Spam Review Detection with Graph Convolutional Networks.

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Framework

Context

Focused on **Xianyu**, largest second-hand goods app in China.

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Main challenges:

- **Scalability** - over 1 billion goods and over 10 million users.
- **Adversarial actions** taken by spammers.

Adversarial actions

Camouflage:

- Dial this number for a part-time job.
- Want to earn more money in your spare time? Contact me.

Adversarial actions

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Deforming the comments:

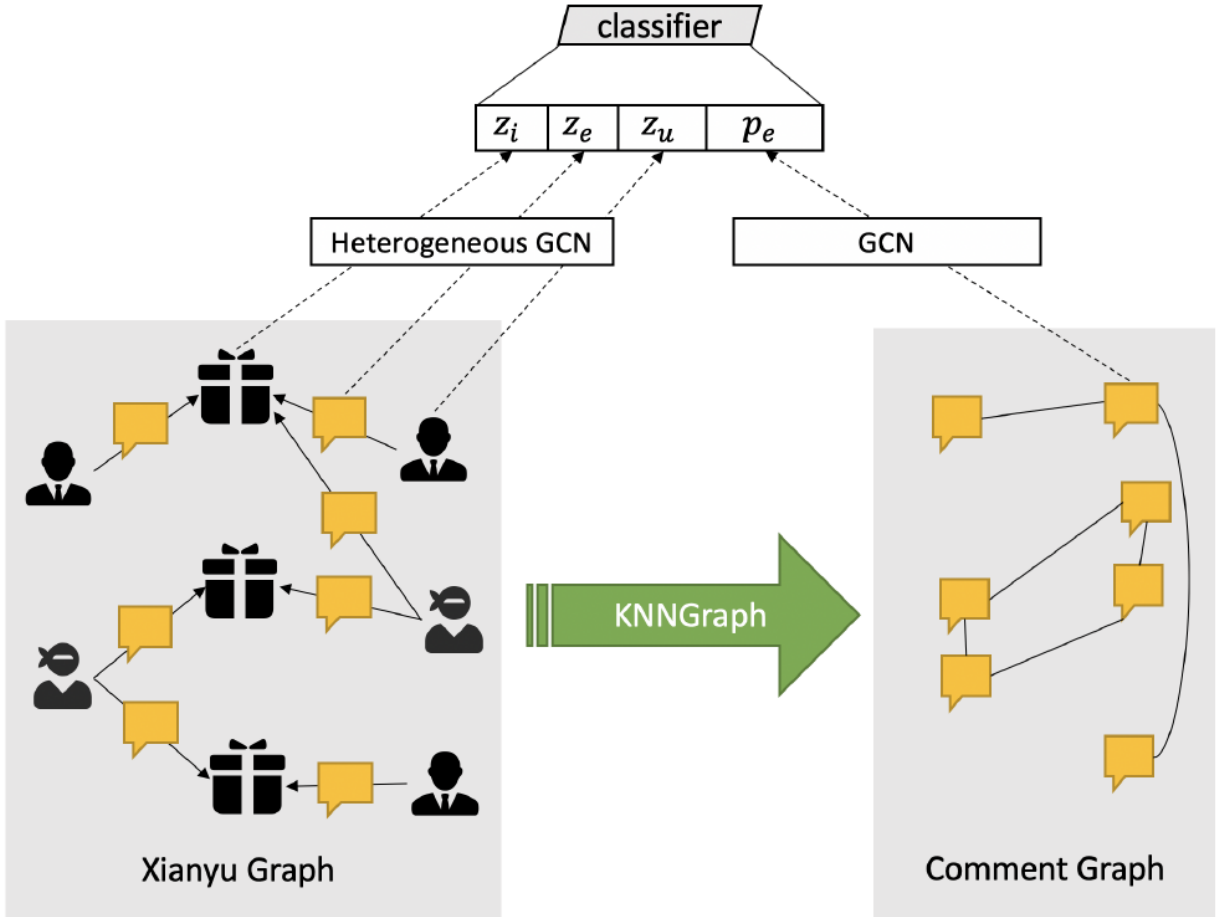
- Add my vx.
- Add my v.
- Add my wx.
- Add my WeChat.

