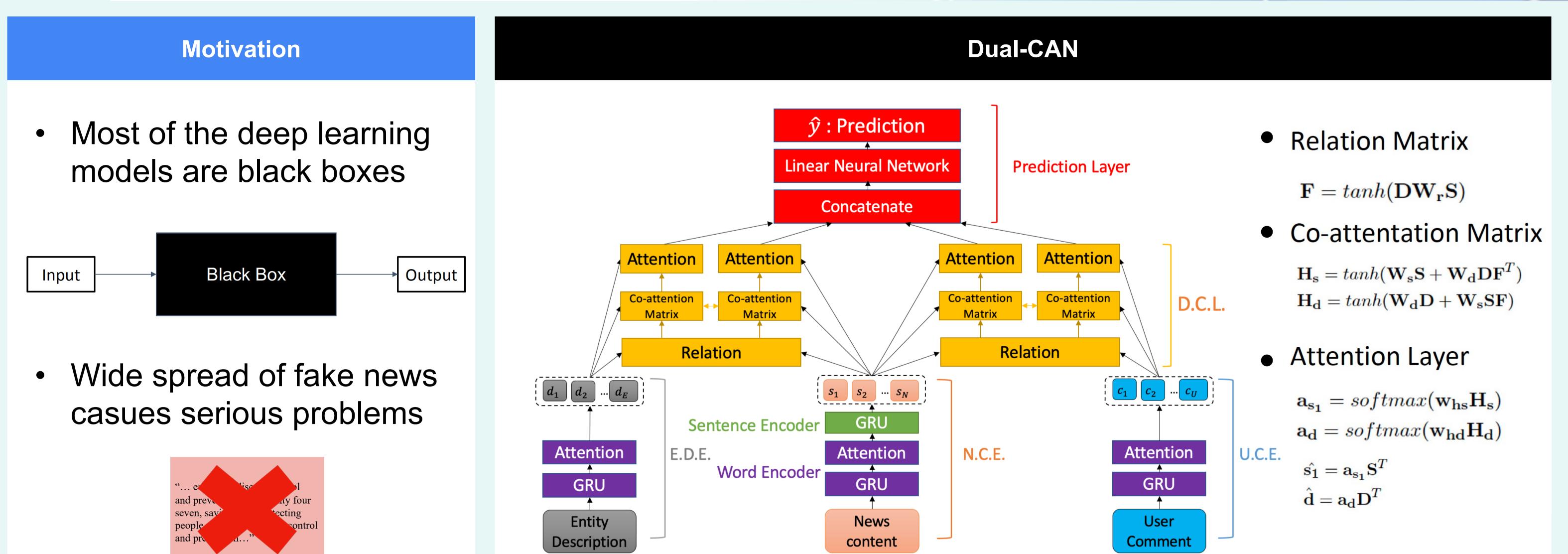# Entity-Aware Dual Co-Attention Network for Fake News Detection

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Motivation

- Most of the deep learning models are black boxes

Input → Black Box → Output

- Wide spread of fake news casues serious problems

Dual-CAN

- Relation Matrix

$$\mathbf{F} = tanh(\mathbf{D}\mathbf{W_r}\mathbf{S})$$

- Co-attention Matrix

$$\mathbf{H_s} = tanh(\mathbf{W_s}\mathbf{S} + \mathbf{W_d}\mathbf{D}\mathbf{F}^T)$$
$$\mathbf{H_d} = tanh(\mathbf{W_d}\mathbf{D} + \mathbf{W_s}\mathbf{S}\mathbf{F})$$

- Attention Layer

$$\mathbf{a_{s_1}} = softmax(\mathbf{w_{hs}}\mathbf{H_s})$$
$$\mathbf{a_d} = softmax(\mathbf{w_{hd}}\mathbf{H_d})$$

$$\hat{\mathbf{s}}_1 = \mathbf{a_{s_1}}\mathbf{S}^T$$
$$\hat{\mathbf{d}} = \mathbf{a_d}\mathbf{D}^T$$

Experiments

Model (Input) (# of Parameters)	GossipCop					CoAID		
	Accuracy	F1	Precision	Recall	PR-AUC	F1	Precision	Recall
BiGRU (N+C+E) (28M)	0.580	0.367	0.290	0.500	0.876	0.782	0.769	0.804
BERT (N+C+E) (339M / 110M)	0.787	0.776	0.787	0.771	0.940	0.877	0.901	0.859
RoBERTa (N+C+E) (384M / 125M)	0.894	0.890	0.896	0.887	0.918	0.877	0.901	0.859
LinkBERT (N+C+E) (330M / 110M)	0.824	0.811	0.841	0.802	0.927	0.880	0.903	0.863
dEFEND (N+C) (5M)	0.771	0.758	0.771	0.754	0.749	0.799	0.792	0.808
Dual-CAN (N+E) (33M)	0.895	0.891	0.901	0.885	0.853	0.884	0.905	0.868
Dual-CAN (N+C) (33M)	0.914	0.912	0.913	0.911	0.937	**0.887**	**0.907**	**0.872**
Dual-CAN (N+C+E) (33M)	**0.949**	**0.947**	**0.946**	**0.949**	**0.954**	0.884	0.905	0.868

Table 1: Experimental results. N, C, and E denote news content, user comments, and entity description, respectively.

Interpretability

Entity Description   User Comment

GossipCop   CoAID   GossipCop   CoAID

News Content

"… enters for disease control and prevention, cdc twenty four seven, saving lives protecting people centers for disease control and prevention…"

Entity Description

The Centers for Disease Control and Prevention (CDC) is the national public health agency of the United States.

Conclusion

- Dual-CAN outperforms previous models in benchmark datasets for fake news detection

- The interpretability bases on attention weights reflects model's predictions

Paper/ Code/ Data