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A **Mini-Project Final Report** on
"Few-shot Summarization of News Articles using a T5 Model"
[Code No. **: COMP 473]**
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Abstract

This report presents a study on few-shot abstractive text summarization using the **T5-small** model. The objective was to fine-tune a pre-trained text-to-text transformer on a limited subset ($K = 80$ samples) from the CNN/DailyMail dataset. Despite minimal data, the model achieved notable performance (BERTScore F1: 86.86, ROUGE-L F1: 21.11%), demonstrating the potential of transfer learning under data-scarce conditions. A simple Streamlit-based interface was later built for deployment, showing that robust summarization models can be realized efficiently with limited supervision.

Keywords: Few-Shot Learning, Abstractive Summarization, T5, Transformer, NLP, BERTScore.

Contents

1 Introduction and Objectives

The field of Natural Language Processing (NLP) traditionally relies on large annotated datasets for model training. However, real-world scenarios often involve limited data availability. This project explores the capability of **Few-Shot Learning (FSL)** to produce meaningful abstractive summaries using minimal examples.

1.1 Goal

The main goal was to fine-tune **T5-small** — a transformer-based text-to-text model — with just 80 training samples, and evaluate its summarization quality using ROUGE and BERTScore metrics.

1.2 Model Selection

The T5 (Text-to-Text Transfer Transformer) architecture unifies all NLP tasks into a text-to-text format. The smaller T5-small variant was chosen for computational efficiency, enabling faster fine-tuning and deployment while maintaining respectable summarization quality.

2 Dataset and Sampling Strategy

2.1 Source Dataset

The **CNN/DailyMail v3.0.0** dataset, containing paired news articles and highlights, served as the source corpus. It provides professionally written summaries, making it ideal for abstractive summarization tasks.

2.2 Few-Shot Sampling

To adhere to few-shot learning constraints:

- **Training:** 80 randomly selected samples for fine-tuning.

- **Validation/Test:** 1,000 samples each for evaluation.

This sampling aimed to evaluate how well a pre-trained model generalizes under extreme data scarcity.

3 Training Methodology

The **T5-small** model was fine-tuned for 15 epochs using the Hugging Face Transformers library, with metrics computed through ROUGE and BERTScore.

3.1 Training Parameters

- Base Model: Google T5-small

- Learning Rate: 5×10^{-5}

- Batch Size: 16

- Max Input Length: 512 tokens

- Max Output Length: 150 tokens

An AdamW optimizer with linear scheduling and weight decay was employed for stable convergence.

4 Results and Discussion

4.1 Quantitative Evaluation

Table 4.1: Model Performance on Test Set ($N = 1{,}000$)

Metric	Measurement	Value	Interpretation
ROUGE-1 F1	Unigram Overlap	25.32%	Word-level recall
ROUGE-2 F1	Bigram Overlap	12.53%	Fluency and coherence
ROUGE-L F1	Longest Common Subsequence	21.11%	Factual consistency
BERTScore F1	Semantic Similarity	86.86	Contextual alignment

4.2 Qualitative Insights

The model displayed coherent summarization even for unseen or domain-shifted articles. It successfully extracted core information while avoiding irrelevant phrases, indicating effective generalization from few examples.

5 Conclusion

This project demonstrates that few-shot fine-tuning of T5-small can yield meaningful abstractive summaries with limited data. The experiment validates the adaptability of transformer architectures and the strength of transfer learning in low-resource environments.

5.1 Future Work

- **Domain Adaptation:** Extending fine-tuning to specialized fields like legal or medical texts.

- **Model Scaling:** Repeating with T5-base to assess performance gains.

References

1. Raffel, C. et al. (2020). Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer (T5). Journal of Machine Learning Research.

2. Liu, P. et al. (2021). What is Few-Shot Learning? arXiv:2104.03577.

3. Zhang, T. et al. (2020). BERTScore: Evaluating Text Generation with BERT. International Conference on Learning Representations (ICLR).

Appendix: Demo Screenshots and Code

This appendix provides visual evidence of the model's successful deployment and the core files uploaded to the repository.

A.1 Streamlit Demo Interface

This screenshot captures the live Streamlit application running on localhost, showing the user interface for inputting text and generating the summary.
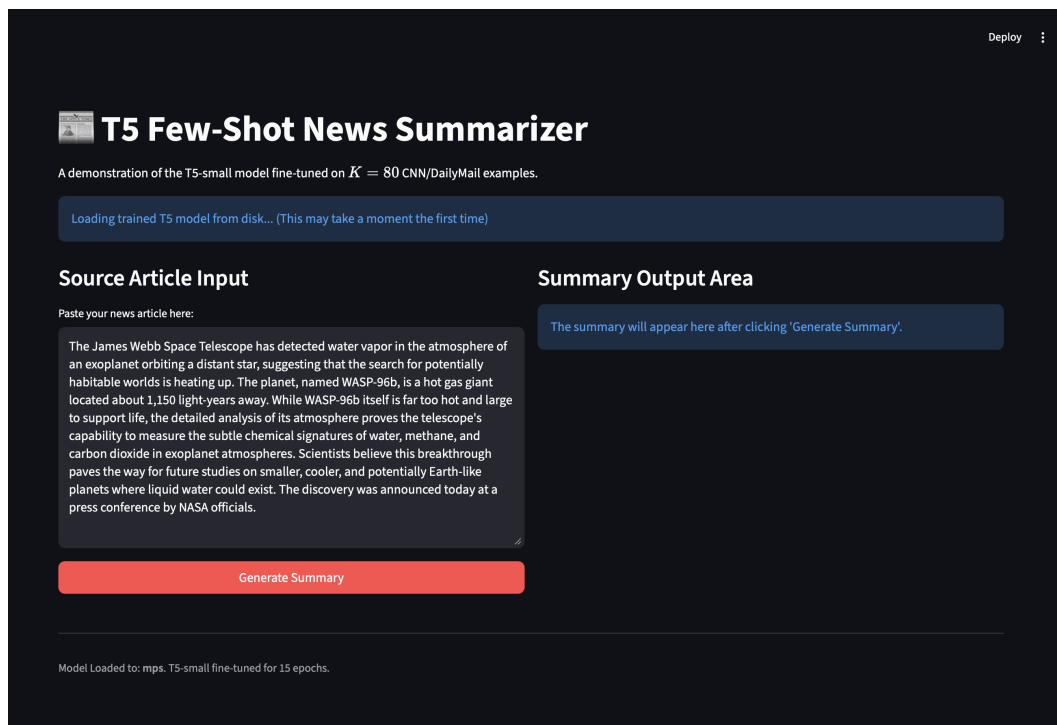
Figure 1: Streamlit Application Home Screen