The GAS model

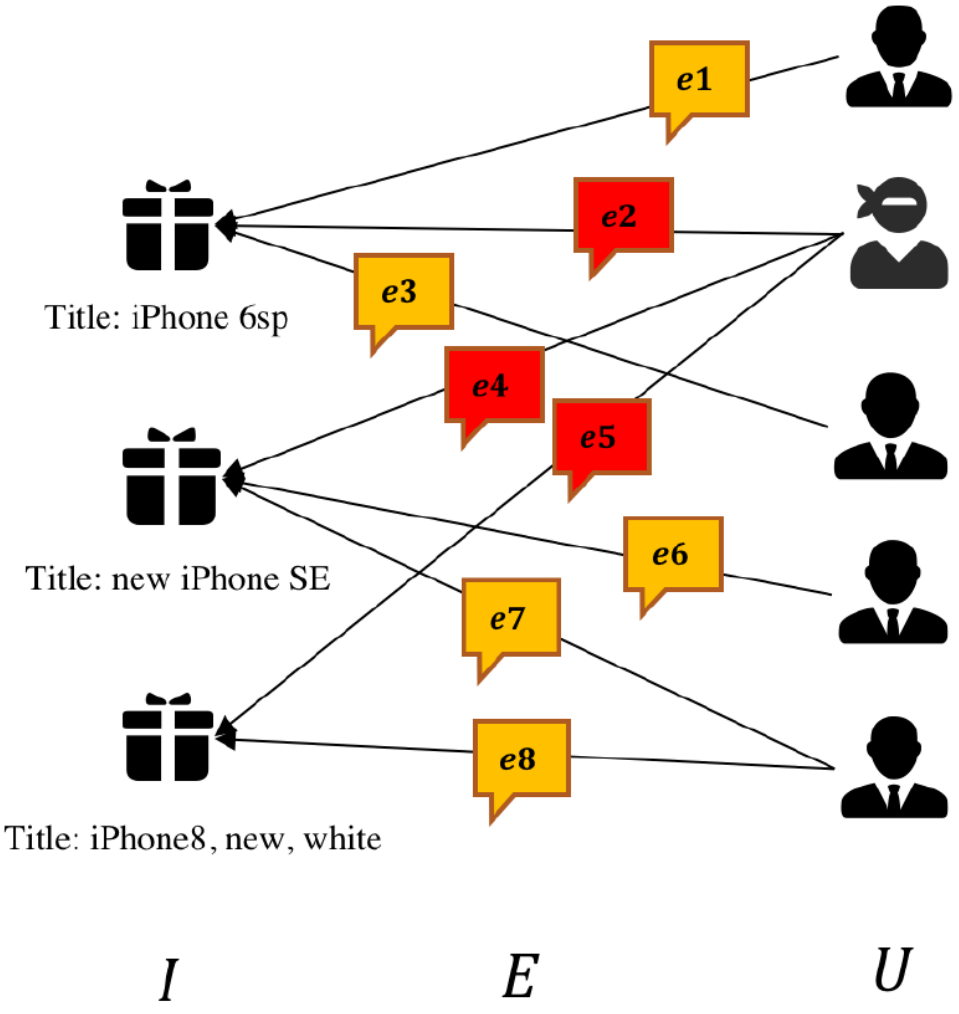
GCN-based Anti-Spam (GAS) method

Using:

- Local context.
- Global context.



Local context - Xianyu Graph



e1: more discount?

e2: get an iPhone 8plus,$130, contaxt me: #1

e3: hello, I want it

e4: get an iPhone 8plus,$130, contaxt me: #1

e5: get an iPhone 8plus,$130, contaxt me: #1

e6: how alrge is the storage space?

e7: hi, is it still on sale?

e8: is it a complete new one?

