Dual-Expert Collaborative Network for Fake News Detection with External Knowledge Integration

Wenxin Luo[1] , Zhu Teng[1*] , Wei Zhang[1], Baopeng Zhang[1]
[1]School of Computer Science and Technology, Beijing Jiaotong University

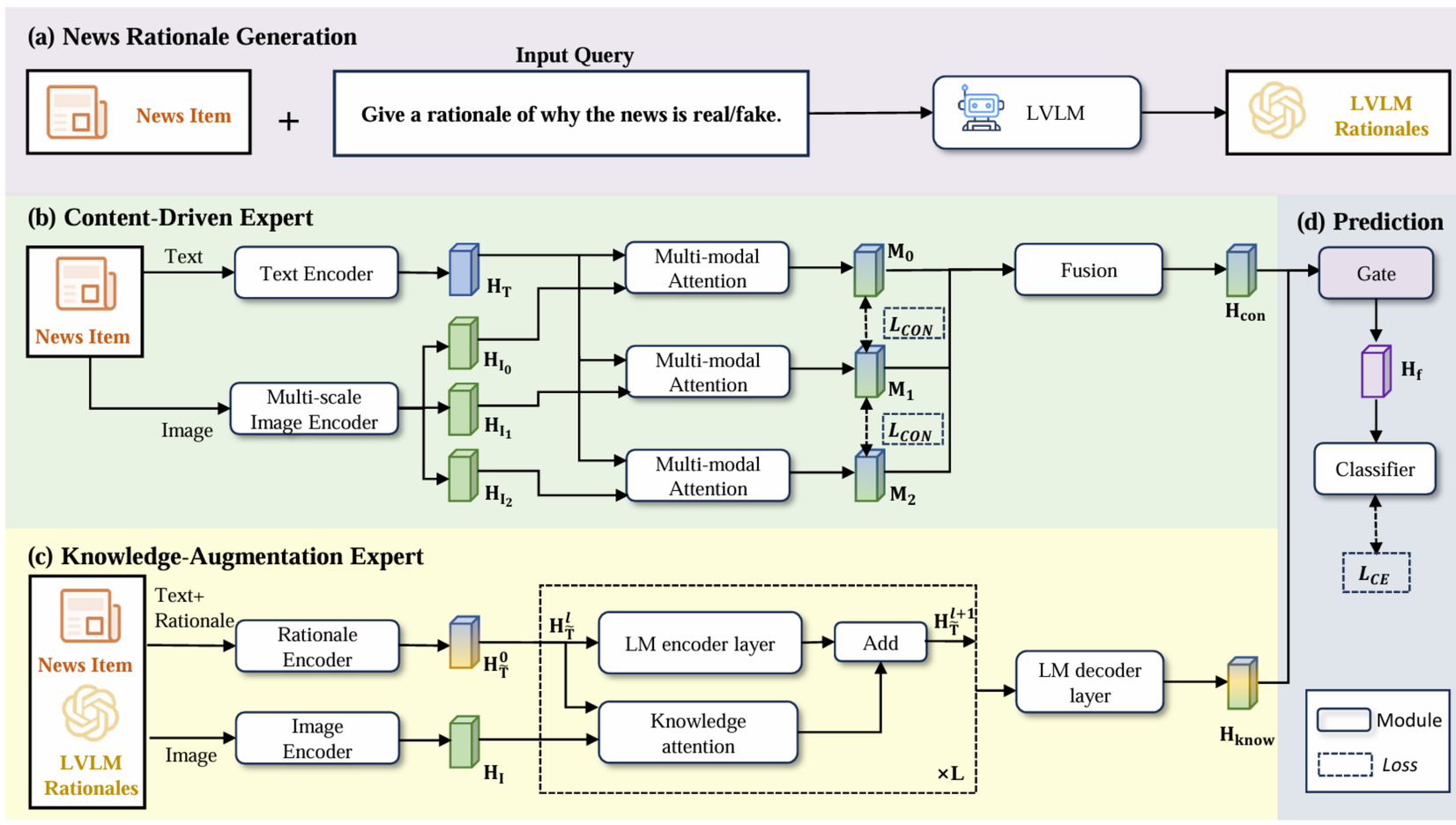
Background&Motivation

- Existing multimodal detection methods still mainly focus on internal content features, but fail to handle complex real-world scenarios.
- Although external knowledge sources have been used, they still fall short of providing a deep understanding and reasoning ability.
- Large Vision-Language Models (LVLMs) demonstrate strong cross-modal reasoning and knowledge integration capabilities, offering a promising direction for improving fake news detection.

Contributions

- We propose **DECNet**, a **Dual-Expert Collaborative Network** integrating a **Content-Driven Expert (CDE)** and a **Knowledge-Augmentation Expert (KAE)** with a gating network for enhancing multi-modal representation and decision-making.
- We integrate **multi-resolution visual embeddings** guided by textual cues and leverage LVLMs to inject external knowledge, enhancing **semantic understanding** and **reasoning**.
- DECNet achieves **state-of-the-art performance** on two public benchmarks, demonstrating its superior detection and generalization performance in fake news detection.

