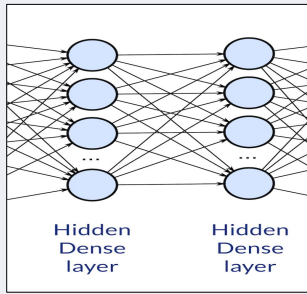


Deep Learning-Based Information Retrieval and Text Summarization



Retrieving and summarizing information from massive datasets is challenging due to the exponential growth of online content. This paper introduces a deep learning (DL) based approach for information retrieval and text summarization. It addresses the limitations of traditional methods and highlights the need for more efficient summarization techniques.

– Vivek Balmi

Summarization Approaches

Extractive Summarization

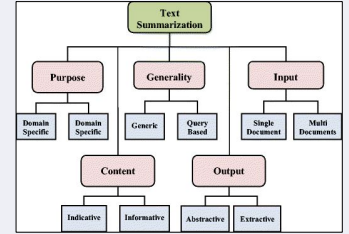
Involves copying portions of the text verbatim.

Abstractive Summarization

Creates summaries by paraphrasing the content.

Deep Learning-based Approach

Overcomes limitations of traditional methods.



The Proposed Model

Information Retrieval

Leverages Bidirectional Long Short-Term Memory (BiLSTM) to extract information.

Template Generation

Creates a brief model using Deep Belief Network (DBN) for text summarization.

Text Summarization

Uses TF-IDF and Similarity to select relevant sentences.

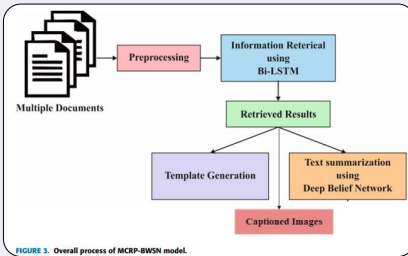
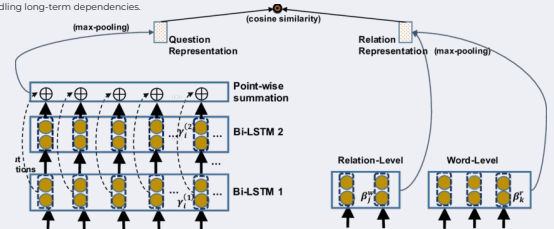


FIGURE 3. Overall process of MCRP-BWNN model.

Information Retrieval with BiLSTM

BiLSTM processes each word in a sentence to extract information and create a semantic vector. This approach effectively captures the contextual meaning of the text by handling long-term dependencies.



DBN-Based Text Summarization

The proposed model utilizes Deep Belief Network (DBN) for text summarization. DBN generates a brief model by embedding sentence vectors obtained from BiLSTM. The model uses TF-IDF and Similarity based on ROUGE-L scores to select the most relevant sentences for summarization, improving the accuracy and effectiveness of text summarization.

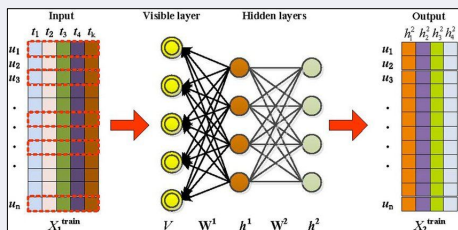
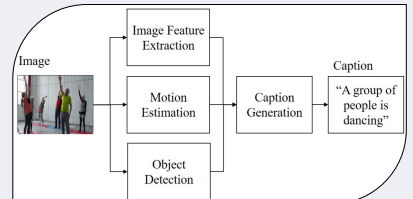


Image Caption Generation

The paper discusses image caption generation using deep learning techniques. The model employs ResNet50 for feature extraction from images and processes sequences of sentences from predefined captions. Attention mechanisms help identify important objects, improving the quality of the generated captions.



Experimental Validation

The proposed model is validated using the Gigaword corpus, DUC corpus, and MS COCO 2014 dataset. Performance is compared to existing models using metrics such as precision, recall, F-score, and BLEU. The results demonstrate the superior performance of the proposed DBN model in terms of precision, recall, and F-score.