Graph Convolutional Networks (GCN)

For each leayer i, aggregation and combination can be written as:

$$h^i_{N(v)} = \sigma\left(W^i \cdot AGG\left(\left\{h^{i-1}_v, \forall v' \in N(v)\right\}\right)\right)$$

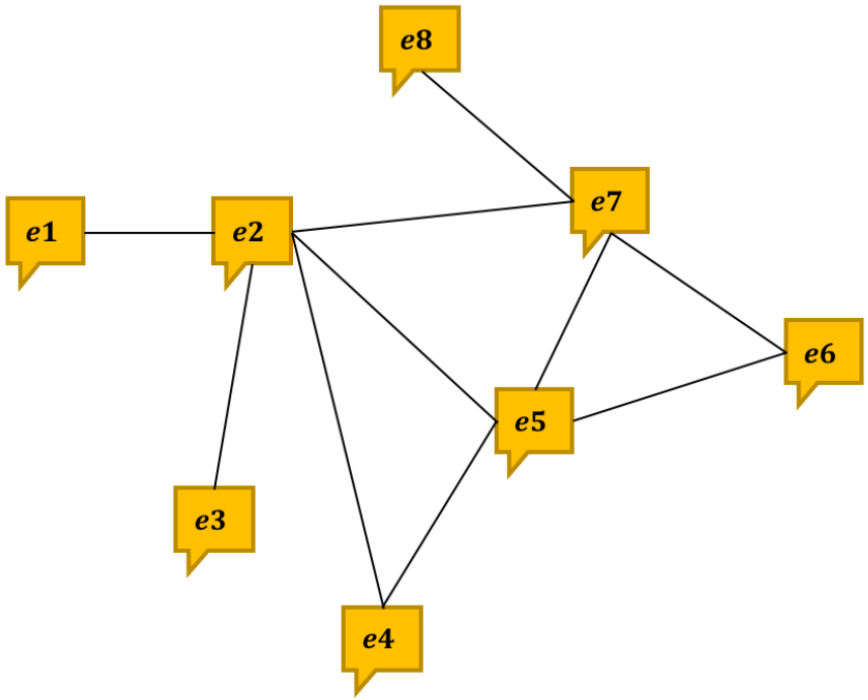
$$h^i_v = COMBINE\left(h^{i-1}_v, h^i_{N(v)}\right)$$

The GCN is fed with:

- Item features.
- User features.
- Comment features: Embeddings by **word2vec** are the input of **TextCNN**. The output of TextCNN is used as the embedding of the comment:

