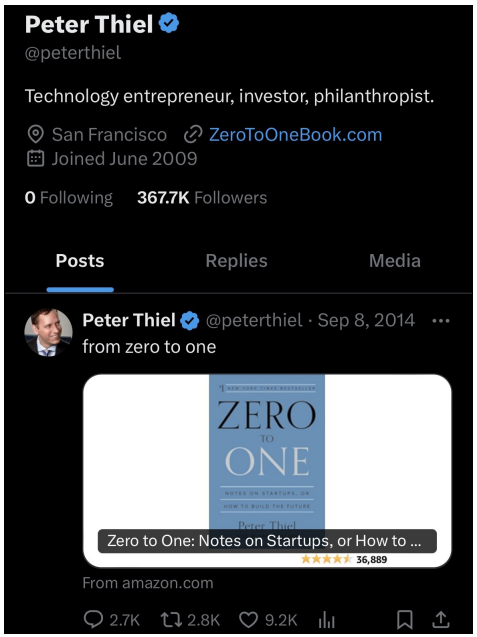
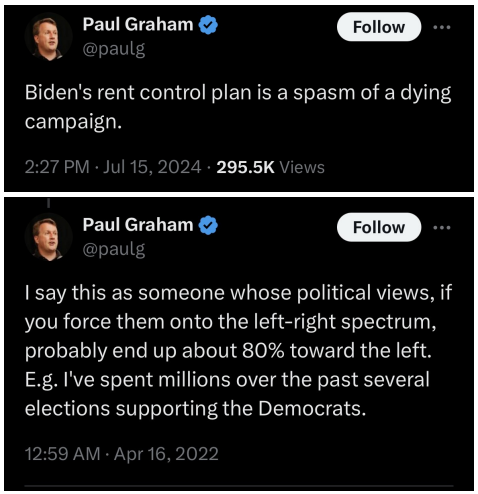
Challenges in multimodal social media user representation learning

- Different groups of users behave very differently on social media.
- If one modality of user data is misleading, it could introduce noise to the representation learning process and make the performance worse than single-modality models.





Case study: fusing text and graph structure information

- Task 1: Predict the political ideology of Twitter/X users.
- Task 2: Predict whether a Twitter account is human or bot.
- Available data: Twitter text content & user interaction graph including follow, retweet, reply, etc.

Algorithm	Encoder Variant		Data Set	
	Text	Graph	TIMME	TwiBot-20-Sub
text-only	GloVe	N/A	0.688 ; 0.681	0.565 ; 0.511
	BERT		0.862 ; 0.859	0.731 ; 0.722
link-only	N/A	MLP	0.932 ; 0.930	0.707 ; 0.697
		R-GCN	0.953 ; 0.953	0.735 ; 0.728
simple fusion	GloVe	R-GCN	0.840 ; 0.837	0.683 ; 0.675
	BERT	R-GCN	0.959 ; 0.959	0.791 ; 0.787

Table: Performance comparison between singlemodal and multimodal methods (format: accuracy ; f1-score)

Problem definition

A social network user embedding fusion framework that could answer:

First objective

Which modality contributes more to the user attribute prediction, hence allowing more customized downstream user behavior analysis.

Second objective

Which modality is more reliable for each user, hence automatically filtering out the untrustworthy information when necessary.

Contribution-Aware Multimodal User Embedding (CAMUE)