Method



- **News Rationale Generation**: The LVLM's comprehension ability is harnessed to generate knowledge for broader exploration, which serves as input to the KAE module.
- **Content-Driven Expert**: Text and multi-scale images are combined to extract insights from the news content.
- **Knowledge-Augmentation Expert**: News and rationales from LVLMs are leveraged to uncover deeper insights.
- **Prediction**: The two experts perform modality interaction gated fusion followed by a final classifier.

$$\ell = \text{Cross-Entropy}(\hat{y}, y) + \alpha \ell_{con}$$

Figure 1: The architecture of the proposed DECNet.

Experiments

Experimental Results

- DECNet achieves the highest accuracy on both Weibo (+2.7%) and Pheme (+2.5%), outperforming all competing methods.
- Compared with other content-based methods, DECNet demonstrates the benefits of incorporating external knowledge to enhance fake news detection.
- Among knowledge-augmented models, DECNet validates the strength of its dual-expert collaboration and LVLM-based reasoning.

Category	Method	Weibo				Pheme			
		Acc	Pre	Rec	F1	Acc	Pre	Rec	F1
Content based	EANN* [25]	0.782	0.790	0.780	0.780	0.681	0.693	0.707	0.721
	SpotFake* [19]	0.851	0.850	0.851	0.851	0.809	0.812	0.704	0.728
	MCAN* [27]	0.884	**0.884**	0.884	**0.884**	0.832	0.795	0.804	0.799
	HMCAN* [17]	0.830	0.830	0.831	0.830	**0.861**	0.838	0.759	0.763
	CAFE* [3]	0.840	0.840	0.841	0.840	**0.861**	0.844	0.794	0.814
Knowledge Enhanced	MKEMN [32]	0.814	0.773	0.809	0.805	0.816	0.813	0.810	0.812
	AKA-Fake [33]	-	-	-	-	0.858	**0.918**	**0.877**	**0.897**
	NSLM [6]	**0.885**	**0.884**	**0.885**	**0.884**	-	-	-	-
Proposed	DECNet w/o CDE	0.892	0.896	0.890	0.891	0.879	0.858	0.845	0.848
	DECNet w/o KAE	0.874	0.875	0.873	0.874	0.871	0.844	0.844	0.844
	DECNet	**0.912**	**0.914**	**0.911**	**0.912**	**0.886**	**0.860**	**0.867**	**0.864**

Table 1: Result of different fake news detection methods on two datasets.

Fusion Strategy	Acc	Pre	Rec	F1
SUM-linear	0.909	0.911	0.907	0.908
SUM-sigmoid	0.906	0.906	0.905	0.905
MUL-sigmoid	0.910	0.910	0.911	0.910
SUM-tanh	0.906	0.906	0.905	0.905
MUL-tanh	0.887	0.890	0.885	0.887
DECNet	**0.912**	**0.914**	**0.911**	**0.912**

Table 2: Impact of the gating network on the Weibo dataset.

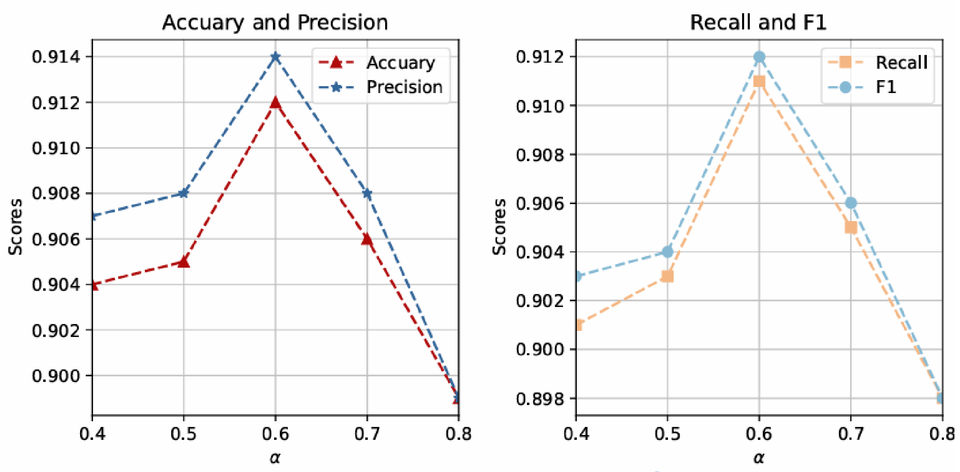


Figure 2: Sensitivity analysis of the parameter α on the Weibo dataset.

Ablation Study

Ablation studies show that both **experts**, the **gating network**, and the **balance parameter** ($\alpha = 0.6$) are crucial for DECNet's performance.