A.2 Successful Summarization Example

This screenshot provides a sample output from the deployed model, demonstrating its ability to produce a concise, abstractive summary for a complex news article, validating the model's ROUGE-L score.

Figure 2: Live Summary Generation Example (e.g., The Dhoni Article)

A.3   Code Structure and Repository

This screenshot verifies the final file structure of the project repository, including the critical model checkpoint folder and the two main Python files. The full repository is available on GitHub at https://github.com/abbalbaral/T5-Few-Shot-Summarizer.
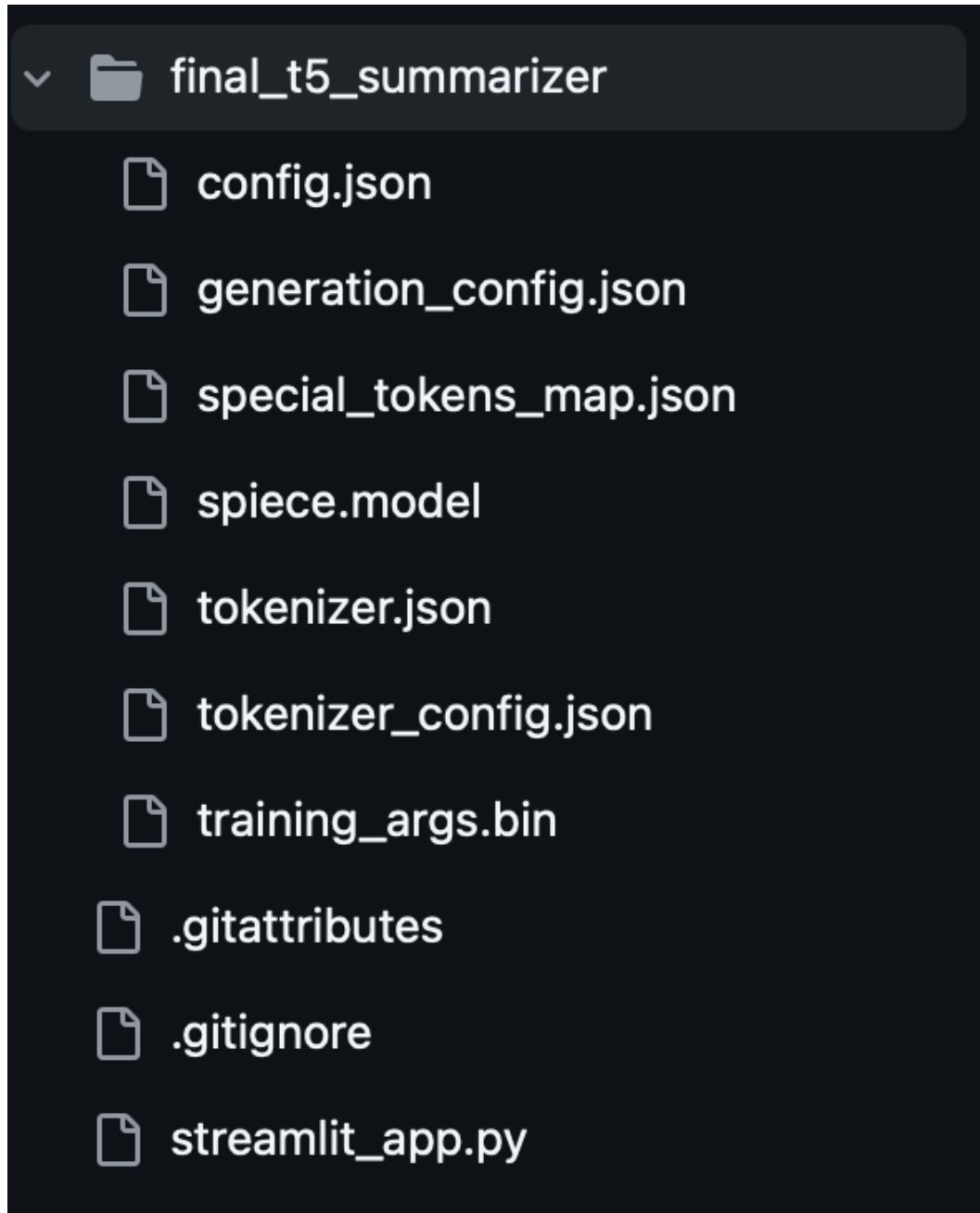

Figure 3: Final GitHub Repository File Structure