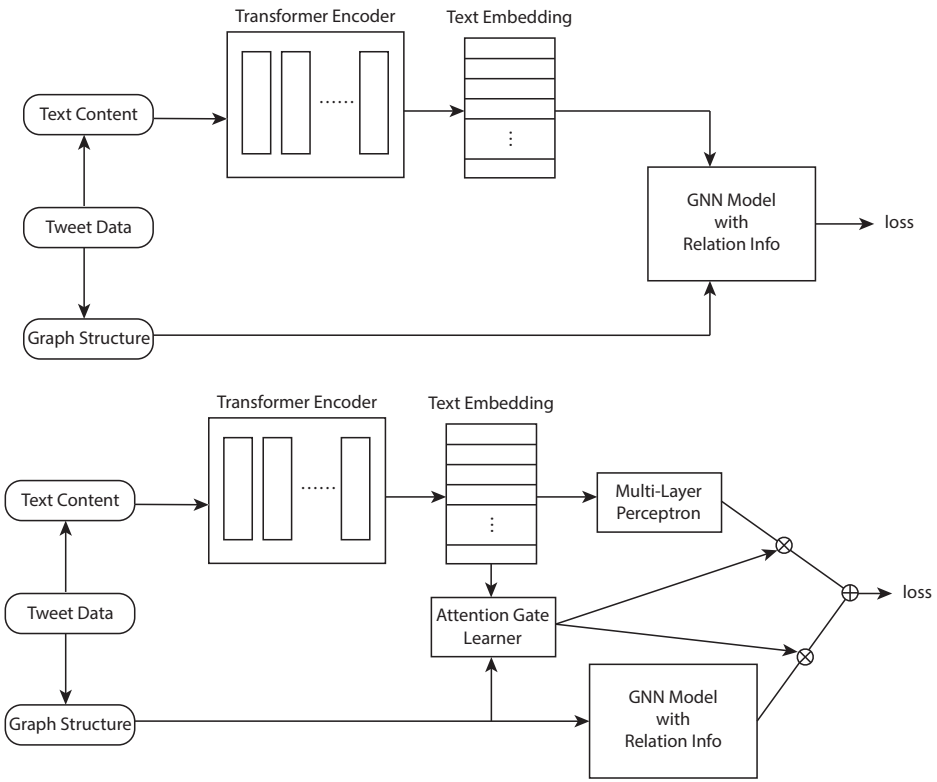


Figure: The architectures of our framework. top: simple fusion method, bottom: CAMUE