$$h^0_e = \text{TextCNN}(w_0, w_1, \ldots, w_n)$$

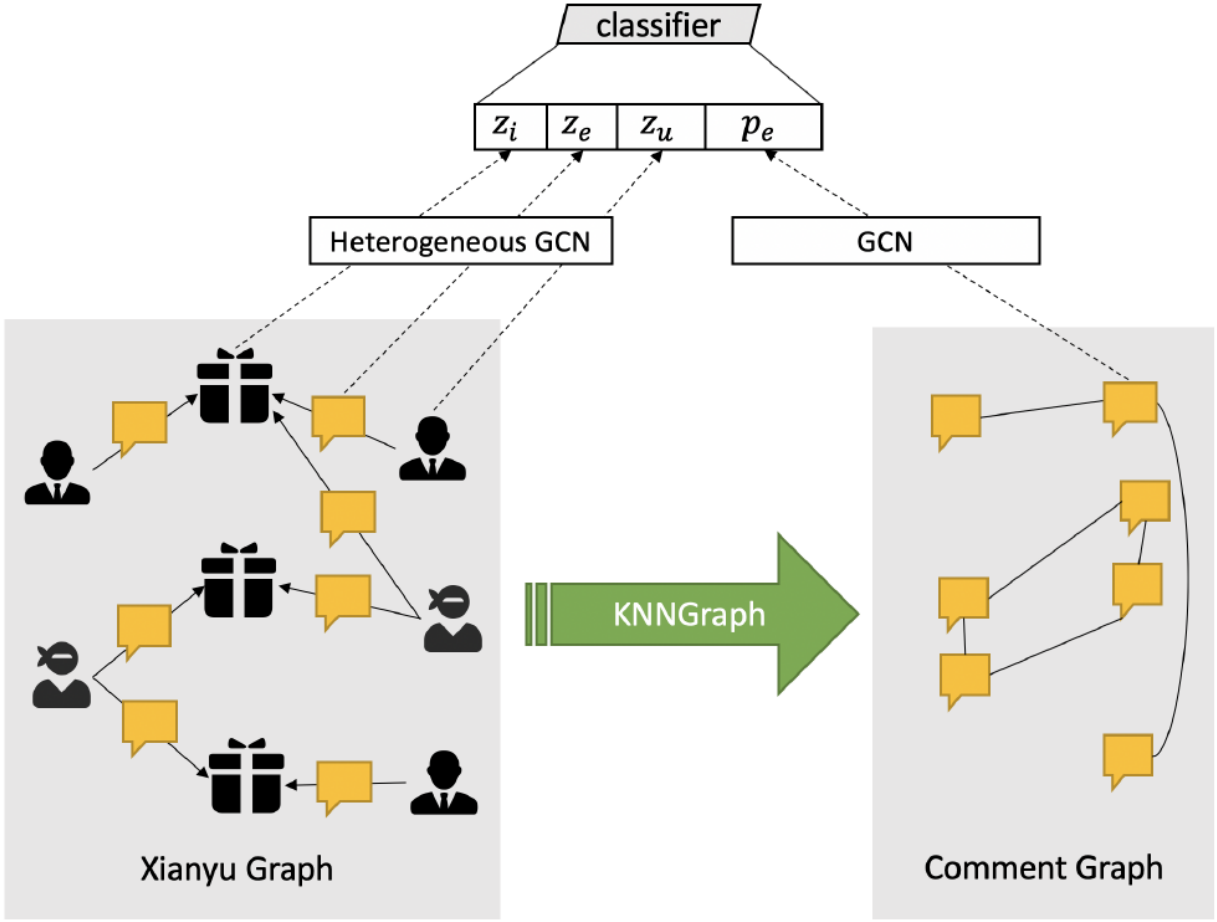
Global context - Comment graph



Processed as follows:

- Remove duplicated comments.
- Generate comments embeddings.
- Approximate KNN to obtain similar comments.
- Recomve comments by same user or under same item.

