Quant - Coding problem

Report : Aspect-based Financial Sentiment Analysis

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1. Introduction:

This problem statement is divided into three tasks, given a text sentence in the financial domain, the aim is to detect the target aspects mentioned in the sentence, predict the aspect categories and predict the sentiment of the given sentence as Positive, Neural or Negative.

For this problem statement I have used an approach to leverage pretrained Large Language Models such as distilbert-base-uncased, finbert, flan-t5-base, and fine-tuned them for a specific task. I have used LoRA for parameter efficient fine-tuning to expedite the model training.

2. Project Workflow:

It begins with Exploratory Data Analysis (EDA), involving visualizing, cleaning, and encoding the data, as well as converting targets into embeddings. Next, we select a suitable Language Model (LLM) for each task.

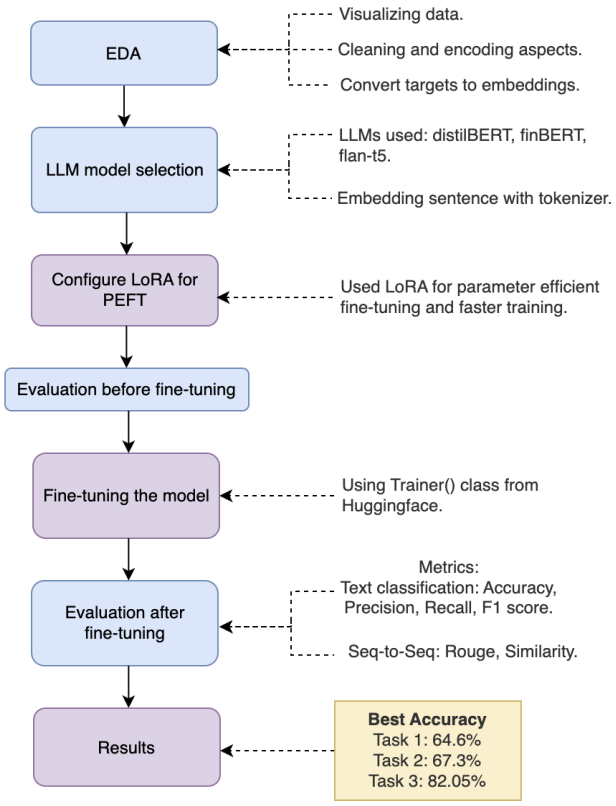

Fig 1. Project Workflow

LLMs used are distilBERT, finBERT, and flan-t5, followed by sentence embedding with respective tokenizers. Then LoRA is configured for Parameter Efficient Fine tuning. The model evaluated before and after fine-tuning. Using the Trainer() class from Huggingface the models are fine-tuned and present the results.

3. Results

Task 1: Sentiment Analysis

Approach 1

Fine-tuned distilBERT for sentiment analysis and classifying the sentiment of the sentence.
Experimented with fine-tuning finBERT for sentiment analysis. Did not yield unsatisfactory results.

Approach 2

Send the aspect categories along with the text to give it more context for Sentiment Analysis.
This approach does a better job in classifying the sentiments. Using this approach the model accuracy increased by 5.33%.

Model: distilBERT

	Approach 1 Evaluation		**Approach 2 Evaluation**
	before fine-tuning	**after fine-tuning**	**improved model**
Accuracy	26%	59.34%	64.67%
Precision	26%	59.34%	64.67%
Recall	26%	59.34%	64.67%
F1 score	26%	59.34%	64.67%

Tabel 1. Task 1 Metrics

Task 2: Classifying aspect categories.

Approach 1

Fine-tuned distilBERT for classifying the sentence into aspect categories.
Experimented with fine-tuning finBERT for sentiment analysis. Did not yield unsatisfactory results.
Approach 2

Make the categories less complex. From upto 6 levels, used only 2 levels to solve this classification task.
This approach does a better job in classifying the aspects. Using this approach the model accuracy increased by 26%.

Model: distilBERT

	Approach 1 Evaluation		Approach 2 Evaluation
	before fine-tuning	**after fine-tuning**	**improved model**
Accuracy	36.67%	41.34%	67.34%
Precision	36.67%	41.34%	67.34%
Recall	36.67%	41.34%	67.34%
F1 score	36.67%	41.34%	67.34%

Tabel 2. Task 2 Metrics

Task 3: Detecting Target from Sentence

Fine-tuned the sequence-to-sequence **flan-t5** model for predicting the target in the sentence.

	Fine-tuned model
Accuracy	82.1%
Precision	82.1%
Recall	82.1%
F1 score	82.1%

Tabel 3. Task 3 Metrics

4. Conclusion

In conclusion, for Task 1 and Task 2, which involve text classification tasks, DistilBERT demonstrates the highest performance. Meanwhile, Task 3, utilizing a seq-to-seq model, flan-t5, achieves good results in accurately predicting targets from the provided sentences.