

A. Implementation Details

We preprocess the original datasets due to the large amount of news-unrelated information they contain. In practice, the preprocessing of news content is based on regular expressions in Python to identify and remove various special characters, such as @ symbol, punctuation marks like < and emojis. This approach effectively reduces the noise in the data which enables the model to learn the key semantic content of the news text better, thus building a more precise and robust model.

During the encoding phase, for Weibo texts, the maximum length is set to 100 words, and each news content is limited to a maximum of 10 entity descriptions. The temperature coefficient is set to 1 according to the previous research works. Considering the Twitter news is shorter than Weibo contents, the maximum length of Twitter news piece is set to 30 characters, with a maximum of 6 concept entity descriptions per news piece. To avoid noise from lengthy entity descriptions, the maximum sentence length for entity descriptions in both datasets is set to 30 words. After processing text encoding, both the news text and entity descriptions are converted into 128-dimensional vectors.

For the image encoding, before inputting the news images into the visual encoder, the image dimensionalities are converted into (3, 224, 224). Standardization is then applied to adjust the mean and standard deviation of each image channel to 0.485, 0.456, 0.406 and 0.229, 0.224, 0.225, respectively, to help eliminate differences among different images. This method makes the model focus more on the image content extraction. After processing image encoding, the image data is converted into a 128-dimensional vector.

In the model training process, the contrastive learning task uses the InfoNCE loss as the training objective and the news classification task utilizes the cross-entropy loss function. The AdamW optimizer is used for both tasks to effectively adjust model parameters and enhance generalization during training. It combines the advantages of the Adam algorithm with a weight decay regularization strategy. The learning rate is initially set to 0.001, and the cosine annealing strategy is employed to dynamically adjust the learning rate which helps the model better explore the parameter settings. What is more, this paper uses a mini-batch to input data. The batch size is set to 128 and the maximum training epoch is 20. The training will continue until the model reaches a convergence state.

B. Baselines

In this paper, we compare our proposed ERIC-FND model with below SOTA models.

att-RNN (Jin et al. 2017b): This method designs a RNN with attention to fuse the multimodal features.

EANN (Wang et al. 2018): This method proposes an event discriminator to reduce the feature impact of event on the news pieces and keep the event-unrelated features for the fake news detection.

MVAE (Khattar et al. 2019b): This model utilizes a bi-modal variational autoencoder with a binary classifier to optimize a bound on the marginal likelihood, thus learning

probabilistic latent variable models.

CAFE (Chen et al. 2022b): This method employs an ambiguity-aware multimodal fake news detection framework with the ambiguity learning module to estimate the ambiguity among different modalities.

MCAN (Wu et al. 2021): This method leverages an attention mechanism to learn the dependencies between different features and achieves fusion of multimodal features through multiple interactions between modalities.

MRML (Peng et al. 2023): This model extracts the relation between real news and fake news in unimodality with metric-based triplet learning and uses contrastive learning to capture inter-modal relationships between different modalities.

KMAGCN (Qian et al. 2021): This model models posts as graphs to learn the long-range semantic relationship and integrates multi-modal information with knowledge conceptualization to enhance the feature representation. Since in this paper we use BERT as pretraining model, $\text{KMAGCN}_{\text{bert}}$ is selected for a fair comparison.