Classification step



$$y = classifier(concat(z_i, z_u, z_e, p_e))$$

Experiments and results

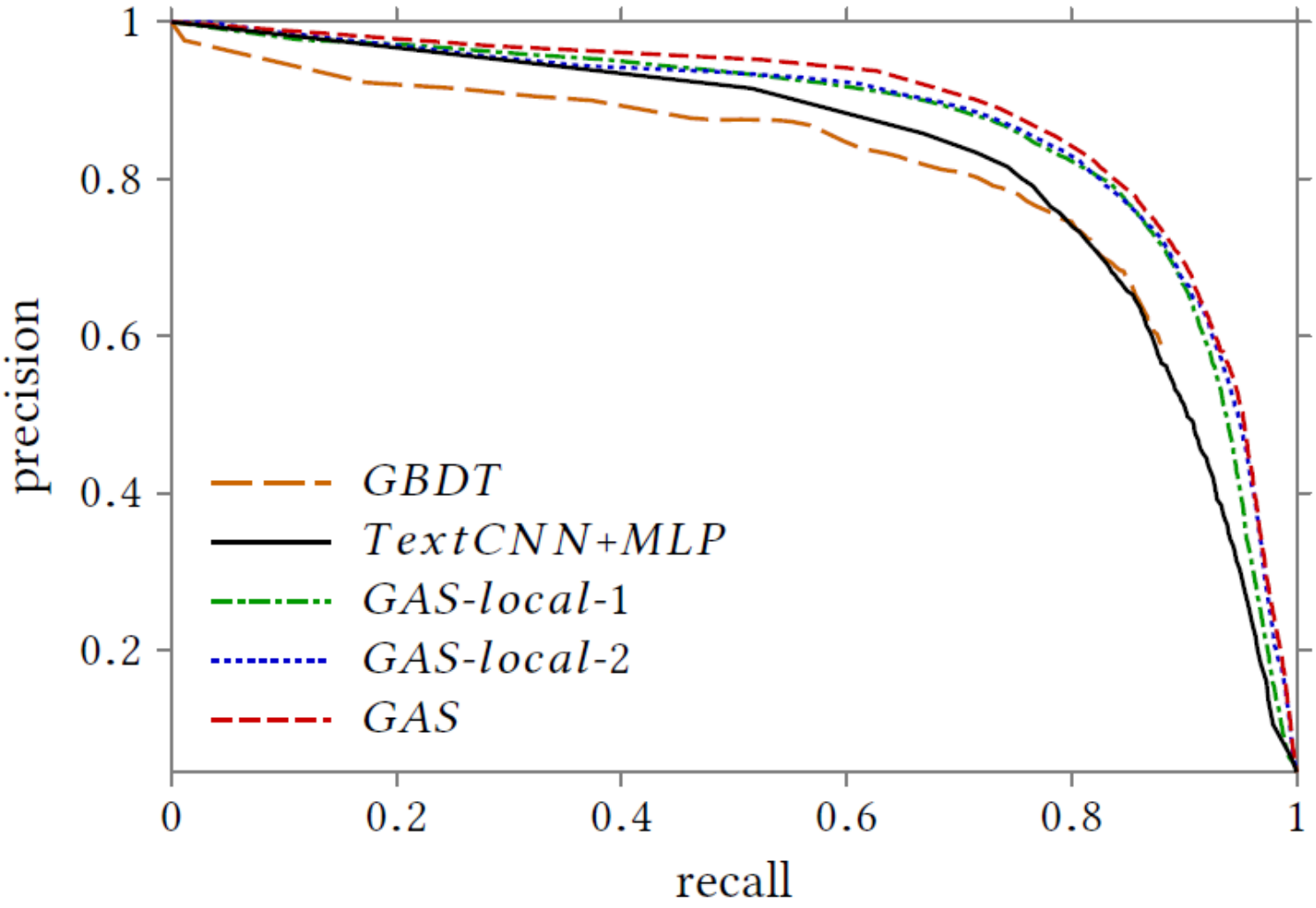
Models compared

- **GBDT**: Domain expert features with Gradient Boosting Decision Trees model.
- **TextCNN+MLP**: user features + item features with 2 layer MLP model.
- **GAS-local-1**: 1 propagation layer on Xianyu Graph.
- **GAS-local-2**: 2 propagation layer on Xianyu Graph.
- **GAS**: GAS model with 2 propagation layers on Xianyu Graph and 1 propagation layer on Comment Graph.