Results and analysis

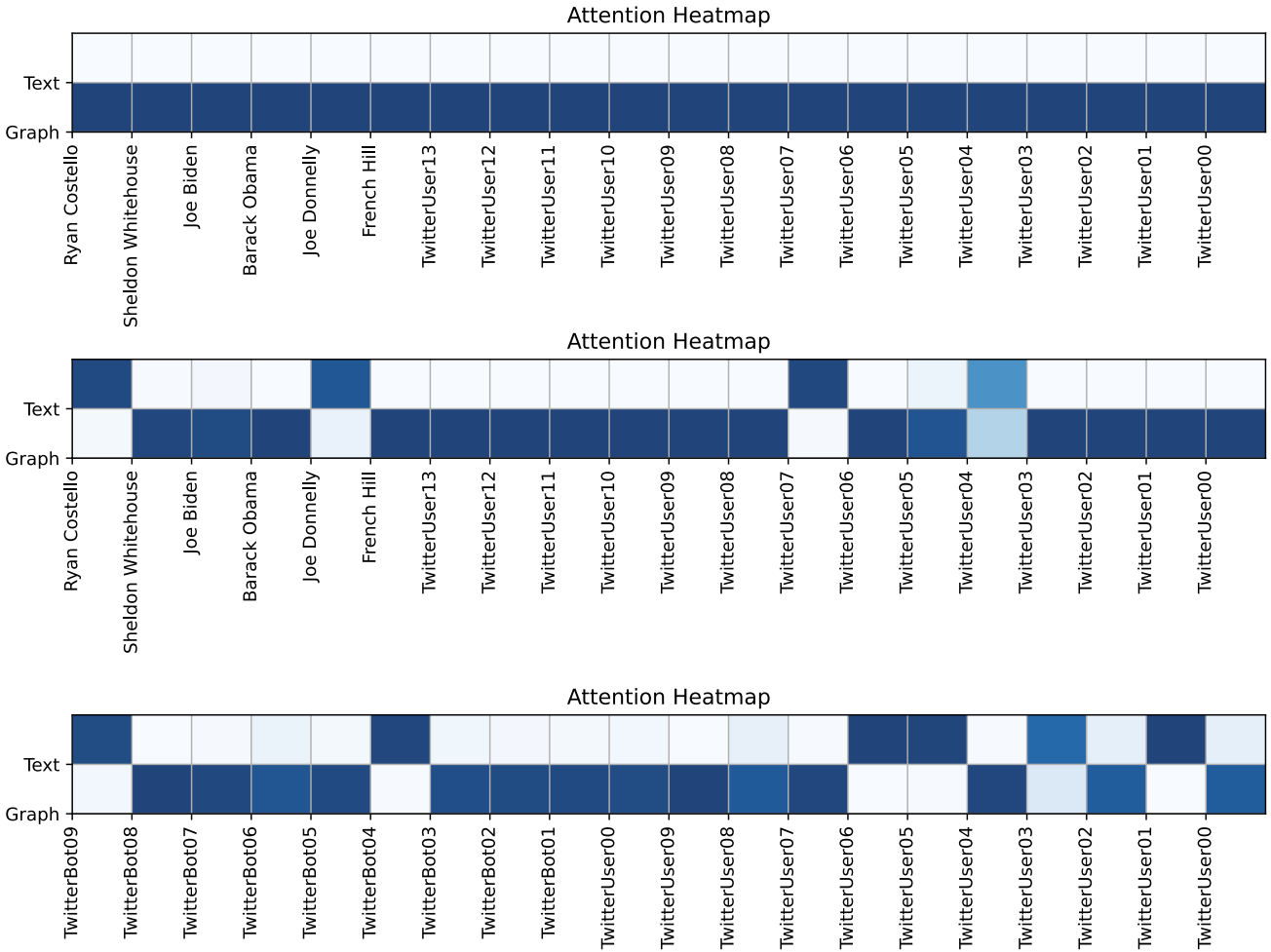


Figure: Contribution map, top: CAMUE(GloVe, R-GCN) for task 1, middle: CAMUE(BERT, R-GCN) for task 2

Results and analysis

Algorithm	Encoder Variant		Data Set	
	Text	Graph	TIMME	TwiBot-20-Sub
CAMUE w. fixed params	GloVe	MLP	0.938 ; 0.937	0.700 ; 0.691
		R-GCN	0.952 ; 0.951	0.734 ; 0.727
	BERT	MLP	0.940 ; 0.938	0.732 ; 0.722
		R-GCN	0.952 ; 0.951	0.779 ; 0.771
CAMUE	GloVe	MLP	0.945 ; 0.944	0.707 ; 0.697
		R-GCN	0.954 ; 0.953	0.738 ; 0.731
	BERT	MLP	0.935 ; 0.933	0.744 ; 0.738
		R-GCN	0.961 ; 0.960	0.782 ; 0.776

Table: Performance of CAMUE framework (format: accuracy ; f1-score)

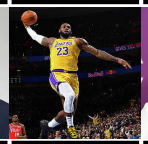
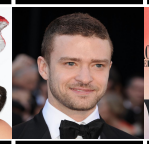
Results and analysis

Name	Ryan Costello
Ground Truth Party	Republican
Sample Graph Data	Liked Ben Rhodes (Democrat) 20 times. Liked Donald Trump 0 time. Following Mike Quigley (Democrat).
Sample Text Data	Despite Trump, Iran's elections & chaotic ME, some Democrats want to race ahead with ill-conceived Iran sanctions RT @SaeedKD: Iran's people care about elections. The so-called democratic fringe doesn't - by me
Graph-backbone Prediction	Democrat (Wrong)
Text-backbone Prediction	Republican (Right)
Simple Fusion Prediction	Democrat (Wrong)
CAMUE Prediction	Republican (Right)

Name	Sheldon Whitehouse
Ground Truth Party	Democrat
Sample Graph Data	Liked Senate Democrats Official Account 26 times. Not following Donald Trump. Following Barack Obama.
Sample Text Data	My Republican partner on the CARA bill, @SenRobPortman, writes a powerful editorial on the success of CARA and CURES (which provided a needed boost of funding to match CARA). Good move by Trump Administration. Cong. @JimLangevin &
Graph-backbone Prediction	Democrat (Right)
Text-backbone Prediction	Republican (Wrong)
Simple Fusion Prediction	Republican (Wrong)
CAMUE Prediction	Democrat (Right)

Results and analysis

Subgroup	% Users w/ graph contribution > text contribution
Democrats	70.9
Republicans	76.1
Politicians	76.2
Non-politicians with Party affiliations	72.4
Non-bot random users	61.2
Bot accounts	**77.3**
TIMME, aggregated	73.5
TwiBot-20-Sub, aggregated	70.1

Name	Elon Musk	Lebron James	Lady Gaga	Bill Gates	Oprah Winfrey	Jimmy Fallon	Katy Perry	Justin Timberlake	Taylor Swift
Photo									
Field	Business	Sports	Music	Business	Television	Television	Music	Music	Music
Text or Graph?	Graph	Text	Text	Graph	Graph	Graph	Text	Graph	Graph
% Text	1	93	100	33	15	0	96	58	1
% Graph	99	7	0	67	85	100	4	42	99
Political Polarity Prediction	R	D	D	R	D	D	D	D	R

Thank you!