TABLE 3. Result analysis of proposed method with existing methods.

Model	BLEU-1	BLEU-2	BLEU-3	BLEU-4
Nearest neighbor	0.48	0.281	0.166	0.1
Google NLP	0.66	0.461	0.329	0.246
LRN	0.62	0.442	0.304	-
AUCR-ResNet50	0.731	0.562	0.41	0.326
BiLSTM-Attention	0.788	0.734	0.746	0.73

Result analysis of proposed method with existing methods [14].

Methods	Rouge-1				Rouge-2				Rouge-L			
	F-Score	Recall	Precision	Precision	F-Score	Recall	Precision	Precision	F-Score	Recall	Precision	Precision
Proposed-DBN	0.57	0.73	0.53	0.48	0.54	0.44	0.55	0.74	0.51			
MAPCoL	0.42	0.46	0.40	0.39	0.43	0.36	0.40	0.46	0.37			
Lexical Chain	0.32	0.36	0.30	0.18	0.20	0.19	0.23	0.21				
TS-MOO	0.40	0.44	0.36	0.18	0.23	0.16	0.35	0.43	0.29			
LSTM + Glove	0.44	0.52	0.38	0.25	0.28	0.22	0.38	0.45	0.34			
LSTM + WordVec	0.42	0.49	0.37	0.24	0.27	0.21	0.37	0.44	0.33			
NB	0.39	0.53	0.30	0.18	0.28	0.14	0.33	0.46	0.26			
RF	0.35	0.38	0.32	0.14	0.16	0.13	0.29	0.33	0.27			
TBS	0.39	0.54	0.30	0.21	0.32	0.15	0.35	0.50	0.27			

Results Analysis

The results of the proposed DBN model are showcased compared to other existing models. Tables and charts visualize the comparison of precision, recall, and F-score. The analysis highlights the superior performance of the DBN model in text summarization.

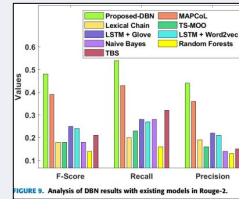


FIGURE 9. Analysis of DBN results with existing models in Rouge-2.

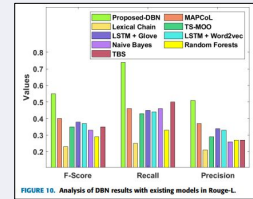


FIGURE 10. Analysis of DBN results with existing models in Rouge-1.

Image Captioning Results

The results of image captioning on the MS COCO 2014 dataset are presented. The BLEU metric is used to evaluate the performance of image captioning. The proposed model outperforms other techniques, demonstrating its effectiveness in generating accurate and descriptive captions for images.

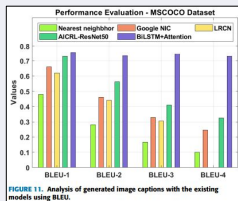


FIGURE 11. Analysis of generated image captions with the existing models using BLEU.

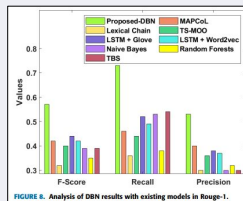


FIGURE 12. Analysis of DBN results with existing models in Rouge-1.

Conclusion

The paper introduces a novel deep learning-based model for information retrieval and text summarization, consisting of three main processes: information retrieval using BiLSTM, template generation using DL, and text summarization with a DBN model. The method's performance is assessed using Gigaword and DUC corpora, showing promising results. Additionally, the model can generate image captions. The study demonstrates the effectiveness of this approach compared to existing methods, with superior precision, recall, F-scores, and image caption quality, making it a valuable contribution to natural language processing and summarization tasks.



References

- [1] P. Mahalakshmi, N. Sabyath Fatima, "Summarization of Text and Image Captioning in Information Retrieval Using Deep Learning Techniques", 09 February 2022. Available: <https://ieeexplore.ieee.org/document/9709290?denied=>