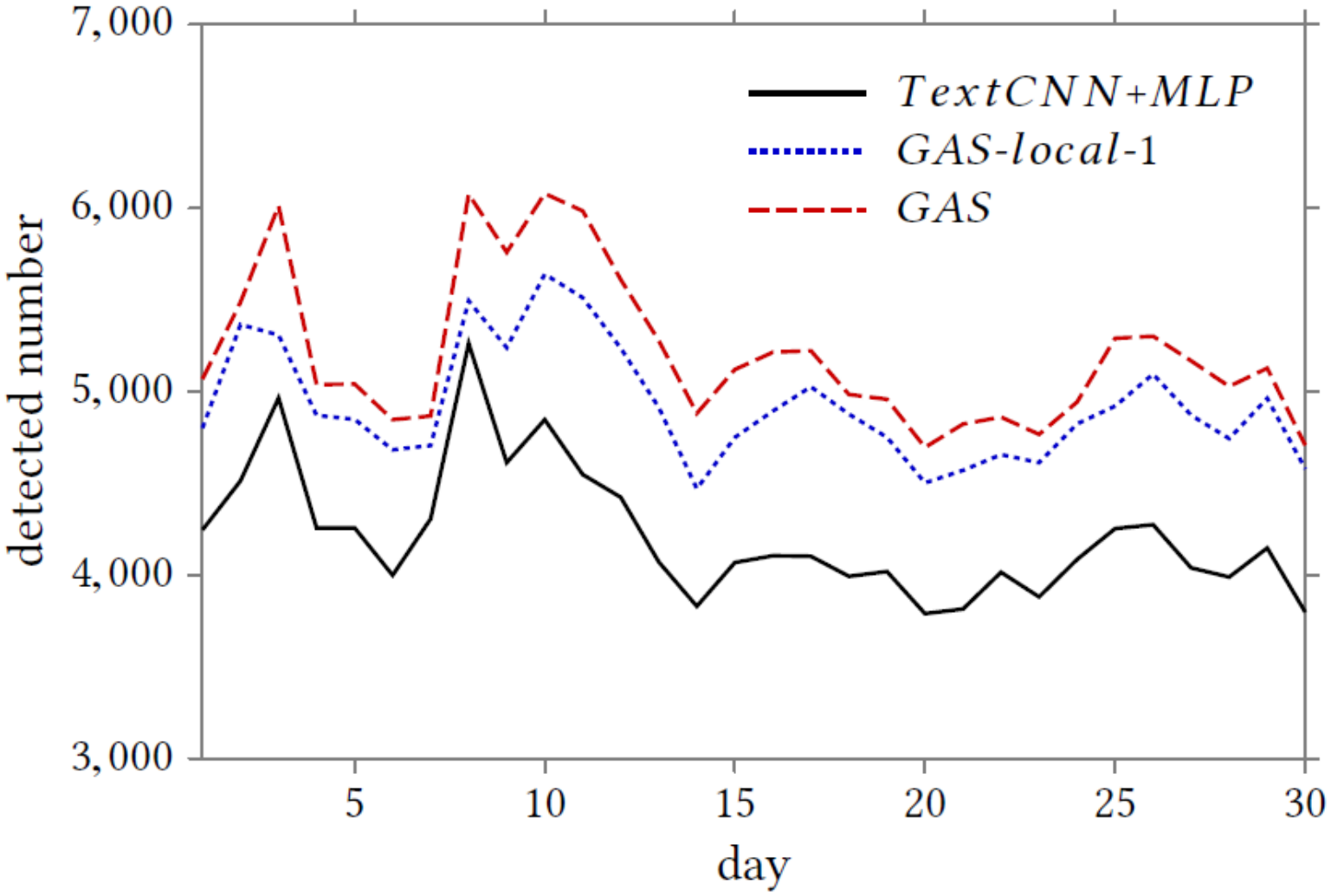
Offline evaluation (1)

Method	AUC	F1 score	recall@90% precision
GBDT	0.9649	0.7686	50.55%
TextCNN+MLP	0.9750	0.7784	54.86%
GAS-local-1	0.9806	0.8138	66.90%
GAS-local-2	0.9860	0.8143	67.02%
GAS	**0.9872**	**0.8217**	**71.02%**

Offline evaluation (2)



Online evaluation



Thank you for your attention!

References

[Li u. a. 2019] Li, Ao ; Qin, Zhou ; Liu, Runshi ; Yang, Yiqun; Li, Dong: Spam Review Detection with Graph Convolutional Networks. (2019). – URL https://arxiv.org/pdf/1908.10679v1.pdf